

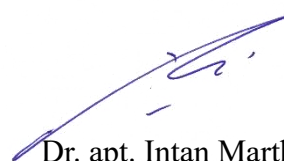
**BUKTI KORESPONDENSI**  
**JURNAL NASIONAL TERAKREDITASI KEMENRISTEKDIKTI PERINGKAT 2**

Judul artikel : Formulation and Characterization of Peel-Off Gel Mask Containing Secang (*Caesalpinia sappan* L.) Wood Extract with Strong Antioxidant Activity  
 Jurnal : Jurnal Jamu Indonesia (JJI)  
 Edisi : Tahun 2025, Vol 10, No.2 Halaman 121-125  
 Penerbit : TropBRC IPB University  
 Penulis : Intan Martha Cahyani, Tan Tanando Tanzaq, Ruth Ditya Agustina, Kemala Ender Setiawati

**Tabel Tahapan Publikasi Artikel**

No	Tahapan Publikasi	Tanggal	Halaman
1	Manuscript Submission	12 Mei 2025	Hal. 1
2	Editor Decision Manuscript ID JJI-403 – Sent to Review	12 Mei 2025	Hal. 1
3	Editor Decision: Revisions Required and reviewer comment	13 Mei 2025	Hal. 2
4	Submit first revised manuscript	13 Mei 2025	Hal. 3
5	Editor’s comments on first revised manuscript	15 Mei 2025	Hal. 4
6	Submit second revised manuscript	15 Mei 2025	Hal. 5
7	Article Acceptance Notification	15 Mei 2025	Hal. 5
8	APC Payment request from JJI editorial	15 Mei 2025	Hal. 6
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10	Copyediting Revision Request from editor JJI	16 Mei 2025	Hal. 9
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12	Confirmation of Revision – Figure 2 Adjustment and Unit Correction	16 Mei 2025	Hal. 12
13	Response to Revision Confirmation	16 Mei 2025	Hal. 13
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15	Response to Proof of Manuscript for Correction	17 Mei 2025	Hal. 15
16	Article Published Vol 10 issue 2 (19 Mei 2025) on website <a href="https://jambu-journal.ipb.ac.id/index.php/JJI/article/view/403">https://jambu-journal.ipb.ac.id/index.php/JJI/article/view/403</a> <a href="https://jambu-journal.ipb.ac.id/index.php/JJI/article/view/403/205">https://jambu-journal.ipb.ac.id/index.php/JJI/article/view/403/205</a>	19 Mei 2025	Hal. 15
17	Lampiran Bukti Korespondensi	-	Hal. 16 - 128

Pengusul



Dr. apt. Intan Martha Cahyani, M.Sc

# 1. Manuscript Submission

The screenshot shows an email interface for the user intanmartha@stifar.ac.id. The inbox on the left contains several messages from ojs@journalnotification.com, with the 'Submission Acknowledgement' email selected. The main content area displays the details of this email, which was received on 2025-05-12 at 12:32. The email body thanks the user for submitting a manuscript titled 'Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization' to Jurnal Jamu Indonesia. It provides a submission URL and username, and offers contact information for any questions.

**Submission Acknowledgement**

From ojs@journalnotification.com on 2025-05-12 12:32

Intan Martha Cahyani:

Thank you for submitting the manuscript, "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization" to Jurnal Jamu Indonesia. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Submission URL: <https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403>  
Username: intanmarthac

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Indonesian Journal of Jamu (*Jurnal Jamu Indonesia*)  
<https://jamu-journal.inh.ac.id/index.nhn/LII/index>

# 2. Editor Decision Manuscript ID JJI-403 – Sent to Review

The screenshot shows the same email interface as above, but with the 'Editor Decision Manuscript ID JJI-403 – Sent to Review' email selected. The email body informs the user that their manuscript has passed the initial screening stage and meets the editorial requirements for further evaluation. It mentions a similarity index of 6% and states that the submission has been forwarded to selected reviewers. The user is notified that the review process is complete and editorial decisions have been made. A link to the author dashboard is provided for tracking the submission progress.

**Editor Decision Manuscript ID JJI-403 – Sent to Review**

From ojs@journalnotification.com on 2025-05-12 13:59

Dear Intan Martha Cahyani,

We have reviewed your submission to *Jurnal Jamu Indonesia*, entitled:

**"Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization"** (Manuscript ID: JJI-403)

We are pleased to inform you that your manuscript has passed the initial screening stage and meets the editorial requirements for further evaluation. Based on the similarity report, which shows a similarity index of 6%, we have decided to proceed with the **peer-review process**.

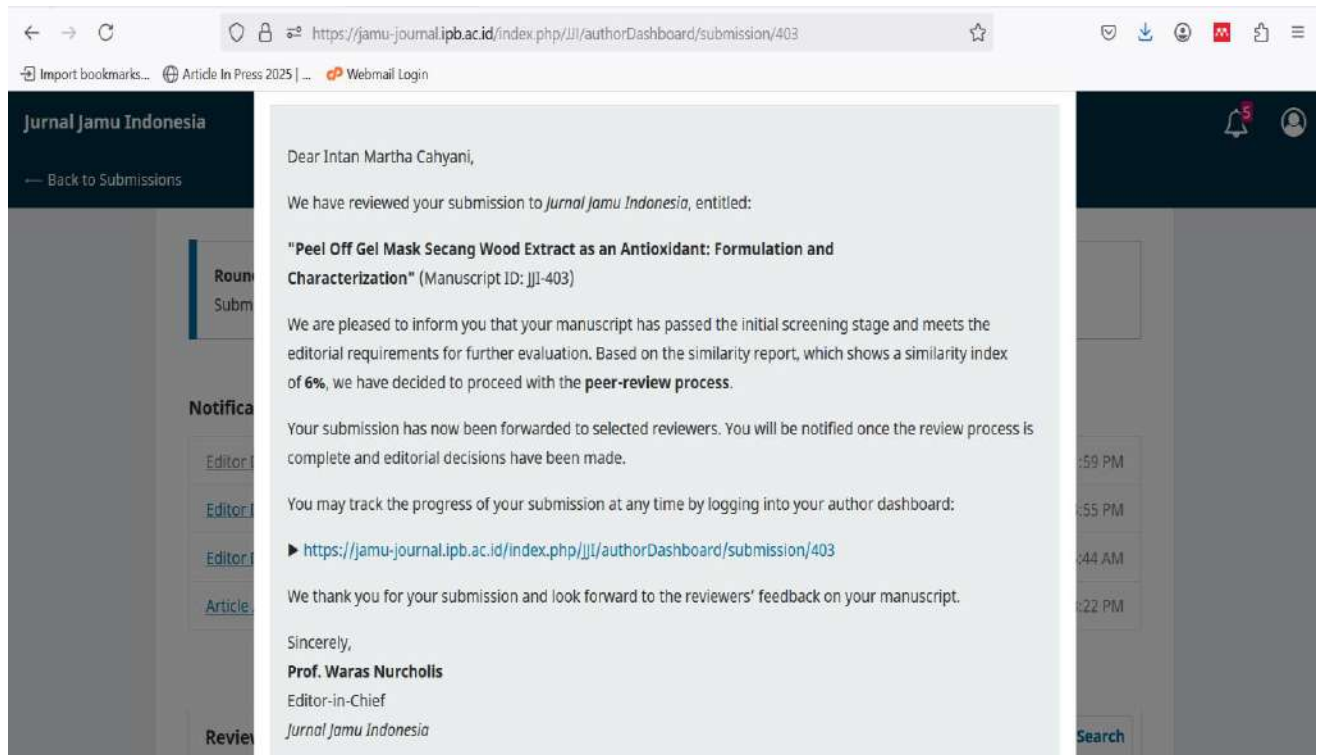
Your submission has now been forwarded to selected reviewers. You will be notified once the review process is complete and editorial decisions have been made.

You may track the progress of your submission at any time by logging into your author dashboard:

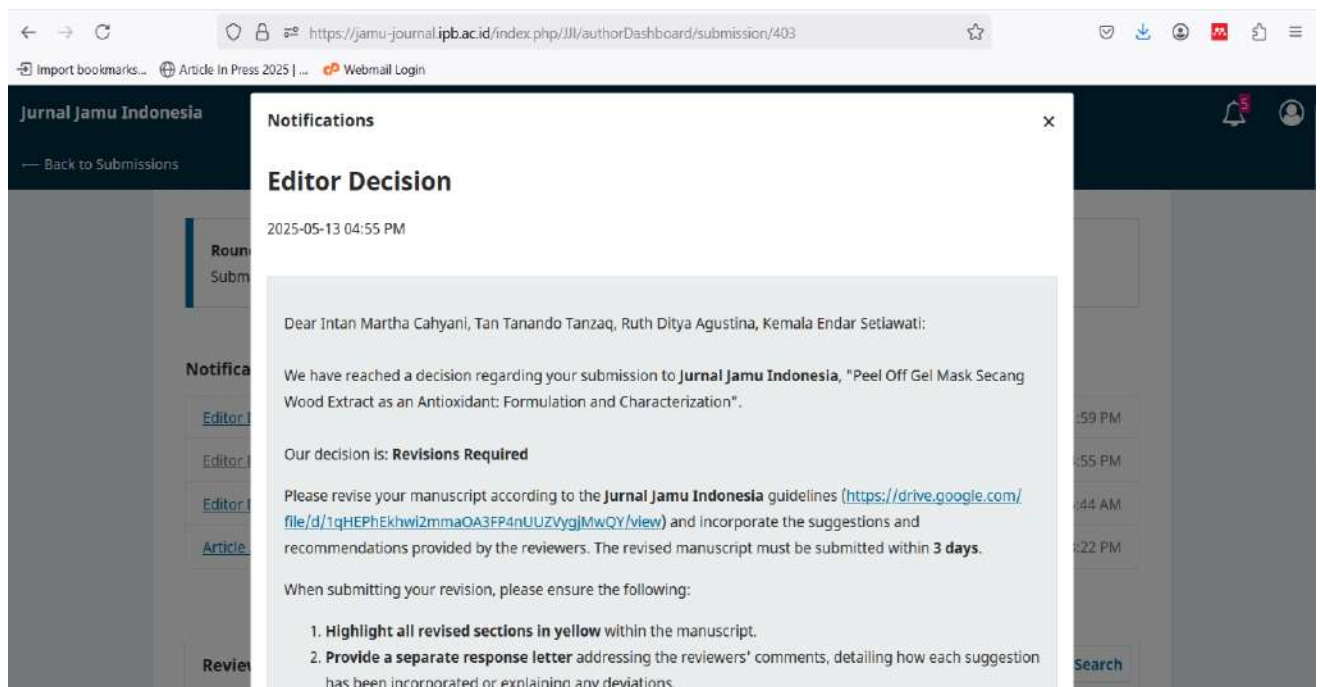
► <https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403>

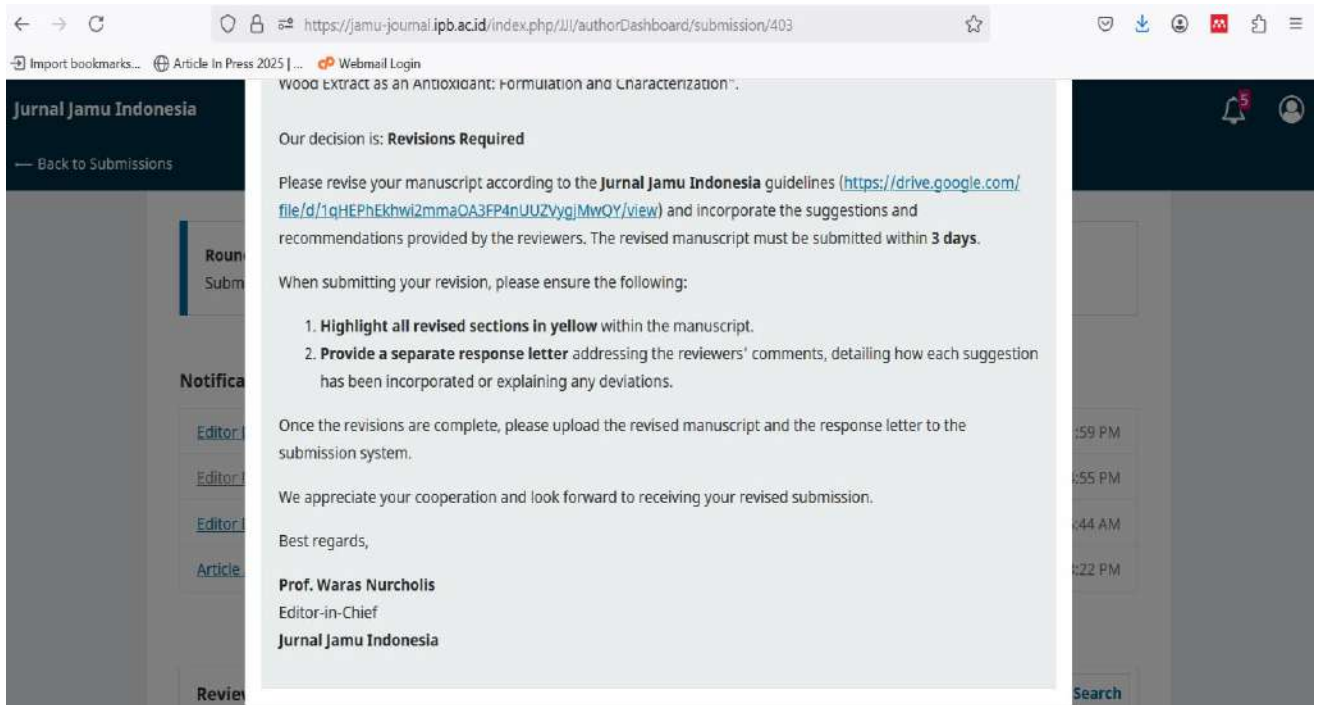
We thank you for your submission and look forward to the reviewers' feedback on your manuscript.

Sincerely,



### 3. Editor Decision: Revisions Required and reviewer comment





#### 4. Submit first revised manuscript



## 5. Editor's comments on first revised manuscript

Dear Intan Martha Cahyani, Tan Tanando Tanzaq, Ruth Ditya Agustina, Kemala Endar Setiawati:

We have reached a decision regarding your submission to **Jurnal Jamu Indonesia**, "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization".

Our decision is: **Revisions Required**

Please revise your manuscript according to the **Jurnal Jamu Indonesia** guidelines (<https://drive.google.com/file/d/1qHEPhEkhwI2mmaOA3FP4nUUZVygjMwQY/view>) and incorporate the suggestions and recommendations provided by the reviewers. The revised manuscript must be submitted within **1 days**.

When submitting your revision, please ensure the following:

1. **Highlight all revised sections in yellow** within the manuscript.
2. **Provide a separate response letter** addressing the reviewers' comments, detailing how each suggestion has been incorporated or explaining any deviations.

Once the revisions are complete, please upload the revised manuscript and the response letter to the submission system.

We appreciate your cooperation and look forward to receiving your revised submission.

Best regards,

**Prof. Waras Nurcholis**  
Editor-in-Chief

intanmartha@stifrar.ac.id

Select Threads Options Empty Refresh

Reply Reply all Forward Delete Archive Not junk Mark More

From ojs@journalnotification.com on 2025-05-15 05:44

Details Headers Plain text

REVISI\_INTAN+MARTHA+CAHYANI+Peel+Off+Gel+Mask+Secang+Wood+Extract+a... (~734 KB)

Dear Intan Martha Cahyani, Tan Tanando Tanzaq, Ruth Ditya Agustina, Kemala Endar Setiawati:

We have reached a decision regarding your submission to **Jurnal Jamu Indonesia**, "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization".

Our decision is: **Revisions Required**

Please revise your manuscript according to the **Jurnal Jamu Indonesia** guidelines (<https://drive.google.com/file/d/1qHEPhEkhwI2mmaOA3FP4nUUZVygjMwQY/view>) and incorporate the suggestions and recommendations provided by the reviewers. The revised manuscript must be submitted within **1 days**.

When submitting your revision, please ensure the following:

1. **Highlight all revised sections in yellow** within the manuscript.
2. **Provide a separate response letter** addressing the reviewers' comments, detailing how each suggestion has been incorporated or explaining any deviations.

Once the revisions are complete, please upload the revised manuscript and the response letter to the

## 6. Submit second revised manuscript

The screenshot shows the author dashboard for Jurnal Jamu Indonesia. The URL is <https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403>. The page title is "Jurnal Jamu Indonesia" and there is a "Back to Submissions" link. The main section is titled "Revisions" and contains a table with the following data:

File Name	Date	Type
3454 Data.xlsx	May 15, 2025	Other
3452 SECOND REVISION_INTAN MARTHA CAHYANI Peel Off Gel Mask Secang Wood Extract as an Antioxidant.docx	May 15, 2025	Article Text
3446 Responses to Reviewers Comments-JJI_INTAN MARTHA CAHYANI.docx	May 15, 2025	Other
3445 REVISI_INTAN MARTHA CAHYANI Peel Off Gel Mask Secang Wood Extract as an Antioxidant.docx	May 13, 2025	Article Text

Below the revisions table is a "Review Discussions" section with an "Add discussion" button. The table below it is empty, showing "No Items".

## 7. Article Acceptance Notification

The screenshot shows an email inbox for intanmartha@stifar.ac.id. The selected email is titled "Article Acceptance Notification - 'Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization'". The sender is ojs@journalnotification.com, dated 2025-05-15 15:22. The email content is as follows:

Dear Intan Martha Cahyani,

We are pleased to inform you that your manuscript entitled "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization" has been **accepted for publication** in **Jurnal Jamu Indonesia**, following a thorough peer review and editorial assessment.

Your article has met the required standards for scientific quality, originality, and relevance to the journal's scope. It will proceed to the **production stage (layout and typesetting)** after the **required publication fee has been successfully paid**.

Please make the payment as per the instructions provided on our journal's website or the payment invoice. Once your payment is confirmed, your article will enter the final processing stage.

If you have any questions regarding payment or the next steps, please do not hesitate to contact us. Thank you for choosing Jurnal Jamu Indonesia as the venue for your research.

Regards,  
Prof. Dr. Waras Nurcholis, SSI, MSI  
Editor-in-Chief

← → ↻ <https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403> ☆

Import bookmarks... Article In Press 2025 | ... Webmail Login

**Jurnal Jamu Indonesia**  
— Back to Submissions

## Article Acceptance Notification – "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization"

2025-05-15 03:22 PM

Dear Intan Martha Cahyani,

We are pleased to inform you that your manuscript entitled "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization" has been **accepted for publication** in **Jurnal Jamu Indonesia**, following a thorough peer review and editorial assessment.

Your article has met the required standards for scientific quality, originality, and relevance to the journal's scope. It will proceed to the **production stage (layout and typesetting)** after the **required publication fee has been successfully paid**.

Please make the payment as per the instructions provided on our journal's website or the payment invoice. Once your payment is confirmed, your article will enter the final processing stage.

If you have any questions regarding payment or the next steps, please do not hesitate to contact us. Thank you for choosing Jurnal Jamu Indonesia as the venue for your research.

Regards,

### 8. APC Payment request from JJI editorial

← → ↻ [https://stifar.ac.id.2096/cpsess9066917119/3rdparty/roundcube/?\\_task=mail&\\_mbox=INBOX.spam](https://stifar.ac.id.2096/cpsess9066917119/3rdparty/roundcube/?_task=mail&_mbox=INBOX.spam) ☆

Import bookmarks... Article In Press 2025 | ... Webmail Login

intanmartha@stifar.ac.id

Select Threads Options Empty Refresh

Reply Reply all Forward Delete Archive Not junk Mark More

**Payment Request**

From [ojs@journalnotification.com](mailto:ojs@journalnotification.com) on 2025-05-15 15:24  
Details Headers Plain text

Dear Authors,

Congratulations, your article has been accepted for publication in **Jurnal Jamu Indonesia**.

The publication fee is **IDR 2,750,000 (fast track 2,000,000 and English article improvement IDR 750,000)**. Please transfer the payment to:

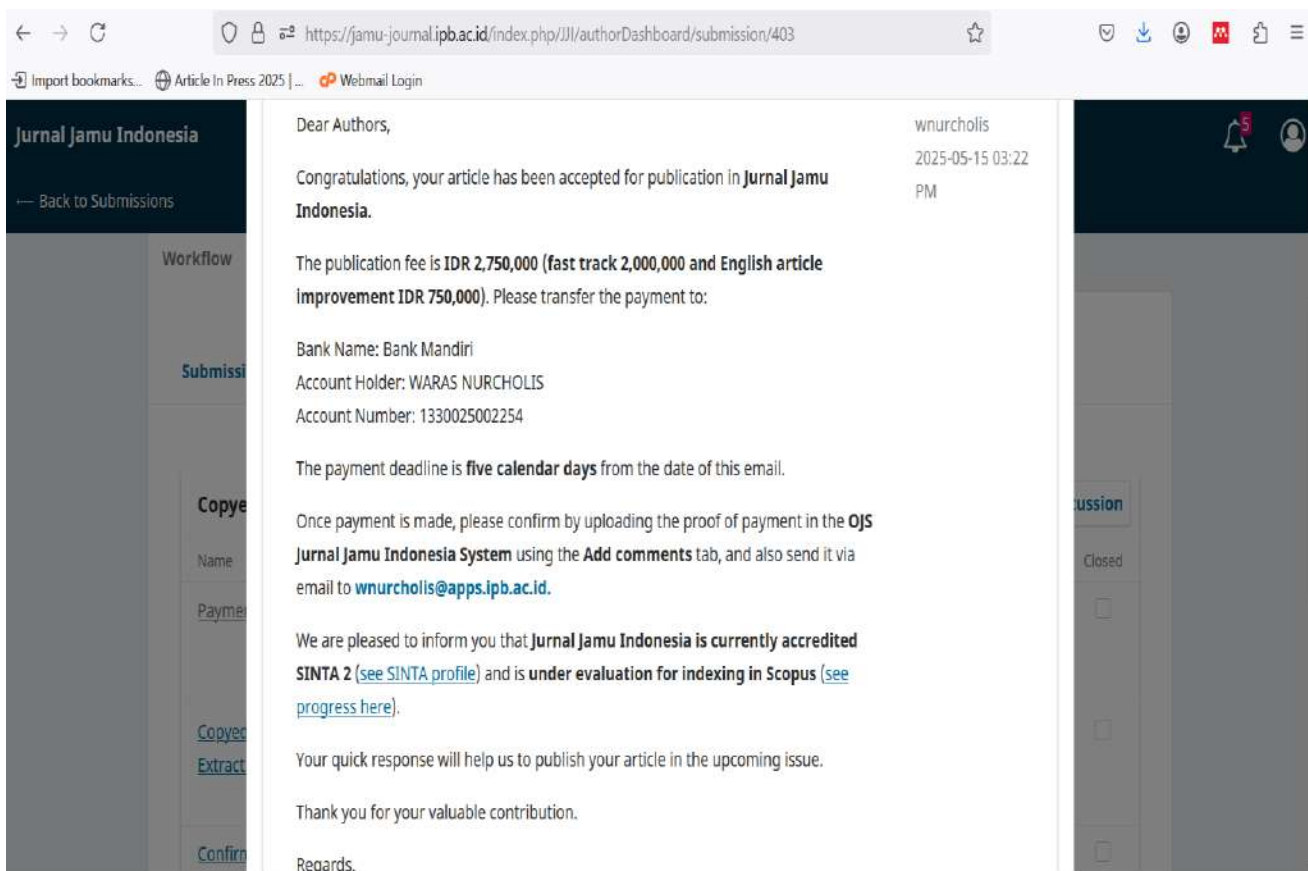
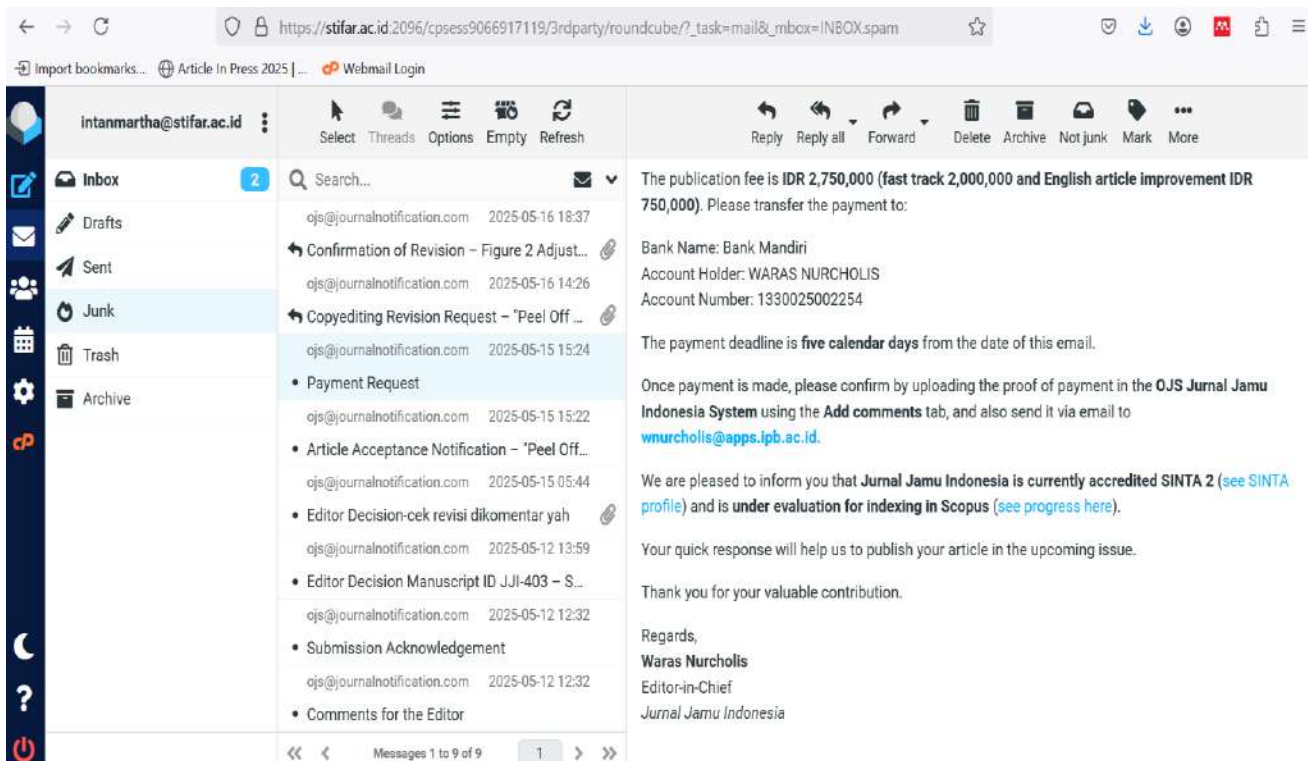
Bank Name: Bank Mandiri  
Account Holder: WARAS NURCHOLIS  
Account Number: 1330025002254

The payment deadline is **five calendar days** from the date of this email.

Once payment is made, please confirm by uploading the proof of payment in the **OJS Jurnal Jamu Indonesia System** using the **Add comments** tab, and also send it via email to [wnurcholis@apps.ipb.ac.id](mailto:wnurcholis@apps.ipb.ac.id).

We are pleased to inform you that **Jurnal Jamu Indonesia is currently accredited SINTA 2 (see SINTA profile)** and is **under evaluation for indexing in Scopus (see progress here)**.

Your quick response will help us to publish your article in the upcoming issue.



## 9. APC Payment Confirmation

The screenshot shows a webmail interface for 'intanmartha@stifar.ac.id'. The inbox on the left lists several messages, with the selected one being 'Proof of Payment' from 'wnurcholis@apps.ipb.ac.id' on 2025-05-15 16:26. The main content of the email is as follows:

**Proof of Payment**  
To: wnurcholis@apps.ipb.ac.id on 2025-05-15 16:26  
Details Headers

Bukti APC INTAN MARTHA CAHYANI.pdf (~39 KB)

Daer Prof. Waras Nurcholis  
Editor-in-Chief  
Jurnal Jamu Indonesia

Attached proof of payment publication manuscript "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization"

Regards,  
Intan Martha Cahyani

The screenshot shows the author dashboard for 'Jurnal Jamu Indonesia' at the URL 'https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403'. The page contains the following text:

email to [wnurcholis@apps.ipb.ac.id](mailto:wnurcholis@apps.ipb.ac.id).

We are pleased to inform you that **Jurnal Jamu Indonesia** is currently accredited **SINTA 2** (see [SINTA profile](#)) and is under evaluation for indexing in Scopus (see [progress here](#)).

Your quick response will help us to publish your article in the upcoming issue.

Thank you for your valuable contribution.

Regards,  
**Waras Nurcholis**  
Editor-in-Chief  
Jurnal Jamu Indonesia

Daer Prof. Waras Nurcholis  
Editor-in-Chief  
Jurnal Jamu Indonesia

Attached proof of payment publication manuscript "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization"

Regards,  
Intan Martha Cahyani

Bukti APC INTAN MARTHA CAHYANI.pdf

## 10. Copyediting Revision Request from editor JJI

The screenshot shows a webmail interface for 'intanmartha@stifar.ac.id'. The inbox on the left lists several messages, with the selected one being a 'Copyediting Revision Request - "Peel Off ..."' from 'ojs@journalnotification.com' dated 2025-05-16 14:26. The main content area displays the email body:

**Copyediting Revision Request – "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization"**

From [ojs@journalnotification.com](mailto:ojs@journalnotification.com) on 2025-05-16 14:26

403 : Cahyani et al. : editor improved.docx (~307 KB)

**Kepada Yth.**  
Intan Martha Cahyani dan Rekan Penulis di Tempat

Dengan hormat,

Kami sampaikan bahwa naskah Bapak/Ibu berjudul:

**"Formulasi dan Karakterisasi Masker Gel Peel-Off Mengandung Ekstrak Kayu Secang (*Caesalpinia sappan* L.) dengan Aktivitas Antioksidan yang Kuat"**

telah melalui proses penyuntingan oleh tim editor *Jurnal Jamu Indonesia* dan telah dilakukan sejumlah perbaikan dari sisi bahasa, struktur ilmiah, konsistensi istilah, serta format sitasi dan daftar pustaka sesuai gaya APA Edisi ke-7. Selain itu, penyajian data pada tabel dan gambar juga telah disesuaikan dengan standar penulisan jurnal ilmiah.

The screenshot shows a reply email from the editor. The main content area displays the email body:

perbaikan dari sisi bahasa, struktur ilmiah, konsistensi istilah, serta format sitasi dan daftar pustaka sesuai gaya APA Edisi ke-7. Selain itu, penyajian data pada tabel dan gambar juga telah disesuaikan dengan standar penulisan jurnal ilmiah.

Sehubungan dengan hal tersebut, kami mohon konfirmasi persetujuan dari penulis untuk melanjutkan naskah ini ke tahap layout dan produksi. Bila terdapat catatan atau keberatan, mohon disampaikan secara tertulis melalui email dalam waktu maksimal 1 (satu) hari kalender sejak surat ini dikirimkan.

Apabila tidak ada tanggapan hingga batas waktu yang ditentukan, maka kami anggap penulis telah menyetujui hasil penyuntingan dan proses layout akan segera dilakukan.

Demikian kami sampaikan. Atas perhatian dan kerja sama Bapak/Ibu, kami ucapkan terima kasih.

Hormat kami,

**Waras Nurcholis**  
Editor  
*Jurnal Jamu Indonesia*  
Email: [wnurcholis@apps.ipb.ac.id](mailto:wnurcholis@apps.ipb.ac.id)

—

Reply to this comment at #403 Cahyani et al or [unsubscribe](#) from emails sent by *Jurnal Jamu Indonesia*.

← → ↻ <https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403> ☆

Import bookmarks... Article In Press 2025 | ... Webmail Login

**Jurnal Jamu Indonesia**  
— Back to Submissions

Workflow

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**Copyediting Revision Request - "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization"** ×

**Participants**

Waras Nurcholis (wnurcholis)  
Intan Martha Cahyani (intanmarthac)

**Messages**

Note	From
<p><b>Kepada Yth.</b> Intan Martha Cahyani dan Rekan Penulis di Tempat</p> <p>Dengan hormat,</p> <p>Kami sampaikan bahwa naskah Bapak/Ibu berjudul:</p> <p><b>"Formulasi dan Karakterisasi Masker Gel Peel-Off Mengandung Ekstrak Kayu Secang (<i>Caesalpinia sappan</i> L.) dengan Aktivitas Antioksidan yang Kuat"</b></p>	<p>wnurcholis 2025-05-16 02:25 PM</p>

Submission

Closed

← → ↻ <https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403> ☆

Import bookmarks... Article In Press 2025 | ... Webmail Login

**Jurnal Jamu Indonesia**  
— Back to Submissions

Workflow

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telah melalui proses penyuntingan oleh tim editor *Jurnal Jamu Indonesia* dan telah dilakukan sejumlah perbaikan dari sisi bahasa, struktur ilmiah, konsistensi istilah, serta format sitasi dan daftar pustaka sesuai gaya APA Edisi ke-7. Selain itu, penyajian data pada tabel dan gambar juga telah disesuaikan dengan standar penulisan jurnal ilmiah.

Sehubungan dengan hal tersebut, kami mohon konfirmasi persetujuan dari penulis untuk melanjutkan naskah ini ke tahap layout dan produksi. Bila terdapat catatan atau keberatan, mohon disampaikan secara tertulis melalui email dalam waktu **maksimal 1 (satu) hari kalender** sejak surat ini dikirimkan.

Apabila tidak ada tanggapan hingga batas waktu yang ditentukan, maka kami anggap penulis telah menyetujui hasil penyuntingan dan proses layout akan segera dilakukan.

Demikian kami sampaikan. Atas perhatian dan kerja sama Bapak/Ibu, kami ucapkan terima kasih.

Hormat kami,

**Waras Nurcholis**  
Editor  
*Jurnal Jamu Indonesia*  
Email: [wnurcholis@apps.ipb.ac.id](mailto:wnurcholis@apps.ipb.ac.id)

Submission

Closed

## 11. Minor revision request from the author on Copyediting results

The screenshot shows an email client interface with the following details:

- Sender:** Intan Martha Cahyani (intanmartha@stifar.ac.id)
- Recipient:** Waras Nurcholis (wnurcholis@apps.ipb.ac.id)
- Subject:** Re: Copyediting Revision Request – "Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization"
- Date:** 2025-05-16 15:21
- Attachments:** 403\_Cahyani et al. \_ editor improved.docx (~303 KB)
- Text Content:**

Daer Prof. Waras Nurcholis  
Editor-in-Chief  
Jurnal Jamu Indonesia

The data in figure 2 does not match the data in the excel that we sent, please adjust it.

If according to the excel data, the figure shows a decrease in IC50 (antioxidant activity is getting stronger)

Regards,  
Intan Martha Cahyani

The screenshot shows the author dashboard for Jurnal Jamu Indonesia with the following details:

- Journal:** Jurnal Jamu Indonesia
- Email:** wnurcholis@apps.ipb.ac.id
- Submission ID:** 403 : Cahyani et al. : editor improved.docx
- Editor:** Daer Prof. Waras Nurcholis, Editor-in-Chief, Jurnal Jamu Indonesia
- Date:** 2025-05-16 03:34 PM
- Revision Request:**
  - The data in figure 2 does not match the data in the excel that we sent, please adjust it.
  - If according to the excel data, the figure shows a decrease in IC50 (antioxidant activity is getting stronger)
  - Y-axis unit of figure 2 (ppm) please change to (mg/mL)
- Sender:** Intan Martha Cahyani
- Attachments:** 403\_Cahyani et al. \_ editor improved.docx

## 12. Confirmation of Revision – Figure 2 Adjustment and Unit Correction

The screenshot shows a webmail interface for 'intanmartha@stifar.ac.id'. The inbox on the left lists several messages, with the selected one being 'Confirmation of Revision – Figure 2 Adjust...'. The main content area displays the email details:

**Confirmation of Revision – Figure 2 Adjustment and Unit Correction**  
From ojs@journalnotification.com on 2025-05-16 18:37  
Details Headers Plain text

403 : Cahyani et al. : editor improved.docx (~317 KB)

Dear Dr. Intan Martha Cahyani,

Thank you for your message and clarification regarding Figure 2.

We acknowledge the correction that the data presented in the previous version of Figure 2 did not accurately reflect the  $IC_{50}$  values provided in your Excel file. We have now revised the figure accordingly to illustrate the correct decreasing trend in  $IC_{50}$  values, consistent with the strengthening antioxidant activity across formulations. Additionally, the unit on the Y-axis has been updated from **ppm** to  **$\mu\text{g/mL}$**  as requested (note:  $\mu\text{g/mL}$  = ppm in water-based solutions, but this aligns better with your manuscript text).

The revised figure has been reinserted into the manuscript, and we are attaching the updated file for your review.

Kindly confirm your approval within **1 (one) day** so we may proceed to the layout and final production stage.

The screenshot shows the author dashboard for 'Jurnal Jamu Indonesia' at 'https://jamu-journal.ipb.ac.id/index.php/JJI/authorDashboard/submission/403'. The email content is identical to the one in the webmail interface:

Dear Dr. Intan Martha Cahyani,

Thank you for your message and clarification regarding Figure 2.

We acknowledge the correction that the data presented in the previous version of Figure 2 did not accurately reflect the  $IC_{50}$  values provided in your Excel file. We have now revised the figure accordingly to illustrate the correct decreasing trend in  $IC_{50}$  values, consistent with the strengthening antioxidant activity across formulations. Additionally, the unit on the Y-axis has been updated from **ppm** to  **$\mu\text{g/mL}$**  as requested (note:  $\mu\text{g/mL}$  = ppm in water-based solutions, but this aligns better with your manuscript text).

The revised figure has been reinserted into the manuscript, and we are attaching the updated file for your review.

Kindly confirm your approval within **1 (one) day** so we may proceed to the layout and final production stage.

Best regards,  
**Waras Nurcholis**  
Editor-in-Chief  
Jurnal Jamu Indonesia  
Email: wnurcholis@apps.ipb.ac.id

403 : Cahyani et al. : editor improved.docx

### 13. Response to Revision Confirmation

The screenshot shows an email client interface for the account `intanmartha@stifar.ac.id`. The left sidebar contains folders: **Inbox** (2), Drafts, Sent, Junk, Trash, and Archive. The main pane displays a list of messages, with the selected message being: **Re: Confirmation of Revision – Figure 2 Adjustment and Unit Correction** from Waras Nurcholis on 2025-05-16 18:51. The right pane shows the email content: **Re: Confirmation of Revision – Figure 2 Adjustment and Unit Correction**, addressed to Waras Nurcholis on 2025-05-16 18:51. The sender is Daer Prof. Waras Nurcholis, Editor-in-Chief of Jurnal Jamu Indonesia. The message text reads: "Thank you, the manuscript is appropriate. We agree to proceed to the next stage." and is signed "Best regards, Intan Martha Cahyani".

### 14. Manuscript Proof for Correction

The screenshot shows an email client interface for the account `intanmartha@stifar.ac.id`. The left sidebar contains folders: **Inbox** (2), Drafts, Sent, Junk, Trash, and Archive. The main pane displays a list of messages, with the selected message being: **Manuscript Proof for Correction** from `ojs@journalnotification.com` on 2025-05-17 16:01. The right pane shows the email content: **Manuscript Proof for Correction**, addressed to Intan Martha Cahyani on 2025-05-17 16:01. The sender is `ojs@journalnotification.com`. The message includes an attachment: **403 Proof read Cahyani et al.pdf (~400 KB)**. The text of the email reads: "Dear Intan Martha Cahyani, We hope this message finds you well. Please find attached the proof of your manuscript. We kindly request that you carefully check the content for errors or corrections. If there are any notes or objections, please submit them in writing via email within a maximum of 1 (one) calendar day since this letter was sent. If there is no response by the specified deadline, then we assume the author has approved the editing results and the layout process will be carried out immediately. If you have any questions or require further assistance, please do not hesitate to contact us. Thank you for your cooperation." and is signed "Best regards".

← → ↻ <https://jamu-journal.ipb.ac.id/index.php/II/authorDashboard/submission/403> ☆

Import bookmarks... Article In Press 2025 | ... Webmail Login

**Jurnal Jamu Indonesia**  
— Back to Submissions

### Manuscript Proof for Correction

**Participants**

Name: Waras Nurcholis (wnurcholis)  
Novian Liwanda (nliwanda)  
Intan Martha Cahyani (intanmarthac)

**Messages**

Note	From
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The screenshot shows the website for Jurnal Jamu Indonesia. The article title is "Formulation and Characterization of Peel-Off Gel Mask Containing Secang (Caesalpinia sappan L.) Wood Extract with Strong Antioxidant Activity". The authors listed are Intan Martha Cahyani<sup>(1)</sup>, Tan Tanando Tanzaq<sup>(2)</sup>, Ruth Ditya Agustina<sup>(3)</sup>, and Kemala Endar Setiawati<sup>(4)</sup>. The article is from Vol. 10 No. 2 (2025). The website also shows a read counter of 57 and a download count of 23. The DOI link is <https://doi.org/10.29244/jji.v10i2.403>. The citation count is 0.

1 **Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and**  
2 **Characterization**

3 **Masker Gel Peel Off Ekstrak Kayu Secang sebagai Antioksidan : Formulasi dan**  
4 **Karakterisasi**

5  
6 **Intan Martha Cahyani<sup>1\*</sup>, Tan Tanando Tanzaq<sup>1</sup>, Ruth Ditya Agustina<sup>1</sup>, Kemala Endar Setiawati<sup>1</sup>**

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9 **Abstract**

10 Secang wood contains active compounds of the flavonoid group, namely brazilin, brazilin, 3'-  
11 O-methylbrazilin, sappanin chalcone, and sappan calchone which can be used as primary  
12 antioxidants or secondary antioxidants. Antioxidants are compounds that can inhibit  
13 oxidation reactions by binding reactive free radicals. Increasing the value of the benefits of  
14 secang wood as an antioxidant can be done by developing a topical preparation formulation.  
15 Peel-off gel mask is the right topical preparation because in addition to maintaining skin  
16 health, it can also increase effectiveness and comfort during use. The study aims to determine  
17 the formula of a peel-off gel mask with secang wood extract as an antioxidant with good  
18 characteristics. The formulation of the peel-off gel mask was made with a concentration of  
19 secang wood extract of 2.5%; 5% and 7.5% using sodium carboxymethyl cellulose, polyvinyl  
20 alcohol and propylene glycol as a base. The preparation of the peel-off gel mask with secang  
21 wood extract produced was then tested with several parameters to determine the physical  
22 characteristics and antioxidant activity. The results showed that the higher the concentration  
23 of secang wood extract, the more significant the effect (p-value <0.05) on increasing viscosity,  
24 adhesiveness and drying time and can reduce pH, spreadability and IC<sub>50</sub> value. The antioxidant  
25 activity of all formulas is included in the strong category with the IC<sub>50</sub> value of the three  
26 formulas respectively being 88, 71 µg/mL; 81.58 µg/mL and 79.04 µg/mL.

27  
28 **Keywords:** Secang wood, Formulation, Peel off gel mask, Antioxidants, Physical characteristics

29 **Abstrak**

30 Kayu secang mengandung senyawa aktif golongan flavonoid yaitu brazilin, brazilin, 3'-O-  
31 metilbrazilin, sappanin chalcone, dan sappan calchone yang dapat digunakan sebagai  
32 antioksidan primer maupun antioksidan sekunder. Antioksidan merupakan senyawa yang  
33 dapat menghambat reaksi oksidasi dengan mengikat radikal bebas yang reaktif. Peningkatan  
34 nilai manfaat kayu secang sebagai antioksidan dapat dilakukan dengan pengembangan  
35 formulasi sediaan topikal. Masker gel peel-off merupakan sediaan topikal yang tepat karena  
36 selain dapat menjaga kesehatan kulit juga dapat meningkatkan efektivitas dan kenyamanan  
37 saat penggunaan. Penelitian bertujuan untuk mengetahui formula masker gel peel off ekstrak  
38 kayu secang sebagai antioksidan dengan karakteristik yang baik. Formulasi masker gel peel  
39 off dibuat dengan konsentrasi ekstrak kayu secang 2.5%; 5% dan 7.5% menggunakan natrium  
40 karboksimetil selulosa, polivinil alkohol dan propilen glikol sebagai basis. Sediaan masker gel  
41 peel off ekstrak kayu secang yang dihasilkan selanjutnya dilakukan pengujian dengan  
42 beberapa parameter untuk mengetahui karakteristik fisik dan aktivitas antioksidan. Hasil  
43 menunjukkan semakin tinggi konsentrasi ekstrak kayu secang berpengaruh signifikan (p-value  
44 < 0,05) pada peningkatan viskositas, daya lekat dan waktu mengering serta dapat

45 menurunkan pH, daya sebar dan nilai IC<sub>50</sub>. Aktivitas antioksidan semua formula termasuk  
46 dalam kategori kuat dengan nilai IC<sub>50</sub> ketiga formula berturut-turut adalah 88.71 µg/mL; 81.58  
47 µg/mL dan 79.04 µg/mL.

48  
49 **Kata Kunci:** Kayu secang, Formulasi, Masker gel peel off, antioksidan, karakteristik fisik

### 50 **1. Introduction**

51 Air pollution is currently experiencing a significant increase, reaching 20%. Low air  
52 quality can have a negative impact because long-term exposure can cause health problems  
53 (Wahdaningsih et al., 2015). One of the mechanisms is the occurrence of oxidative stress in  
54 the body. The high level of air pollution today can cause the formation of free radicals so it  
55 needs to be balanced with natural antioxidant intake to prevent oxidative damage which is a  
56 trigger for various diseases, especially skin disorders (Widowati, 2011). Flavonoids are natural  
57 compounds that have the ability as antioxidants by inhibiting the formation of free radicals  
58 hydroxyl, peroxide, alkoxyl, superoxide anions, oxygen singkets and hydrogen peroxide (Utari,  
59 2017).

60 Secang wood contains active compounds of the flavonoid group which can be used as  
61 primary antioxidants or secondary antioxidants. The presence of brazilin components in  
62 secang wood has the effect of protecting the body from poisoning due to free radicals (Rina  
63 et al., 2012). Has reliable antioxidant power with a higher antioxidant index than commercial  
64 antioxidants (BHT and BHA) so it has the potential as a free radical scavenging agent  
65 (Sugiyanto et al., 2013). Secang wood extract has been proven effective as an antioxidant with  
66 an IC<sub>50</sub> value of 74,44 µg/mL (Tanzaq et al., 2019).

67 Mask is one of the cosmetics for facial skin care. However, the use of masks is generally  
68 less efficient. The demands of market needs with today's lifestyle are not only effective but  
69 easy, comfortable and flexible in their use. Peel off gel mask is the result of the development  
70 of facial skin care products that can answer these challenges (Ningsih et al., 2016). Peel off  
71 gel mask is a type of facial mask that has the advantage of being easy to remove or lift like an  
72 elastic membrane (Rahmawanty et al., 2015). Several studies have proven that peel off gel  
73 mask preparations can increase the effectiveness of antioxidants, including Paedaria fotida  
74 extract (Eka et al., 2022), areca seed extract (Dwi Mulyani et al., 2023), red spinach leaves  
75 extract (Welly et al., 2022) and mangrove leaves extract (Hasibuan et al., 2024).

76

## 2. Methods

### 2.1 Materials and Tools

The materials used in this study were secang wood, ethanol 96% (Merck), Sodium Carboxymethyl Cellulose (CMC Na), Polyvinil Alcohol (PVA), propilenglicol, vitamin C dan 1,1-difenil-2-pikrilhidrazil (DPPH) .

The tools used in this study were rotary evaporator (Heidolph), alat-alat gelas (Pyrex), pH meter (Hanna Instrument pH 210 Microprocessor), viskometer (Brookfield DV-I Prime), and spektrofotometer UV-Vis mini 1240 (Shimadzu).

### 2.2 Sengon Wood Extraction

The extraction method used is maceration by soaking secang wood powder using 96% ethanol solvent with a ratio of 1:10. Extraction is carried out for 3x24 hours. The filtrate obtained is then evaporated with a rotary evaporator until a thick extract is obtained (Tanzaq et al., 2019).

### 2.3 Formulation of Peel Off Gel Masker Secang Wood Extract

Peel-off gel mask of secang wood extract was made by developing PVA and CMC Na (Table 1) in hot distilled water until fully expanded. PVA mass plus expanded propylene glycol and CMC Na was stirred until homogeneous. Ethanol extract of secang wood was added little by little into the peel-off gel mask base, distilled water was added until the weight of the preparation was 100% and stirred until homogeneous (Cahyani et al., 2025).

### 2.4 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

#### Organoleptic

Observations were made on the color, odor, and dosage form of the Peel Off Gel Mask Secang Wood Extract (Syam et al., 2021).

#### Homogeneity

Observations are made by preparing a number of preparations on object glass (Cahyani & Putri, 2017). All particles are evenly dispersed on the object glass indicating a homogeneous preparation (Syam et al., 2021)

#### pH

The pH meter electrode is dipped into the preparation until the display on the device shows a constant pH value (Andini et al., 2017). Results that match the skin pH (4.5-6.5) can increase acceptability when used (Silvia et al., 2021).

**108 Viscosity**

109 The viscosity of the preparation was measured using a Brookfield spindle 64 viscometer  
110 at a speed of 1.0 rpm (Cahyani & Putri, 2017). At a viscosity of 2000-50000 cps indicates a  
111 good peel-off gel mask (SNI 16-4399-1996: 1).

**112 Spreadability**

113 Observations were made on the spreading ability of 0.5 grams of the preparation placed  
114 in the middle of the spreading power tester, then covered with a glass plate that had  
115 previously been weighed and its weight recorded, left for one minute. The spreading ability  
116 is indicated by measuring the diameter of the four sides of the spread. Do the same steps for  
117 each additional 50 grams of load above it until the diameter of the spread is constant(Cahyani  
118 & Putri, 2017). The ideal spread of the peel off gel mask is 5-7 cm (Silvia et al., 2021).

**119 Adhesion**

120 0.25 g preparation on a glass object is given a load pressure of 100 grams for 5 minutes  
121 and then placed on the adhesive strength tester. The adhesive strength is measured by  
122 recording the time when the two glass objects are released. A time of more than 1 second  
123 indicates good adhesive strength of the peel off gel mask (Syam et al., 2021).

**124 Drying Time**

125 0.1 g of the preparation is applied to the arm with an area of 2.5 x 2.5 cm, then the time  
126 is observed until the preparation dries (Andini et al., 2017). standard drying time for a peel-  
127 off gel mask is 15-30 minutes (Silvia et al., 2021).

**128 2.5 Antioxidant Activity with DPPH (2,2-difenyl-1-picrylhydrazyl) Method**

129 The test was carried out in several stages. First, determine the maximum wavelength of  
130 the DPPH 30 solution  $\mu\text{g/mL}$  with a UV-Vis spectrophotometer in the 400-800 nm region.  
131 Determination of operating time is done by measuring the absorption at the maximum  
132 wavelength obtained using a standard solution (vitamin C) and DPPH 30 solution  $\mu\text{g/mL}$  at a  
133 1:1 ratio for 60 minutes.

134 An amount of 0.05 grams of the preparation was dissolved in methanol up to 50 mL and  
135 diluted to obtain sample solution concentrations of 60,70,80,100 and 120  $\mu\text{g/mL}$ . For each  
136 concentration, DPPH 30 solution was added  $\mu\text{g/mL}$  at a ratio of 1:1 and absorbance  
137 measurements were carried out using a UV-Vis spectrophotometer at a maximum  
138 wavelength after being incubated at room temperature for the time obtained from the results

139 of determining the operating time. The same stage was also carried out on vitamin C solutions  
140 with concentrations of 2.4,6,8,10  $\mu\text{g}/\text{mL}$  as a reference standard. Determine the  $\text{IC}_{50}$  value  
141 from the results of measuring the absorbance of the sample solution and the reference  
142 standard obtained (Maharani et al., 2022).

143

144

### **3. Results and Discussion**

#### **3.1 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract**

146 Traditionally, secang wood has many health benefits, including antibacterial, anti-  
147 inflammatory, anti-diabetic, tuberculosis, malaria and tetanus (Setyowati et al., 2023). In  
148 addition, it is also widely used in food and cosmetics as an antioxidant (Rajput et al., 2022).  
149 Secang wood contains active compounds that are included in the flavonoid group, namely  
150 brazilin, brazilin, 3'-o-methylbrazilin, sappanin, chalcone, and sappan chalcone. Brazilin in  
151 secang wood has an antioxidant effect (Ngamwonglumert & Devahastin, 2023). For the  
152 manufacture of secang wood extract, the maceration method using 96% ethanol (1:1) was  
153 used. The peel-off gel mask has unique characteristics with the formation of a transparent,  
154 elastic and easily removable film layer without rinsing which can increase the comfort of use  
155 and the effectiveness of active compounds. Therefore, this study was designed to make a  
156 peel-off gel mask of secang wood extract as an antioxidant F1 (2.5%) F2 (5%) and F3 (7.5%)  
157 with the results of the physical characteristics test presented in Table 2.

158 Organoleptic and homogeneity testing aims to see the physical appearance and  
159 distribution of each component of a preparation. Based on table 2, the results show that the  
160 three formulas give the same results. The level of comfort of using a preparation is also  
161 influenced by the pH of the preparation. The higher the concentration of secang wood extract,  
162 the lower the pH of the preparation as seen in Figure 1a. This occurs because the ethanol  
163 extract of secang wood has a pH that tends to be acidic (2-6) (Muslimin et al., 2024), so that  
164 by adding the amount of secang wood extract, the pH of the preparation will decrease. The  
165 pH value of secang wood extract can affect the color of the peel-off gel mask preparation  
166 produced. This effect is caused because the stability of brazilin is greatly influenced by its  
167 acidity level where at pH 2-5 (yellow-orange), pH 6-7 (pink) and pH > 7 (red-violet) where the  
168 degradation results of brazilin into brazilein which is red in color (Rina et al., 2017).

169 The results of the viscosity test showed an increase that was proportional to the  
170 increase in the concentration of secang wood extract in the peel-off gel mask formula (Figure  
171 1b). The thick concentration of secang wood extract showed high resistance so that it would  
172 affect the resistance of the preparation to flow. The viscosity of the preparation is closely  
173 related to the spreadability, adhesion and drying time. The higher the viscosity, the lower the  
174 spreadability (Figure 1c) and the higher the adhesion (Figure 1d) of the preparation because  
175 high resistance indicates a stronger bond between particles which causes water to be trapped  
176 and dry longer (Figure 1e) (Cahyani et al., 2025).

### 177 **3.2 Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract**

178 Test results all formulas showed antioxidant activity included in the strong category  
179 as indicated by the IC<sub>50</sub> value (Table 2) so it can be said that the selection of the peel off gel  
180 mask preparation is right and the resulting formula can maintain the stability of the active  
181 compound. The increase in antioxidant activity is indicated by a decrease in the IC<sub>50</sub> value  
182 along with the increase in extract concentration (Figure 2). This is because the higher the  
183 concentration of sengon wood extract, the higher the brazilin content in the peel off gel mask  
184 preparation. Brazilin, in addition to playing a role in the color produced, is also a flavonoid  
185 with high antioxidant activity and is widely used in natural skin care (Faizah et al., 2023).  
186 Brazilin is a flavonoid with the ability to ward off free radicals and can inhibit enzymes  
187 responsible for the production of free radicals (Hu et al., 2008)

188

## 189 **4. Conclusion**

190 Increasing the concentration of secang wood extract has a significant effect (p-value  
191 <0.05) on increasing the viscosity, adhesiveness and drying time and can reduce pH,  
192 spreadability and IC<sub>50</sub> value. The antioxidant activity of all formulas is included in the strong  
193 category with the IC<sub>50</sub> values of the three formulas respectively being 88, 71 µg/mL; 81.58  
194 µg/mL and 79.04 µg/mL. Peel off gel mask preparation formula with good characteristics and  
195 strong antioxidant activity at a concentration of 7.5% secang wood extract.

196

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**Table 1.** Formulation of Peel Off Gel Masker Secang Wood Extract

Material	Formula (%)		
	I	II	III
Secang Wood Extract	2,5	5	7,5
CMC Na	1,26	1,26	1,26
PVA	6,74	6,74	6,74
Propilenglikol	4	4	4
Aqua destilata ad	100	100	100

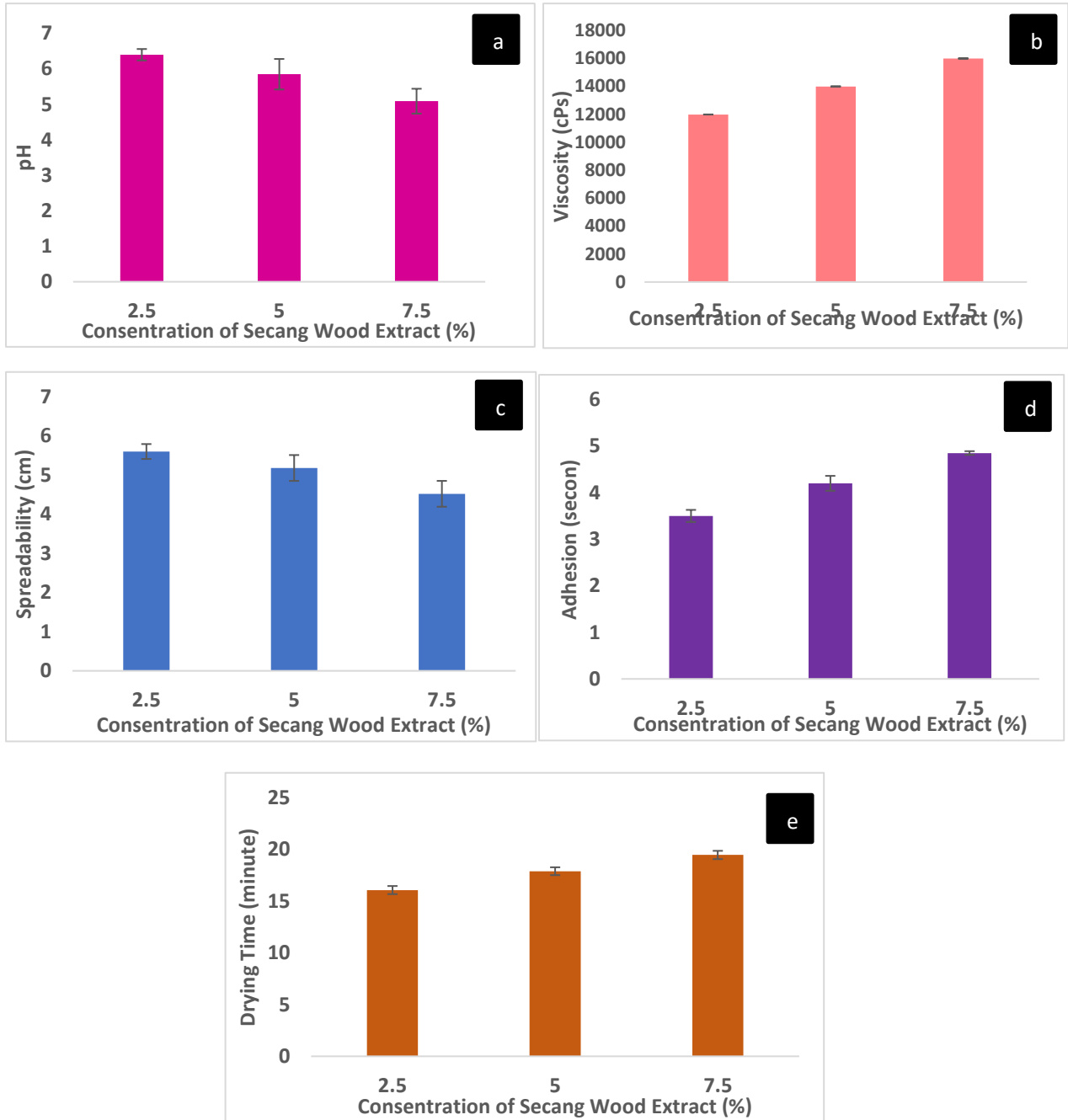
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300 **Table 2.** Characterization and Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

Evaluation	Formula		
	I	II	III
Organoleptic	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell
Homogeneity	Homogeneous	Homogeneous	Homogeneous
pH	6.4 ± 0.16	5.85 ± 0.43	5.09 ± 0.35
Viscosity (cPs)	11986.4 ± 6.02	13992.6 ± 5.13	15993.2 ± 5.36
Spreadability (cm)	5.6 ± 0.19	5.18 ± 0.33	4.52 ± 0.33
Adhesion (secon)	3.5 ± 0.13	4.2 ± 0.16	4.85 ± 0.04
Drying Time (minute)	16.06 ± 0.39	17.88 ± 0.38	19.45 ± 0.40
IC <sub>50</sub> (µg/mL)	88.71 ± 2.06	81.58 ± 3.60	79.04 ± 1.84

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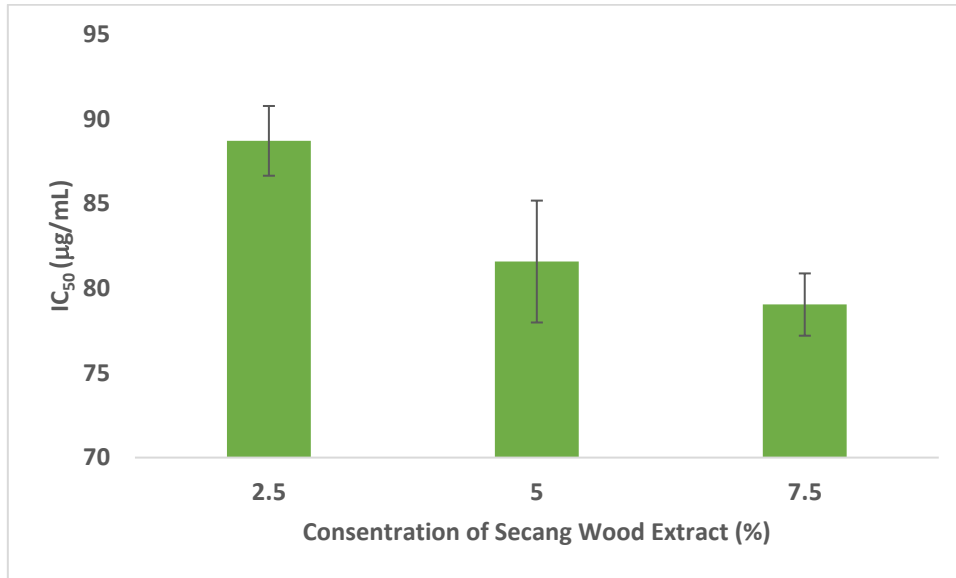
**Figure 1.** Characterization of Peel Off Gel Mask Secang Wood Extract: (a) pH, (b) Viscosity, (c) Spreadability, (d) Adhesion and (e) Drying Time

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**Figure 2.** Antioxidant activity (IC<sub>50</sub>) of Peel Off Gel Mask Secang Wood Extract

## BUKTI KORESPONDENSI CATATAN REVIEWER 1

### 1 Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and 2 Characterization

### 3 Masker Gel Peel Off Ekstrak Kayu Secang sebagai Antioksidan : Formulasi dan 4 Karakterisasi 5

#### 6 Abstract

7 Secang wood contains active compounds of the flavonoid group, namely brazilin, brazilin, 3'-  
8 O-methylbrazilin, sappanin chalcone, and sappan chalcone which can be used as primary  
9 antioxidants or secondary antioxidants. Antioxidants are compounds that can inhibit  
10 oxidation reactions by binding reactive free radicals. Increasing the value of the benefits of  
11 secang wood as an antioxidant can be done by developing a topical preparation formulation.  
12 Peel-off gel mask is the right topical preparation because in addition to maintaining skin  
13 health, it can also increase effectiveness and comfort during use. The study aims to determine  
14 the formula of a peel-off gel mask with secang wood extract as an antioxidant with good  
15 characteristics. The formulation of the peel-off gel mask was made with a concentration of  
16 secang wood extract of 2.5%; 5% and 7.5% using sodium carboxymethyl cellulose, polyvinyl  
17 alcohol and propylene glycol as a base. The preparation of the peel-off gel mask with secang  
18 wood extract produced was then tested with several parameters to determine the physical  
19 characteristics and antioxidant activity. The results showed that the higher the concentration  
20 of secang wood extract, the more significant the effect (p-value <0.05) on increasing viscosity,  
21 adhesiveness and drying time and can reduce pH, spreadability and IC<sub>50</sub> value. The antioxidant  
22 activity of all formulas is included in the strong category with the IC<sub>50</sub> value of the three  
23 formulas respectively being 88, 71 µg/mL; 81.58 µg/mL and 79.04 µg/mL.  
24

25 Keywords: Secang wood, Formulation, Peel off gel mask, Antioxidants, Physical characteristics

#### 26 Abstrak

27 Kayu secang mengandung senyawa aktif golongan flavonoid yaitu brazilin, brazilin, 3'-O-  
28 metilbrazilin, sappanin chalcone, dan sappan chalcone yang dapat digunakan sebagai  
29 antioksidan primer maupun antioksidan sekunder. Antioksidan merupakan senyawa yang  
30 dapat menghambat reaksi oksidasi dengan mengikat radikal bebas yang reaktif. Peningkatan  
31 nilai manfaat kayu secang sebagai antioksidan dapat dilakukan dengan pengembangan  
32 formulasi sediaan topikal. Masker gel peel-off merupakan sediaan topikal yang tepat karena  
33 selain dapat menjaga kesehatan kulit juga dapat meningkatkan efektivitas dan kenyamanan  
34 saat penggunaan. Penelitian bertujuan untuk mengetahui formula masker gel peel off ekstrak  
35 kayu secang sebagai antioksidan dengan karakteristik yang baik. Formulasi masker gel peel  
36 off dibuat dengan konsentrasi ekstrak kayu secang 2.5%; 5% dan 7.5% menggunakan natrium  
37 karboksimetil selulosa, polivinil alkohol dan propilen glikol sebagai basis. Sediaan masker gel  
38 peel off ekstrak kayu secang yang dihasilkan selanjutnya dilakukan pengujian dengan  
39 beberapa parameter untuk mengetahui karakteristik fisik dan aktivitas antioksidan. Hasil  
40 menunjukkan semakin tinggi konsentrasi ekstrak kayu secang berpengaruh signifikan (p-value  
41 < 0,05) pada peningkatan viskositas, daya lekat dan waktu mengering serta dapat  
42 menurunkan pH, daya sebar dan nilai IC<sub>50</sub>. Aktivitas antioksidan semua formula termasuk  
43 dalam kategori kuat dengan nilai IC<sub>50</sub> ketiga formula berturut-turut adalah 88.71 µg/mL; 81.58  
44 µg/mL dan 79.04 µg/mL.

Commented [AS1]: It has not been stated what the vulnerable value is if it is classified as a strong category.

## BUKTI KORESPONDENSI CATATAN REVIEWER 1

45  
46 **Kata Kunci:** Kayu secang, Formulasi, Masker gel peel off, antioksidan, karakteristik fisik

### 47 **1. Introduction**

48 Air pollution is currently experiencing a significant increase, reaching 20%. Low air  
49 quality can have a negative impact because long-term exposure can cause health problems  
50 (Wahdaningsih et al., 2015). One of the mechanisms is the occurrence of oxidative stress in  
51 the body. The high level of air pollution today can cause the formation of free radicals so it  
52 needs to be balanced with natural antioxidant intake to prevent oxidative damage which is a  
53 trigger for various diseases, especially skin disorders (Widowati, 2011). Flavonoids are natural  
54 compounds that have the ability as antioxidants by inhibiting the formation of free radicals  
55 hydroxyl, peroxide, alkoxyl, superoxide anions, oxygen singkets and hydrogen peroxide (Utari,  
56 2017).

57 Secang wood contains active compounds of the flavonoid group which can be used as  
58 primary antioxidants or secondary antioxidants. The presence of brazilin components in  
59 secang wood has the effect of protecting the body from poisoning due to free radicals (Rina  
60 et al., 2012). Has reliable antioxidant power with a higher antioxidant index than commercial  
61 antioxidants (BHT and BHA) so it has the potential as a free radical scavenging agent  
62 (Sugiyanto et al., 2013). Secang wood extract has been proven effective as an antioxidant with  
63 an IC<sub>50</sub> value of 74,44 µg/mL (Tanzaq et al., 2019).

64 Mask is one of the cosmetics for facial skin care. However, the use of masks is generally  
65 less efficient. The demands of market needs with today's lifestyle are not only effective but  
66 easy, comfortable and flexible in their use. Peel off gel mask is the result of the development  
67 of facial skin care products that can answer these challenges (Ningsih et al., 2016). Peel off  
68 gel mask is a type of facial mask that has the advantage of being easy to remove or lift like an  
69 elastic membrane (Rahmawanty et al., 2015). Several studies have proven that peel off gel  
70 mask preparations can increase the effectiveness of antioxidants, including Paedaria fotida  
71 extract (Eka et al., 2022), areca seed extract (Dwi Mulyani et al., 2023), red spinach leaves  
72 extract (Welly et al., 2022) and mangrove leaves extract (Hasibuan et al., 2024).

### 74 **2. Methods**

#### 75 **2.1 Materials and Tools**

**Commented [AS2]:** Write down the novelty of this research that distinguishes it from previous studies that used secang wood as a peel off gel marker.

## BUKTI KORESPONDENSI CATATAN REVIEWER 1

76 The materials used in this study were secang wood, ethanol 96% (Merck), Sodium  
77 Carboxymethyl Cellulose (CMC Na), Polyvinil Alcohol (PVA), propilenglicol, vitamin C dan 1,1-  
78 difenil-2-pikrilhidrazil (DPPH) .

79 The tools used in this study were rotary evaporator (Heidolph), alat-alat gelas (Pyrex),  
80 pH meter (Hanna Instrument pH 210 Microprocessor), viskometer (Brookfield DV-I Prime),  
81 and spektrofotometer UV-Vis mini 1240 (Shimadzu).

### 82 **2.2 Sengon Wood Extraction**

83 The extraction method used is maceration by soaking secang wood powder using 96%  
84 ethanol solvent with a ratio of 1:10. Extraction is carried out for 3x24 hours. The filtrate  
85 obtained is then evaporated with a rotary evaporator until a thick extract is obtained (Tanzaq  
86 et al., 2019).

### 87 **2.3 Formulation of Peel Off Gel Masker Secang Wood Extract**

88 Peel-off gel mask of secang wood extract was made by developing PVA and CMC Na (Table  
89 1) in hot distilled water until fully expanded. PVA mass plus expanded propylene glycol and  
90 CMC Na was stirred until homogeneous. Ethanol extract of secang wood was added little by  
91 little into the peel-off gel mask base, distilled water was added until the weight of the  
92 preparation was 100% and stirred until homogeneous (Cahyani et al., 2025).

### 93 **2.4 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract**

#### 94 **Organoleptic**

95 Observations were made on the color, odor, and dosage form of the Peel Off Gel Mask  
96 Secang Wood Extract (Syam et al., 2021).

#### 97 **Homogeneity**

98 Observations are made by preparing a number of preparations on object glass (Cahyani  
99 & Putri, 2017). All particles are evenly dispersed on the object glass indicating a homogeneous  
100 preparation (Syam et al., 2021)

#### 101 **pH**

102 The pH meter electrode is dipped into the preparation until the display on the device  
103 shows a constant pH value (Andini et al., 2017). Results that match the skin pH (4.5-6.5) can  
104 increase acceptability when used (Silvia et al., 2021).

#### 105 **Viscosity**

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106 The viscosity of the preparation was measured using a Brookfield spindle 64 viscometer  
107 at a speed of 1.0 rpm (Cahyani & Putri, 2017). At a viscosity of 2000-50000 cps indicates a  
108 good peel-off gel mask (SNI 16-4399-1996: 1).

### 109 **Spreadability**

110 Observations were made on the spreading ability of 0.5 grams of the preparation placed  
111 in the middle of the spreading power tester, then covered with a glass plate that had  
112 previously been weighed and its weight recorded, left for one minute. The spreading ability  
113 is indicated by measuring the diameter of the four sides of the spread. Do the same steps for  
114 each additional 50 grams of load above it until the diameter of the spread is constant (Cahyani  
115 & Putri, 2017). The ideal spread of the peel off gel mask is 5-7 cm (Silvia et al., 2021).

### 116 **Adhesion**

117 0.25 g preparation on a glass object is given a load pressure of 100 grams for 5 minutes  
118 and then placed on the adhesive strength tester. The adhesive strength is measured by  
119 recording the time when the two glass objects are released. A time of more than 1 second  
120 indicates good adhesive strength of the peel off gel mask (Syam et al., 2021).

### 121 **Drying Time**

122 0.1 g of the preparation is applied to the arm with an area of 2.5 x 2.5 cm, then the time  
123 is observed until the preparation dries (Andini et al., 2017). standard drying time for a peel-  
124 off gel mask is 15-30 minutes (Silvia et al., 2021).

### 125 **2.5 Antioxidant Activity with DPPH (2,2-difenyl-1-picrylhydrazyl) Method**

126 The test was carried out in several stages. First, determine the maximum wavelength of  
127 the DPPH 30 solution  $\mu\text{g/mL}$  with a UV-Vis spectrophotometer in the 400-800 nm region.  
128 Determination of operating time is done by measuring the absorption at the maximum  
129 wavelength obtained using a standard solution (vitamin C) and DPPH 30 solution  $\mu\text{g/mL}$  at a  
130 1:1 ratio for 60 minutes.

131 An amount of 0.05 grams of the preparation was dissolved in methanol up to 50 mL and  
132 diluted to obtain sample solution concentrations of 60,70,80,100 and 120  $\mu\text{g/mL}$ . For each  
133 concentration, DPPH 30 solution was added  $\mu\text{g/mL}$  at a ratio of 1:1 and absorbance  
134 measurements were carried out using a UV-Vis spectrophotometer at a maximum  
135 wavelength after being incubated at room temperature for the time obtained from the results  
136 of determining the operating time. The same stage was also carried out on vitamin C solutions

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137 with concentrations of 2.4,6,8,10 µg/mL as a reference standard. Determine the IC<sub>50</sub> value  
138 from the results of measuring the absorbance of the sample solution and the reference  
139 standard obtained (Maharani et al., 2022).

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### 3. Results and Discussion

#### 3.1 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

143 Traditionally, secang wood has many health benefits, including antibacterial, anti-  
144 inflammatory, anti-diabetic, tuberculosis, malaria and tetanus (Setyowati et al., 2023). In  
145 addition, it is also widely used in food and cosmetics as an antioxidant (Rajput et al., 2022).  
146 Secang wood contains active compounds that are included in the flavonoid group, namely  
147 brazilin, brazilin, 3'-o-methylbrazilin, sappanin, chalcone, and sappan chalcone. Brazilin in  
148 secang wood has an antioxidant effect (Ngamwonglumlert & Devahastin, 2023). For the  
149 manufacture of secang wood extract, the maceration method using 96% ethanol (1:1) was  
150 used. The peel-off gel mask has unique characteristics with the formation of a transparent,  
151 elastic and easily removable film layer without rinsing which can increase the comfort of use  
152 and the effectiveness of active compounds. Therefore, this study was designed to make a  
153 peel-off gel mask of secang wood extract as an antioxidant F1 (2.5%) F2 (5%0 and F3 (7.5%)  
154 with the results of the physical characteristics test presented in Table 2.

155 Organoleptic and homogeneity testing aims to see the physical appearance and  
156 distribution of each component of a preparation. Based on table 2, the results show that the  
157 three formulas give the same results. The level of comfort of using a preparation is also  
158 influenced by the pH of the preparation. The higher the concentration of secang wood extract,  
159 the lower the pH of the preparation as seen in Figure 1a. This occurs because the ethanol  
160 extract of secang wood has a pH that tends to be acidic (2-6) (Muslimin et al., 2024), so that  
161 by adding the amount of secang wood extract, the pH of the preparation will decrease. The  
162 pH value of secang wood extract can affect the color of the peel-off gel mask preparation  
163 produced. This effect is caused because the stability of brazilin is greatly influenced by its  
164 acidity level where at pH 2-5 (yellow-orange), pH 6-7 (pink) and pH > 7 (red-violet) where the  
165 degradation results of brazilin into brazilein which is red in color (Rina et al., 2017).

166 The results of the viscosity test showed an increase that was proportional to the  
167 increase in the concentration of secang wood extract in the peel-off gel mask formula (Figure

Commented [AS3]: explanation for table 1 has not been included in the research results

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168 1b). The thick concentration of secang wood extract showed high resistance so that it would  
169 affect the resistance of the preparation to flow. The viscosity of the preparation is closely  
170 related to the spreadability, adhesion and drying time. The higher the viscosity, the lower the  
171 spreadability (Figure 1c) and the higher the adhesion (Figure 1d) of the preparation because  
172 high resistance indicates a stronger bond between particles which causes water to be trapped  
173 and dry longer (Figure 1e) (Cahyani et al., 2025).

### 174 3.2 Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

175 Test results all formulas showed antioxidant activity included in the strong category  
176 as indicated by the IC<sub>50</sub> value (Table 2) so it can be said that the selection of the peel off gel  
177 mask preparation is right and the resulting formula can maintain the stability of the active  
178 compound. The increase in antioxidant activity is indicated by a decrease in the IC<sub>50</sub> value  
179 along with the increase in extract concentration (Figure 2). This is because the higher the  
180 concentration of sengon wood extract, the higher the brazilin content in the peel off gel mask  
181 preparation. Brazilin, in addition to playing a role in the color produced, is also a flavonoid  
182 with high antioxidant activity and is widely used in natural skin care (Faizah et al., 2023).  
183 Brazilin is a flavonoid with the ability to ward off free radicals and can inhibit enzymes  
184 responsible for the production of free radicals (Hu et al., 2008)

**Commented [AS4]:** It has not been explained on what basis the antioxidants obtained are categorized as strong, medium, or weak.

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## 4. Conclusion

187 Increasing the concentration of secang wood extract has a significant effect (p-value  
188 <0.05) on increasing the viscosity, adhesiveness and drying time and can reduce pH,  
189 spreadability and IC<sub>50</sub> value. The antioxidant activity of all formulas is included in the strong  
190 category with the IC<sub>50</sub> values of the three formulas respectively being 88, 71 µg/mL; 81.58  
191 µg/mL and 79.04 µg/mL. Peel off gel mask preparation formula with good characteristics and  
192 strong antioxidant activity at a concentration of 7.5% secang wood extract.

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**Table 1.** Formulation of Peel Off Gel Masker Secang Wood Extract

Material	Formula (%)		
	I	II	III
Secang Wood Extract	2,5	5	7,5
CMC Na	1,26	1,26	1,26
PVA	6,74	6,74	6,74
Propilenglikol	4	4	4
Aqua destilata ad	100	100	100

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297 **Table 2.** Characterization and Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

Evaluation	Formula		
	I	II	III
Organoleptic	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell
Homogeneity	Homogeneous	Homogeneous	Homogeneous
pH	6.4 ± 0.16	5.85 ± 0.43	5.09 ± 0.35
Viscosity (cPs)	11986.4 ± 6.02	13992.6 ± 5.13	15993.2 ± 5.36
Spreadability (cm)	5.6 ± 0.19	5.18 ± 0.33	4.52 ± 0.33
Adhesion (secon)	3.5 ± 0.13	4.2 ± 0.16	4.85 ± 0.04
Drying Time (minute)	16.06 ± 0.39	17.88 ± 0.38	19.45 ± 0.40
IC <sub>50</sub> (µg/mL)	88.71 ± 2.06	81.58 ± 3.60	79.04 ± 1.84

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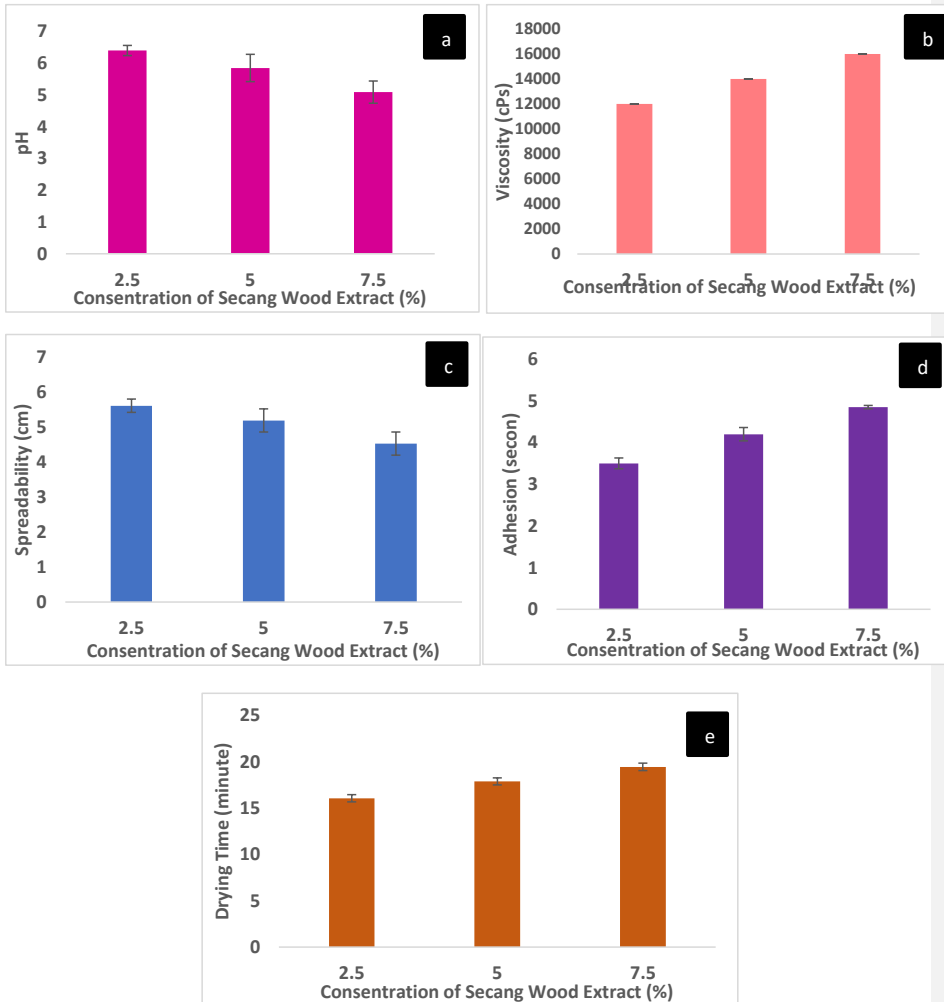
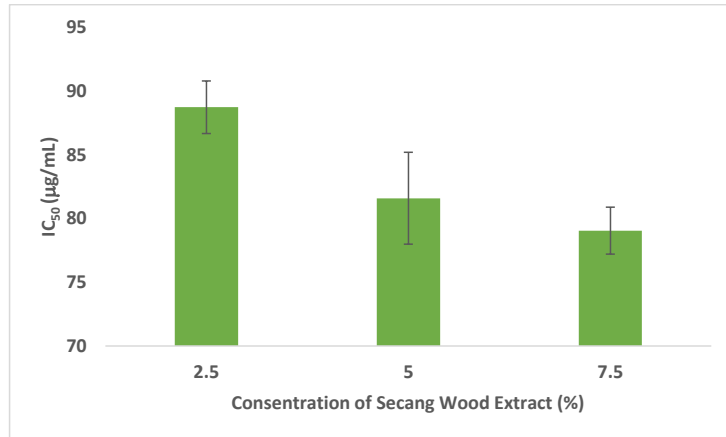


Figure 1. Characterization of Peel Off Gel Mask Secang Wood Extract: (a) pH, (b) Viscosity, (c) Spreadability, (d) Adhesion and (e) Drying Time

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**Figure 2.** Antioxidant activity (IC<sub>50</sub>) of Peel Off Gel Mask Secang Wood Extract

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## BUKTI KORESPONDENSI CATATAN REVIEWER 2

### 1 Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and 2 Characterization

### 3 Masker Gel Peel Off Ekstrak Kayu Secang sebagai Antioksidan : Formulasi dan 4 Karakterisasi 5

#### 6 Abstract

7 Secang wood contains active compounds of the flavonoid group, namely brazilin, brazilin, 3'-  
8 O-methylbrazilin, sappanin chalcone, and sappan chalcone which can be used as primary  
9 antioxidants or secondary antioxidants. Antioxidants are compounds that can inhibit  
10 oxidation reactions by binding reactive free radicals. Increasing the value of the benefits of  
11 secang wood as an antioxidant can be done by developing a topical preparation formulation.  
12 Peel-off gel mask is the right topical preparation because in addition to maintaining skin  
13 health, it can also increase effectiveness and comfort during use. The study aims to determine  
14 the formula of a peel-off gel mask with secang wood extract as an antioxidant with good  
15 characteristics. The formulation of the peel-off gel mask was made with a concentration of  
16 secang wood extract of 2.5%; 5% and 7.5% using sodium carboxymethyl cellulose, polyvinyl  
17 alcohol and propylene glycol as a base. The preparation of the peel-off gel mask with secang  
18 wood extract produced was then tested with several parameters to determine the physical  
19 characteristics and antioxidant activity. The results showed that the higher the concentration  
20 of secang wood extract, the more significant the effect (p-value <0.05) on increasing viscosity,  
21 adhesiveness and drying time and can reduce pH, spreadability and IC<sub>50</sub> value. The antioxidant  
22 activity of all formulas is included in the strong category with the IC<sub>50</sub> value of the three  
23 formulas respectively being 88, 71 µg/mL; 81.58 µg/mL and 79.04 µg/mL.  
24

25 Keywords: Secang wood, Formulation, Peel off gel mask, Antioxidants, Physical characteristics

#### 26 Abstrak

27 Kayu secang mengandung senyawa aktif golongan flavonoid yaitu brazilin, brazilin, 3'-O-  
28 metilbrazilin, sappanin chalcone, dan sappan chalcone yang dapat digunakan sebagai  
29 antioksidan primer maupun antioksidan sekunder. Antioksidan merupakan senyawa yang  
30 dapat menghambat reaksi oksidasi dengan mengikat radikal bebas yang reaktif. Peningkatan  
31 nilai manfaat kayu secang sebagai antioksidan dapat dilakukan dengan pengembangan  
32 formulasi sediaan topikal. Masker gel peel-off merupakan sediaan topikal yang tepat karena  
33 selain dapat menjaga kesehatan kulit juga dapat meningkatkan efektivitas dan kenyamanan  
34 saat penggunaan. Penelitian bertujuan untuk mengetahui formula masker gel peel off ekstrak  
35 kayu secang sebagai antioksidan dengan karakteristik yang baik. Formulasi masker gel peel  
36 off dibuat dengan konsentrasi ekstrak kayu secang 2.5%; 5% dan 7.5% menggunakan natrium  
37 karboksimetil selulosa, polivinil alkohol dan propilen glikol sebagai basis. Sediaan masker gel  
38 peel off ekstrak kayu secang yang dihasilkan selanjutnya dilakukan pengujian dengan  
39 beberapa parameter untuk mengetahui karakteristik fisik dan aktivitas antioksidan. Hasil  
40 menunjukkan semakin tinggi konsentrasi ekstrak kayu secang berpengaruh signifikan (p-value  
41 < 0,05) pada peningkatan viskositas, daya lekat dan waktu mengering serta dapat  
42 menurunkan pH, daya sebar dan nilai IC<sub>50</sub>. Aktivitas antioksidan semua formula termasuk  
43 dalam kategori kuat dengan nilai IC<sub>50</sub> ketiga formula berturut-turut adalah 88.71 µg/mL; 81.58  
44 µg/mL dan 79.04 µg/mL.

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46 **Kata Kunci:** Kayu secang, Formulasi, Masker gel peel off, antioksidan, karakteristik fisik

### 47 **1. Introduction**

48 Air pollution is currently experiencing a significant increase, reaching 20%. Low air  
49 quality can have a negative impact because long-term exposure can cause health problems  
50 (Wahdaningsih et al., 2015). One of the mechanisms is the occurrence of oxidative stress in  
51 the body. The high level of air pollution today can cause the formation of free radicals so it  
52 needs to be balanced with natural antioxidant intake to prevent oxidative damage which is a  
53 trigger for various diseases, especially skin disorders (Widowati, 2011). Flavonoids are natural  
54 compounds that have the ability as antioxidants by inhibiting the formation of free radicals  
55 hydroxyl, peroxide, alkoxyl, superoxide anions, oxygen singkets and hydrogen peroxide (Utari,  
56 2017).

57 Secang wood contains active compounds of the flavonoid group which can be used as  
58 primary antioxidants or secondary antioxidants. The presence of brazilin components in  
59 secang wood has the effect of protecting the body from poisoning due to free radicals (Rina  
60 et al., 2012). Has reliable antioxidant power with a higher antioxidant index than commercial  
61 antioxidants (BHT and BHA) so it has the potential as a free radical scavenging agent  
62 (Sugiyanto et al., 2013). Secang wood extract has been proven effective as an antioxidant with  
63 an IC<sub>50</sub> value of 74,44 µg/mL (Tanzaq et al., 2019).

64 Mask is one of the cosmetics for facial skin care. However, the use of masks is generally  
65 less efficient. The demands of market needs with today's lifestyle are not only effective but  
66 easy, comfortable and flexible in their use. Peel off gel mask is the result of the development  
67 of facial skin care products that can answer these challenges (Ningsih et al., 2016). Peel off  
68 gel mask is a type of facial mask that has the advantage of being easy to remove or lift like an  
69 elastic membrane (Rahmawanty et al., 2015). Several studies have proven that peel off gel  
70 mask preparations can increase the effectiveness of antioxidants, including *Paedaria fotida*  
71 extract (Eka et al., 2022), areca seed extract (Dwi Mulyani et al., 2023), red spinach leaves  
72 extract (Welly et al., 2022) and mangrove leaves extract (Hasibuan et al., 2024).

### 73 74 **2. Methods**

#### 75 **2.1 Materials and Tools**

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76 The materials used in this study were secang wood, ethanol 96% (Merck), Sodium  
77 Carboxymethyl Cellulose (CMC Na), Polyvinil Alcohol (PVA), propilenglicol, vitamin C dan 1,1-  
78 difenil-2-pikrilhidrazil (DPPH) .

79 The tools used in this study were rotary evaporator (Heidolph), alat-alat gelas (Pyrex),  
80 pH meter (Hanna Instrument pH 210 Microprocessor), viskometer (Brookfield DV-I Prime),  
81 and spektrofotometer UV-Vis mini 1240 (Shimadzu).

### 82 **2.2 Sengon Wood Extraction**

83 The extraction method used is maceration by soaking secang wood powder using 96%  
84 ethanol solvent with a ratio of 1:10. Extraction is carried out for 3x24 hours. The filtrate  
85 obtained is then evaporated with a rotary evaporator until a thick extract is obtained (Tanzaq  
86 et al., 2019).

### 87 **2.3 Formulation of Peel Off Gel Masker Secang Wood Extract**

88 Peel-off gel mask of secang wood extract was made by developing PVA and CMC Na (Table  
89 1) in hot distilled water until fully expanded. PVA mass plus expanded propylene glycol and  
90 CMC Na was stirred until homogeneous. Ethanol extract of secang wood was added little by  
91 little into the peel-off gel mask base, distilled water was added until the weight of the  
92 preparation was 100% and stirred until homogeneous (Cahyani et al., 2025).

### 93 **2.4 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract**

#### 94 **Organoleptic**

95 Observations were made on the color, odor, and dosage form of the Peel Off Gel Mask  
96 Secang Wood Extract (Syam et al., 2021).

#### 97 **Homogeneity**

98 Observations are made by preparing a number of preparations on object glass (Cahyani  
99 & Putri, 2017). All particles are evenly dispersed on the object glass indicating a homogeneous  
100 preparation (Syam et al., 2021)

#### 101 **pH**

102 The pH meter electrode is dipped into the preparation until the display on the device  
103 shows a constant pH value (Andini et al., 2017). Results that match the skin pH (4.5-6.5) can  
104 increase acceptability when used (Silvia et al., 2021).

#### 105 **Viscosity**

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106 The viscosity of the preparation was measured using a Brookfield spindle 64 viscometer  
107 at a speed of 1.0 rpm (Cahyani & Putri, 2017). At a viscosity of 2000-50000 cps indicates a  
108 good peel-off gel mask (SNI 16-4399-1996: 1).

### 109 **Spreadability**

110 Observations were made on the spreading ability of 0.5 grams of the preparation placed  
111 in the middle of the spreading power tester, then covered with a glass plate that had  
112 previously been weighed and its weight recorded, left for one minute. The spreading ability  
113 is indicated by measuring the diameter of the four sides of the spread. Do the same steps for  
114 each additional 50 grams of load above it until the diameter of the spread is constant (Cahyani  
115 & Putri, 2017). The ideal spread of the peel off gel mask is 5-7 cm (Silvia et al., 2021).

### 116 **Adhesion**

117 0.25 g preparation on a glass object is given a load pressure of 100 grams for 5 minutes  
118 and then placed on the adhesive strength tester. The adhesive strength is measured by  
119 recording the time when the two glass objects are released. A time of more than 1 second  
120 indicates good adhesive strength of the peel off gel mask (Syam et al., 2021).

### 121 **Drying Time**

122 0.1 g of the preparation is applied to the arm with an area of 2.5 x 2.5 cm, then the time  
123 is observed until the preparation dries (Andini et al., 2017). standard drying time for a peel-  
124 off gel mask is 15-30 minutes (Silvia et al., 2021).

### 125 **2.5 Antioxidant Activity with DPPH (2,2-difenyl-1-picrylhydrazyl) Method**

126 The test was carried out in several stages. First, determine the maximum wavelength of  
127 the DPPH 30 solution  $\mu\text{g/mL}$  with a UV-Vis spectrophotometer in the 400-800 nm region.  
128 Determination of operating time is done by measuring the absorption at the maximum  
129 wavelength obtained using a standard solution (vitamin C) and DPPH 30 solution  $\mu\text{g/mL}$  at a  
130 1:1 ratio for 60 minutes.

131 An amount of 0.05 grams of the preparation was dissolved in methanol up to 50 mL and  
132 diluted to obtain sample solution concentrations of 60,70,80,100 and 120  $\mu\text{g/mL}$ . For each  
133 concentration, DPPH 30 solution was added  $\mu\text{g/mL}$  at a ratio of 1:1 and absorbance  
134 measurements were carried out using a UV-Vis spectrophotometer at a maximum  
135 wavelength after being incubated at room temperature for the time obtained from the results  
136 of determining the operating time. The same stage was also carried out on vitamin C solutions

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137 with concentrations of 2.4,6,8,10 µg/mL as a reference standard. Determine the IC<sub>50</sub> value  
138 from the results of measuring the absorbance of the sample solution and the reference  
139 standard obtained (Maharani et al., 2022).

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### 3. Results and Discussion

#### 3.1 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

143 Traditionally, secang wood has many health benefits, including antibacterial, anti-  
144 inflammatory, anti-diabetic, tuberculosis, malaria and tetanus (Setyowati et al., 2023). In  
145 addition, it is also widely used in food and cosmetics as an antioxidant (Rajput et al., 2022).  
146 Secang wood contains active compounds that are included in the flavonoid group, namely  
147 brazilin, brazilin, 3'-o-methylbrazilin, sappanin, chalcone, and sappan chalcone. Brazilin in  
148 secang wood has an antioxidant effect (Ngamwonglumlert & Devahastin, 2023). For the  
149 manufacture of secang wood extract, the maceration method using 96% ethanol (1:1) was  
150 used. The peel-off gel mask has unique characteristics with the formation of a transparent,  
151 elastic and easily removable film layer without rinsing which can increase the comfort of use  
152 and the effectiveness of active compounds. Therefore, this study was designed to make a  
153 peel-off gel mask of secang wood extract as an antioxidant F1 (2.5%) F2 (5%) and F3 (7.5%)  
154 with the results of the physical characteristics test presented in Table 2.

155 Organoleptic and homogeneity testing aims to see the physical appearance and  
156 distribution of each component of a preparation. Based on table 2, the results show that the  
157 three formulas give the same results. The level of comfort of using a preparation is also  
158 influenced by the pH of the preparation. The higher the concentration of secang wood extract,  
159 the lower the pH of the preparation as seen in Figure 1a. This occurs because the ethanol  
160 extract of secang wood has a pH that tends to be acidic (2-6) (Muslimin et al., 2024), so that  
161 by adding the amount of secang wood extract, the pH of the preparation will decrease. The  
162 pH value of secang wood extract can affect the color of the peel-off gel mask preparation  
163 produced. This effect is caused because the stability of brazilin is greatly influenced by its  
164 acidity level where at pH 2-5 (yellow-orange), pH 6-7 (pink) and pH > 7 (red-violet) where the  
165 degradation results of brazilin into brazilein which is red in color (Rina et al., 2017).

166 The results of the viscosity test showed an increase that was proportional to the  
167 increase in the concentration of secang wood extract in the peel-off gel mask formula (Figure

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168 1b). The thick concentration of secang wood extract showed high resistance so that it would  
169 affect the resistance of the preparation to flow. The viscosity of the preparation is closely  
170 related to the spreadability, adhesion and drying time. The higher the viscosity, the lower the  
171 spreadability (Figure 1c) and the higher the adhesion (Figure 1d) of the preparation because  
172 high resistance indicates a stronger bond between particles which causes water to be trapped  
173 and dry longer (Figure 1e) (Cahyani et al., 2025).

### 174 3.2 Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

175 Test results all formulas showed antioxidant activity included in the strong category  
176 as indicated by the IC<sub>50</sub> value (Table 2) so it can be said that the selection of the peel off gel  
177 mask preparation is right and the resulting formula can maintain the stability of the active  
178 compound. The increase in antioxidant activity is indicated by a decrease in the IC<sub>50</sub> value  
179 along with the increase in extract concentration (Figure 2). This is because the higher the  
180 concentration of **sengon** wood extract, the higher the brazilin content in the peel off gel mask  
181 preparation. Brazilin, in addition to playing a role in the color produced, is also a flavonoid  
182 with high antioxidant activity and is widely used in natural skin care (Faizah et al., 2023).  
183 Brazilin is a flavonoid with the ability to ward off free radicals and can inhibit enzymes  
184 responsible for the production of free radicals (Hu et al., 2008)

Commented [da1]: How is the analysis of vitamin C as a standard against the three formulas?

185

186

#### 4. Conclusion

187 Increasing the concentration of secang wood extract has a significant effect (p-value  
188 <0.05) on increasing the viscosity, adhesiveness and drying time and can reduce pH,  
189 spreadability and IC<sub>50</sub> value. The antioxidant activity of all formulas is included in the strong  
190 category with the IC<sub>50</sub> values of the three formulas respectively being 88, 71 µg/mL; 81.58  
191 µg/mL and 79.04 µg/mL. Peel off gel mask preparation formula with good characteristics and  
192 strong antioxidant activity at a concentration of 7.5% secang wood extract.

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**Table 1.** Formulation of Peel Off Gel Masker Secang Wood Extract

Material	Formula (%)		
	I	II	III
Secang Wood Extract	2,5	5	7,5
CMC Na	1,26	1,26	1,26
PVA	6,74	6,74	6,74
Propilenglikol	4	4	4
Aqua destilata ad	100	100	100

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297 **Table 2.** Characterization and Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

Evaluation	Formula		
	I	II	III
Organoleptic	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell
Homogeneity	Homogeneous	Homogeneous	Homogeneous
pH	6.4 ± 0.16	5.85 ± 0.43	5.09 ± 0.35
Viscosity (cPs)	11986.4 ± 6.02	13992.6 ± 5.13	15993.2 ± 5.36
Spreadability (cm)	5.6 ± 0.19	5.18 ± 0.33	4.52 ± 0.33
Adhesion (secon)	3.5 ± 0.13	4.2 ± 0.16	4.85 ± 0.04
Drying Time (minute)	16.06 ± 0.39	17.88 ± 0.38	19.45 ± 0.40
IC <sub>50</sub> (µg/mL)	88.71 ± 2.06	81.58 ± 3.60	79.04 ± 1.84

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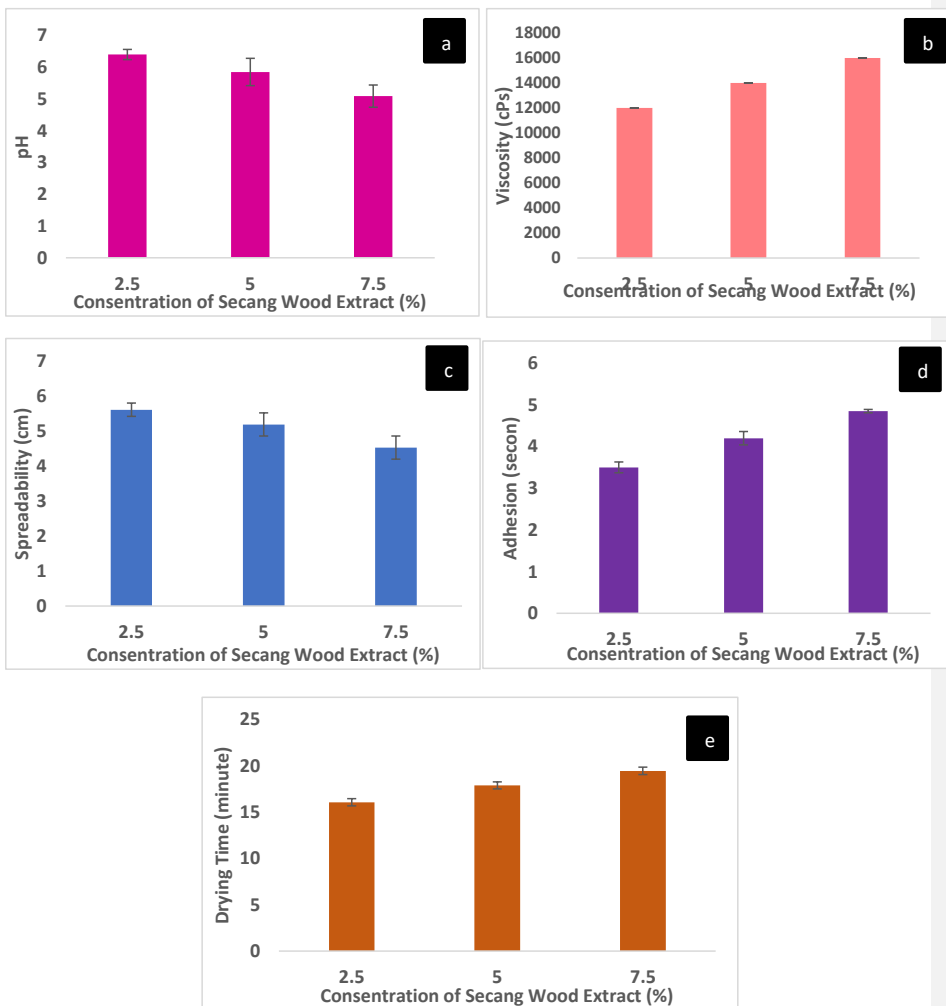
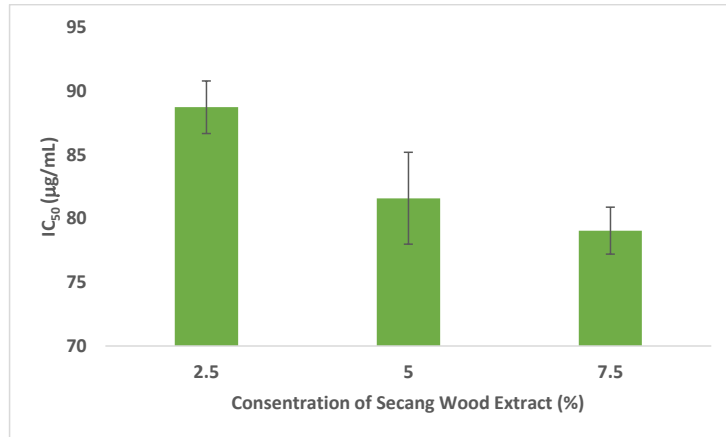


Figure 1. Characterization of Peel Off Gel Mask Secang Wood Extract: (a) pH, (b) Viscosity, (c) Spreadability, (d) Adhesion and (e) Drying Time

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**Figure 2.** Antioxidant activity (IC<sub>50</sub>) of Peel Off Gel Mask Secang Wood Extract

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## BUKTI KORESPONDENSI CATATAN REVIEWER 3

### 1 Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and 2 Characterization

### 3 Masker Gel Peel Off Ekstrak Kayu Secang sebagai Antioksidan : Formulasi dan 4 Karakterisasi 5

#### 6 Abstract

7 Secang wood contains active compounds of the flavonoid group, namely brazilin, brazilin, 3'-  
8 O-methylbrazilin, sappanin chalcone, and sappan chalcone which can be used as primary  
9 antioxidants or secondary antioxidants. Antioxidants are compounds that can inhibit  
10 oxidation reactions by binding reactive free radicals. Increasing the value of the benefits of  
11 secang wood as an antioxidant can be done by developing a topical preparation formulation.  
12 Peel-off gel mask is the right topical preparation because in addition to maintaining skin  
13 health, it can also increase effectiveness and comfort during use. The study aims to determine  
14 the formula of a peel-off gel mask with secang wood extract as an antioxidant with good  
15 characteristics. The formulation of the peel-off gel mask was made with a concentration of  
16 secang wood extract of 2.5%; 5% and 7.5% using sodium carboxymethyl cellulose, polyvinyl  
17 alcohol and propylene glycol as a base. The preparation of the peel-off gel mask with secang  
18 wood extract produced was then tested with several parameters to determine the physical  
19 characteristics and antioxidant activity. The results showed that the higher the concentration  
20 of secang wood extract, the more significant the effect (p-value <0.05) on increasing viscosity,  
21 adhesiveness and drying time and can reduce pH, spreadability and IC<sub>50</sub> value. The antioxidant  
22 activity of all formulas is included in the strong category with the IC<sub>50</sub> value of the three  
23 formulas respectively being 88, 71 µg/mL; 81.58 µg/mL and 79.04 µg/mL.  
24

25 Keywords: Secang wood, Formulation, Peel off gel mask, Antioxidants, Physical characteristics

#### 26 Abstrak

27 Kayu secang mengandung senyawa aktif golongan flavonoid yaitu brazilin, brazilin, 3'-O-  
28 metilbrazilin, sappanin chalcone, dan sappan chalcone yang dapat digunakan sebagai  
29 antioksidan primer maupun antioksidan sekunder. Antioksidan merupakan senyawa yang  
30 dapat menghambat reaksi oksidasi dengan mengikat radikal bebas yang reaktif. Peningkatan  
31 nilai manfaat kayu secang sebagai antioksidan dapat dilakukan dengan pengembangan  
32 formulasi sediaan topikal. Masker gel peel-off merupakan sediaan topikal yang tepat karena  
33 selain dapat menjaga kesehatan kulit juga dapat meningkatkan efektivitas dan kenyamanan  
34 saat penggunaan. Penelitian bertujuan untuk mengetahui formula masker gel peel off ekstrak  
35 kayu secang sebagai antioksidan dengan karakteristik yang baik. Formulasi masker gel peel  
36 off dibuat dengan konsentrasi ekstrak kayu secang 2.5%; 5% dan 7.5% menggunakan natrium  
37 karboksimetil selulosa, polivinil alkohol dan propilen glikol sebagai basis. Sediaan masker gel  
38 peel off ekstrak kayu secang yang dihasilkan selanjutnya dilakukan pengujian dengan  
39 beberapa parameter untuk mengetahui karakteristik fisik dan aktivitas antioksidan. Hasil  
40 menunjukkan semakin tinggi konsentrasi ekstrak kayu secang berpengaruh signifikan (p-value  
41 < 0,05) pada peningkatan viskositas, daya lekat dan waktu mengering serta dapat  
42 menurunkan pH, daya sebar dan nilai IC<sub>50</sub>. Aktivitas antioksidan semua formula termasuk  
43 dalam kategori kuat dengan nilai IC<sub>50</sub> ketiga formula berturut-turut adalah 88.71 µg/mL; 81.58  
44 µg/mL dan 79.04 µg/mL.

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46 **Kata Kunci:** Kayu secang, Formulasi, Masker gel peel off, antioksidan, karakteristik fisik

### 47 **1. Introduction**

48 Air pollution is currently experiencing a significant increase, reaching 20%. Low air  
49 quality can have a negative impact because long-term exposure can cause health problems  
50 (Wahdaningsih et al., 2015). One of the mechanisms is the occurrence of oxidative stress in  
51 the body. The high level of air pollution today can cause the formation of free radicals so it  
52 needs to be balanced with natural antioxidant intake to prevent oxidative damage which is a  
53 trigger for various diseases, especially skin disorders (Widowati, 2011). Flavonoids are natural  
54 compounds that have the ability as antioxidants by inhibiting the formation of free radicals  
55 hydroxyl, peroxide, alkoxyl, superoxide anions, oxygen singkets and hydrogen peroxide (Utari,  
56 2017).

57 Secang wood contains active compounds of the flavonoid group which can be used as  
58 primary antioxidants or secondary antioxidants. The presence of brazilin components in  
59 secang wood has the effect of protecting the body from poisoning due to free radicals (Rina  
60 et al., 2012). Has reliable antioxidant power with a higher antioxidant index than commercial  
61 antioxidants (BHT and BHA) so it has the potential as a free radical scavenging agent  
62 (Sugiyanto et al., 2013). Secang wood extract has been proven effective as an antioxidant with  
63 an IC<sub>50</sub> value of 74,44 µg/mL (Tanzaq et al., 2019).

64 Mask is one of the cosmetics for facial skin care. However, the use of masks is generally  
65 less efficient. The demands of market needs with today's lifestyle are not only effective but  
66 easy, comfortable and flexible in their use. Peel off gel mask is the result of the development  
67 of facial skin care products that can answer these challenges (Ningsih et al., 2016). Peel off  
68 gel mask is a type of facial mask that has the advantage of being easy to remove or lift like an  
69 elastic membrane (Rahmawanty et al., 2015). Several studies have proven that peel off gel  
70 mask preparations can increase the effectiveness of antioxidants, including Paedaria fotida  
71 extract (Eka et al., 2022), areca seed extract (Dwi Mulyani et al., 2023), red spinach leaves  
72 extract (Welly et al., 2022) and mangrove leaves extract (Hasibuan et al., 2024).

### 73 74 **2. Methods**

#### 75 **2.1 Materials and Tools**

### BUKTI KORESPONDENSI CATATAN REVIEWER 3

76 The materials used in this study were secang wood, ethanol 96% (Merck), Sodium  
77 Carboxymethyl Cellulose (CMC Na), Polyvinil Alcohol (PVA), propilenglicol, vitamin C dan 1,1-  
78 difenil-2-pikrilhidrazil (DPPH) .

79 The tools used in this study were rotary evaporator (Heidolph), alat-alat gelas (Pyrex),  
80 pH meter (Hanna Instrument pH 210 Microprocessor), viskometer (Brookfield DV-I Prime),  
81 and spektrofotometer UV-Vis mini 1240 (Shimadzu).

#### 82 2.2 Sengon Wood Extraction

83 The extraction method used is maceration by soaking secang wood powder using 96%  
84 ethanol solvent with a ratio of 1:10. Extraction is carried out for 3x24 hours. The filtrate  
85 obtained is then evaporated with a rotary evaporator until a thick extract is obtained (Tanzaq  
86 et al., 2019).

#### 87 2.3 Formulation of Peel Off Gel Masker Secang Wood Extract

88 Peel-off gel mask of secang wood extract was made by developing PVA and CMC Na (Table  
89 1) in hot distilled water until fully expanded. PVA mass plus expanded propylene glycol and  
90 CMC Na was stirred until homogeneous. Ethanol extract of secang wood was added little by  
91 little into the peel-off gel mask base, distilled water was added until the weight of the  
92 preparation was 100% and stirred until homogeneous (Cahyani et al., 2025).

#### 93 2.4 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

##### 94 Organoleptic

95 Observations were made on the color, odor, and dosage form of the Peel Off Gel Mask  
96 Secang Wood Extract (Syam et al., 2021).

##### 97 Homogeneity

98 Observations are made by preparing a number of preparations on object glass (Cahyani  
99 & Putri, 2017). All particles are evenly dispersed on the object glass indicating a homogeneous  
100 preparation (Syam et al., 2021)

##### 101 pH

102 The pH meter electrode is dipped into the preparation until the display on the device  
103 shows a constant pH value (Andini et al., 2017). Results that match the skin pH (4.5-6.5) can  
104 increase acceptability when used (Silvia et al., 2021).

##### 105 Viscosity

Commented [L1]: Sengon wood or secang wood?

Commented [L2]: What about the comparative formula? both negative and positive. Should be included in table 1 and discussion

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106 The viscosity of the preparation was measured using a Brookfield spindle 64 viscometer  
107 at a speed of 1.0 rpm (Cahyani & Putri, 2017). At a viscosity of 2000-50000 cps indicates a  
108 good peel-off gel mask (SNI 16-4399-1996: 1).

#### 109 **Spreadability**

110 Observations were made on the spreading ability of 0.5 grams of the preparation placed  
111 in the middle of the spreading power tester, then covered with a glass plate that had  
112 previously been weighed and its weight recorded, left for one minute. The spreading ability  
113 is indicated by measuring the diameter of the four sides of the spread. Do the same steps for  
114 each additional 50 grams of load above it until the diameter of the spread is constant (Cahyani  
115 & Putri, 2017). The ideal spread of the peel off gel mask is 5-7 cm (Silvia et al., 2021).

#### 116 **Adhesion**

117 0.25 g preparation on a glass object is given a load pressure of 100 grams for 5 minutes  
118 and then placed on the adhesive strength tester. The adhesive strength is measured by  
119 recording the time when the two glass objects are released. A time of more than 1 second  
120 indicates good adhesive strength of the peel off gel mask (Syam et al., 2021).

#### 121 **Drying Time**

122 0.1 g of the preparation is applied to the arm with an area of 2.5 x 2.5 cm, then the time  
123 is observed until the preparation dries (Andini et al., 2017). standard drying time for a peel-  
124 off gel mask is 15-30 minutes (Silvia et al., 2021).

#### 125 **2.5 Antioxidant Activity with DPPH (2,2-difenyl-1-picrylhydrazyl) Method**

126 The test was carried out in several stages. First, determine the maximum wavelength of  
127 the DPPH 30 solution  $\mu\text{g/mL}$  with a UV-Vis spectrophotometer in the 400-800 nm region.  
128 Determination of operating time is done by measuring the absorption at the maximum  
129 wavelength obtained using a standard solution (vitamin C) and DPPH 30 solution  $\mu\text{g/mL}$  at a  
130 1:1 ratio for 60 minutes.

131 An amount of 0.05 grams of the preparation was dissolved in methanol up to 50 mL and  
132 diluted to obtain sample solution concentrations of 60,70,80,100 and 120  $\mu\text{g/mL}$ . For each  
133 concentration, DPPH 30 solution was added  $\mu\text{g/mL}$  at a ratio of 1:1 and absorbance  
134 measurements were carried out using a UV-Vis spectrophotometer at a maximum  
135 wavelength after being incubated at room temperature for the time obtained from the results  
136 of determining the operating time. The same stage was also carried out on vitamin C solutions

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137 with concentrations of 2.4,6,8,10 µg/mL as a reference standard. Determine the IC<sub>50</sub> value  
138 from the results of measuring the absorbance of the sample solution and the reference  
139 standard obtained (Maharani et al., 2022).

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### 3. Results and Discussion

#### 3.1 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

143 Traditionally, secang wood has many health benefits, including antibacterial, anti-  
144 inflammatory, anti-diabetic, tuberculosis, malaria and tetanus (Setyowati et al., 2023). In  
145 addition, it is also widely used in food and cosmetics as an antioxidant (Rajput et al., 2022).  
146 Secang wood contains active compounds that are included in the flavonoid group, namely  
147 brazilin, brazilin, 3'-o-methylbrazilin, sappanin, chalcone, and sappan chalcone. Brazilin in  
148 secang wood has an antioxidant effect (Ngamwonglumlert & Devahastin, 2023). For the  
149 manufacture of secang wood extract, the maceration method using 96% ethanol (1:1) was  
150 used. The peel-off gel mask has unique characteristics with the formation of a transparent,  
151 elastic and easily removable film layer without rinsing which can increase the comfort of use  
152 and the effectiveness of active compounds. Therefore, this study was designed to make a  
153 peel-off gel mask of secang wood extract as an antioxidant F1 (2.5%) F2 (5%0 and F3 (7.5%)  
154 with the results of the physical characteristics test presented in Table 2.

155 Organoleptic and homogeneity testing aims to see the physical appearance and  
156 distribution of each component of a preparation. Based on table 2, the results show that the  
157 three formulas give the same results. The level of comfort of using a preparation is also  
158 influenced by the pH of the preparation. The higher the concentration of secang wood extract,  
159 the lower the pH of the preparation as seen in Figure 1a. This occurs because the ethanol  
160 extract of secang wood has a pH that tends to be acidic (2-6) (Muslimin et al., 2024), so that  
161 by adding the amount of secang wood extract, the pH of the preparation will decrease. The  
162 pH value of secang wood extract can affect the color of the peel-off gel mask preparation  
163 produced. This effect is caused because the stability of brazilin is greatly influenced by its  
164 acidity level where at pH 2-5 (yellow-orange), pH 6-7 (pink) and pH > 7 (red-violet) where the  
165 degradation results of brazilin into brazilein which is red in color (Rina et al., 2017).

166 The results of the viscosity test showed an increase that was proportional to the  
167 increase in the concentration of secang wood extract in the peel-off gel mask formula (Figure

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168 1b). The thick concentration of secang wood extract showed high resistance so that it would  
169 affect the resistance of the preparation to flow. The viscosity of the preparation is closely  
170 related to the spreadability, adhesion and drying time. The higher the viscosity, the lower the  
171 spreadability (Figure 1c) and the higher the adhesion (Figure 1d) of the preparation because  
172 high resistance indicates a stronger bond between particles which causes water to be trapped  
173 and dry longer (Figure 1e) (Cahyani et al., 2025).

#### 174 3.2 Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

175 Test results all formulas showed antioxidant activity included in the strong category  
176 as indicated by the IC<sub>50</sub> value (Table 2) so it can be said that the selection of the peel off gel  
177 mask preparation is right and the resulting formula can maintain the stability of the active  
178 compound. The increase in antioxidant activity is indicated by a decrease in the IC<sub>50</sub> value  
179 along with the increase in extract concentration (Figure 2). This is because the higher the  
180 concentration of secang wood extract, the higher the brazilin content in the peel off gel mask  
181 preparation. Brazilin, in addition to playing a role in the color produced, is also a flavonoid  
182 with high antioxidant activity and is widely used in natural skin care (Faizah et al., 2023).  
183 Brazilin is a flavonoid with the ability to ward off free radicals and can inhibit enzymes  
184 responsible for the production of free radicals (Hu et al., 2008)

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#### 4. Conclusion

187 Increasing the concentration of secang wood extract has a significant effect (p-value  
188 <0.05) on increasing the viscosity, adhesiveness and drying time and can reduce pH,  
189 spreadability and IC<sub>50</sub> value. The antioxidant activity of all formulas is included in the strong  
190 category with the IC<sub>50</sub> values of the three formulas respectively being 88, 71 µg/mL; 81.58  
191 µg/mL and 79.04 µg/mL. Peel off gel mask preparation formula with good characteristics and  
192 strong antioxidant activity at a concentration of 7.5% secang wood extract.

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**Table 1.** Formulation of Peel Off Gel Masker Secang Wood Extract

Material	Formula (%)		
	I	II	III
Secang Wood Extract	2,5	5	7,5
CMC Na	1,26	1,26	1,26
PVA	6,74	6,74	6,74
Propilenglikol	4	4	4
Aqua destilata ad	100	100	100

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**Table 2.** Characterization and Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

Evaluation	Formula		
	I	II	III
Organoleptic	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell
Homogeneity	Homogeneous	Homogeneous	Homogeneous
pH	6.4 ± 0.16	5.85 ± 0.43	5.09 ± 0.35
Viscosity (cPs)	11986.4 ± 6.02	13992.6 ± 5.13	15993.2 ± 5.36
Spreadability (cm)	5.6 ± 0.19	5.18 ± 0.33	4.52 ± 0.33
Adhesion (secon)	3.5 ± 0.13	4.2 ± 0.16	4.85 ± 0.04
Drying Time (minute)	16.06 ± 0.39	17.88 ± 0.38	19.45 ± 0.40
IC <sub>50</sub> (µg/mL)	88.71 ± 2.06	81.58 ± 3.60	79.04 ± 1.84

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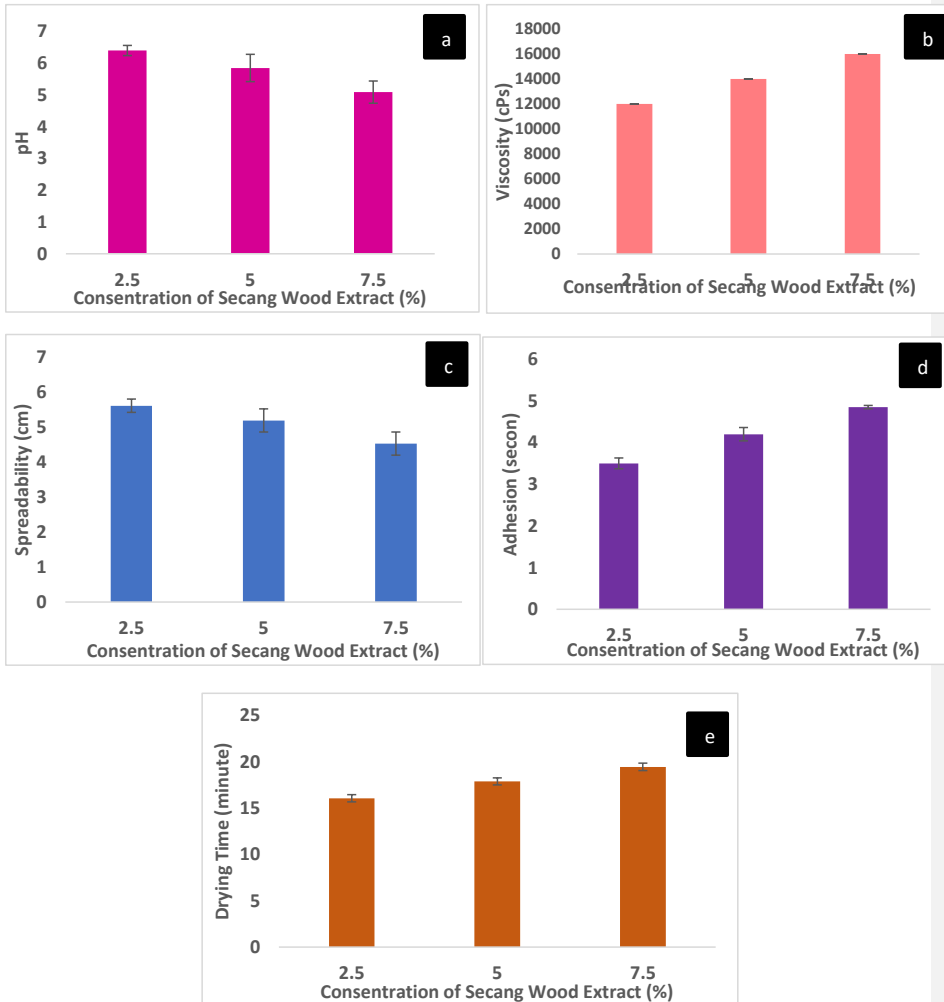
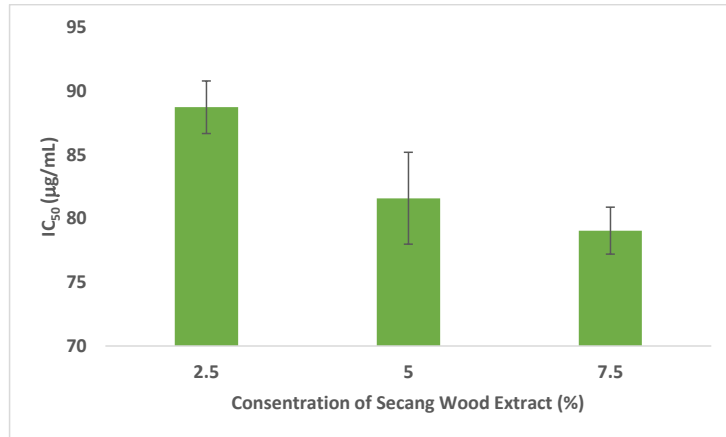


Figure 1. Characterization of Peel Off Gel Mask Secang Wood Extract: (a) pH, (b) Viscosity, (c) Spreadability, (d) Adhesion and (e) Drying Time

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**Figure 2.** Antioxidant activity (IC<sub>50</sub>) of Peel Off Gel Mask Secang Wood Extract

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# Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization

## Masker Gel Peel Off Ekstrak Kayu Secang sebagai Antioksidan : Formulasi dan Karakterisasi

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### Abstract

Secang wood contains active compounds of the flavonoid group, namely brazilin, brazilin, 3'-O-methylbrazilin, sappanin chalcone, and sappan calchone which can be used as primary antioxidants or secondary antioxidants. Antioxidants are compounds that can inhibit oxidation reactions by binding reactive free radicals. Increasing the value of the benefits of secang wood as an antioxidant can be done by developing a topical preparation formulation. Peel-off gel mask is the right topical preparation because in addition to maintaining skin health, it can also increase effectiveness and comfort during use. The study aims to determine the formula of a peel-off gel mask with secang wood extract as an antioxidant with good characteristics. The formulation of the peel-off gel mask was made with a concentration of secang wood extract of 2.5%; 5% and 7.5% using sodium carboxymethyl cellulose, polyvinyl alcohol and propylene glycol as a base. The preparation of the peel-off gel mask with secang wood extract produced was then tested with several parameters to determine the physical characteristics and antioxidant activity. The results showed that the higher the concentration of secang wood extract, the more significant the effect ( $p$ -value  $< 0.05$ ) on increasing viscosity, adhesiveness and drying time and can reduce pH, spreadability and  $IC_{50}$  value. The antioxidant activity of all formulas is included in the strong category were the  $IC_{50}$  value (50-100  $\mu\text{g/mL}$ ) and the third formula respectively are 88, 71  $\mu\text{g/mL}$ ; 81.58  $\mu\text{g/mL}$  and 79.04  $\mu\text{g/mL}$ .

Keywords: Secang wood, Formulation, Peel off gel mask, Antioxidants, Physical characteristics

### Abstrak

Kayu secang mengandung senyawa aktif golongan flavonoid yaitu brazilin, brazilin, 3'-O-metilbrazilin, sappanin chalcone, dan sappan calchone yang dapat digunakan sebagai antioksidan primer maupun antioksidan sekunder. Antioksidan merupakan senyawa yang dapat menghambat reaksi oksidasi dengan mengikat radikal bebas yang reaktif. Peningkatan nilai manfaat kayu secang sebagai antioksidan dapat dilakukan dengan pengembangan formulasi sediaan topikal. Masker gel peel-off merupakan sediaan topikal yang tepat karena selain dapat menjaga kesehatan kulit juga dapat meningkatkan efektivitas dan kenyamanan saat penggunaan. Penelitian bertujuan untuk mengetahui formula masker gel peel off ekstrak kayu secang sebagai antioksidan dengan karakteristik yang baik. Formulasi masker gel peel off dibuat dengan konsentrasi ekstrak kayu secang 2.5%; 5% dan 7.5% menggunakan natrium karboksimetil selulosa, polivinil alkohol dan propilen glikol sebagai basis. Sediaan masker gel peel off ekstrak kayu secang yang dihasilkan selanjutnya dilakukan pengujian dengan beberapa parameter untuk mengetahui karakteristik fisik dan aktivitas antioksidan. Hasil menunjukkan semakin tinggi konsentrasi ekstrak kayu secang berpengaruh signifikan ( $p$ -value  $< 0,05$ ) pada peningkatan viskositas, daya lekat dan waktu mengering serta dapat

45 menurunkan pH, daya sebar dan nilai IC<sub>50</sub>. Aktivitas antioksidan semua formula termasuk  
46 dalam kategori kuat dimana nilai IC<sub>50</sub> (50-100 µg/mL) dan pada ketiga formula berturut-turut  
47 adalah 88.71 µg/mL; 81.58 µg/mL dan 79.04 µg/mL.

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49 **Kata Kunci:** Kayu secang, Formulasi, Masker gel peel off, antioksidan, karakteristik fisik

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## 1. Introduction

51 Air pollution is currently experiencing a significant increase, reaching 20%. Low air  
52 quality can have a negative impact because long-term exposure can cause health problems  
53 (Wahdaningsih et al., 2015). One of the mechanisms is the occurrence of oxidative stress in  
54 the body. The high level of air pollution today can cause the formation of free radicals so it  
55 needs to be balanced with natural antioxidant intake to prevent oxidative damage which is a  
56 trigger for various diseases, especially skin disorders (Widowati, 2011). Flavonoids are natural  
57 compounds that have the ability as antioxidants by inhibiting the formation of free radicals  
58 hydroxyl, peroxide, alkoxyl, superoxide anions, oxygen singkets and hydrogen peroxide (Utari,  
59 2017).

60 Secang wood contains active compounds of the flavonoid group which can be used as  
61 primary antioxidants or secondary antioxidants. The presence of brazilin components in  
62 secang wood has the effect of protecting the body from poisoning due to free radicals (Rina  
63 et al., 2012). Has reliable antioxidant power with a higher antioxidant index than commercial  
64 antioxidants (BHT and BHA) so it has the potential as a free radical scavenging agent  
65 (Sugiyanto et al., 2013). Secang wood extract has been proven effective as an antioxidant with  
66 an IC<sub>50</sub> value of 74,44 µg/mL (Tanzaq et al., 2019).

67 Mask is one of the cosmetics for facial skin care. However, the use of masks is generally  
68 less efficient. The demands of market needs with today's lifestyle are not only effective but  
69 easy, comfortable and flexible in their use. Peel off gel mask is the result of the development  
70 of facial skin care products that can answer these challenges (Ningsih et al., 2016). Peel off  
71 gel mask is a type of facial mask that has the advantage of being easy to remove or lift like an  
72 elastic membrane (Rahmawanty et al., 2015). Several studies have proven that peel off gel  
73 mask preparations can increase the effectiveness of antioxidants, including Paedaria fotida  
74 extract (Eka et al., 2022), areca seed extract (Dwi Mulyani et al., 2023), red spinach leaves  
75 extract (Welly et al., 2022) and mangrove leaves extract (Hasibuan et al., 2024).

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## 2. Methods

### 2.1 Materials and Tools

The materials used in this study were secang wood, ethanol 96% (Merck), Sodium Carboxymethyl Cellulose (CMC Na), Polyvinil Alcohol (PVA), propilenglicol, vitamin C dan 1,1-difenil-2-pikrilhidrazil (DPPH) .

The tools used in this study were rotary evaporator (Heidolph), alat-alat gelas (Pyrex), pH meter (Hanna Instrument pH 210 Microprocessor), viskometer (Brookfield DV-I Prime), and spektrofotometer UV-Vis mini 1240 (Shimadzu).

### 2.2 Secang Wood Extraction

The extraction method used is maceration by soaking secang wood powder using 96% ethanol solvent with a ratio of 1:10. Extraction is carried out for 3x24 hours. The filtrate obtained is then evaporated with a rotary evaporator until a thick extract is obtained (Tanzaq et al., 2019).

### 2.3 Formulation of Peel Off Gel Masker Secang Wood Extract

Peel-off gel mask of secang wood extract was made by developing PVA and CMC Na (Table 1) in distilled water (80°C) until fully expanded. PVA mass plus expanded propylene glycol and CMC Na was stirred until homogeneous. Ethanol extract of secang wood was added little by little into the peel-off gel mask base, distilled water was added until the weight of the preparation was 100% and stirred until homogeneous (Cahyani et al., 2025).

### 2.4 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

#### Organoleptic

Observations were made on the color, odor, and dosage form of the Peel Off Gel Mask Secang Wood Extract (Syam et al., 2021).

#### Homogeneity

Observations are made by preparing a number of preparations on object glass (Cahyani & Putri, 2017). All particles are evenly dispersed on the object glass indicating a homogeneous preparation (Syam et al., 2021)

#### pH

106 The pH meter electrode is dipped into the preparation until the display on the device  
107 shows a constant pH value (Andini et al., 2017). Results that match the skin pH (4.5-6.5) can  
108 increase acceptability when used (Silvia et al., 2021).

109

#### 110 **Viscosity**

111 The viscosity of the preparation was measured using a Brookfield spindle 64 viscometer  
112 at a speed of 1.0 rpm (Cahyani & Putri, 2017). At a viscosity of 2000-50000 cps indicates a  
113 good peel-off gel mask (SNI 16-4399-1996: 1).

#### 114 **Spreadability**

115 Observations were made on the spreading ability of 0.5 grams of the preparation placed  
116 in the middle of the spreading power tester, then covered with a glass plate that had  
117 previously been weighed and its weight recorded, left for one minute. The spreading ability  
118 is indicated by measuring the diameter of the four sides of the spread. Do the same steps for  
119 each additional 50 grams of load above it until the diameter of the spread is constant (Cahyani  
120 & Putri, 2017). The ideal spread of the peel off gel mask is 5-7 cm (Silvia et al., 2021).

#### 121 **Adhesion**

122 0.25 g preparation on a glass object is given a load pressure of 100 grams for 5 minutes  
123 and then placed on the adhesive strength tester. The adhesive strength is measured by  
124 recording the time when the two glass objects are released. A time of more than 1 second  
125 indicates good adhesive strength of the peel off gel mask (Syam et al., 2021).

#### 126 **Drying Time**

127 0.1 g of the preparation is applied to the arm with an area of 2.5 x 2.5 cm, then the time  
128 is observed until the preparation dries (Andini et al., 2017). standard drying time for a peel-  
129 off gel mask is 15-30 minutes (Silvia et al., 2021).

#### 130 **2.5 Antioxidant Activity with DPPH (2,2-difenyl-1-picrylhydrazyl) Method**

131 The test was carried out in several stages. First, determine the maximum wavelength of  
132 the DPPH 30 solution  $\mu\text{g/mL}$  with a UV-Vis spectrophotometer in the 400-800 nm region.  
133 Determination of operating time is done by measuring the absorption at the maximum  
134 wavelength obtained using a standard solution (vitamin C) and DPPH 30 solution  $\mu\text{g/mL}$  at a  
135 1:1 ratio for 60 minutes.

136 An amount of 0.05 grams of the preparation was dissolved in methanol up to 50 mL and  
137 diluted to obtain sample solution concentrations of 60,70,80,100 and 120  $\mu\text{g}/\text{mL}$ . For each  
138 concentration, DPPH 30 solution was added  $\mu\text{g}/\text{mL}$  at a ratio of 1:1 and absorbance  
139 measurements were carried out using a UV-Vis spectrophotometer at a maximum  
140 wavelength after being incubated at room temperature for the time obtained from the results  
141 of determining the operating time. The same stage was also carried out on vitamin C solutions  
142 with concentrations of 2.4,6,8,10  $\mu\text{g}/\text{mL}$  as a reference standard. Determine the  $\text{IC}_{50}$  value  
143 from the results of measuring the absorbance of the sample solution and the reference  
144 standard obtained (Maharani et al., 2022).

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### 3. Results and Discussion

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#### 3.1 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

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Traditionally, secang wood has many health benefits, including antibacterial, anti-inflammatory, anti-diabetic, tuberculosis, malaria and tetanus (Setyowati et al., 2023). In addition, it is also widely used in food and cosmetics as an antioxidant (Rajput et al., 2022). Secang wood contains active compounds that are included in the flavonoid group, namely brazilin, brazilin, 3'-o-methylbrazilin, sappanin, chalcone, and sappan chalcone. Brazilin in secang wood has an antioxidant effect (Ngamwonglumert & Devahastin, 2023). For the manufacture of secang wood extract, the maceration method using 96% ethanol (1:1) was used. The peel-off gel mask has unique characteristics with the formation of a transparent, elastic and easily removable film layer without rinsing which can increase the comfort of use and the effectiveness of active compounds. Therefore, this study was designed to make a peel-off gel mask of secang wood extract as an antioxidant F1 (2.5%) F2 (5%) and F3 (7.5%) with the results of the physical characteristics test presented in Table 2.

160

Gelling agents used in the peel-off gel mask formulation are PVA and CMC Na (Table 1).

161

PVA is a hydrophilic polymer with adhesive properties that are easy to peel off when dry and

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provide a film layer effect called the peel-off effect (Anindhita et al., 2023). However, the film

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layer formed tends to be stiff and easily broken (Sinambela & Telaumbanua, 2022).

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Carboxymethyl Cellulose Sodium (CMC Na) is a hydrophilic polymer with a more stable

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viscosity in the long term (Eryani et al., 2023) so that it can increase the elasticity of the PVA

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layer formed as reported in previous studies (Cahyani et al., 2025).

167 Organoleptic and homogeneity testing aims to see the physical appearance and  
168 distribution of each component of a preparation. Based on table 2, the results show that the  
169 three formulas give the same results. The level of comfort of using a preparation is also  
170 influenced by the pH of the preparation. The higher the concentration of secang wood extract,  
171 the lower the pH of the preparation as seen in Figure 1a. This occurs because the ethanol  
172 extract of secang wood has a pH that tends to be acidic (2-6) (Muslimin et al., 2024), so that  
173 by adding the amount of secang wood extract, the pH of the preparation will decrease. The  
174 pH value of secang wood extract can affect the color of the peel-off gel mask preparation  
175 produced. This effect is caused because the stability of brazilin is greatly influenced by its  
176 acidity level where at pH 2-5 (yellow-orange), pH 6-7 (pink) and pH> 7 (red-violet) where the  
177 degradation results of brazilin into brazilein which is red in color (Rina et al., 2017).

178 The results of the viscosity test showed an increase that was proportional to the  
179 increase in the concentration of secang wood extract in the peel-off gel mask formula (Figure  
180 1b). The thick concentration of secang wood extract showed high resistance so that it would  
181 affect the resistance of the preparation to flow. The viscosity of the preparation is closely  
182 related to the spreadability, adhesion and drying time. The higher the viscosity, the lower the  
183 spreadability (Figure 1c) and the higher the adhesion (Figure 1d) of the preparation because  
184 high resistance indicates a stronger bond between particles which causes water to be trapped  
185 and dry longer (Figure 1e) (Cahyani et al., 2025).

### 186 **3.2 Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract**

187 Test results all formulas showed antioxidant activity included in the strong category  
188 as indicated by the IC<sub>50</sub> value. The determination of the antioxidant activity category is based  
189 on IC<sub>50</sub> where it is very strong (<50 µg/mL), strong (50-100 µg/mL), moderate (100-150 µg/mL)  
190 and weak (151-200µg/mL) (Puspitasari & Wulandari, 2017). IC<sub>50</sub> value of the three formulas  
191 in Table 2. indicated that the selection of the peel off gel mask preparation is right and the  
192 resulting formula can maintain the stability of the active compound. The increase in  
193 antioxidant activity is indicated by a decrease in the IC<sub>50</sub> value along with the increase in  
194 extract concentration (Figure 2). This is because the higher the concentration of secang wood  
195 extract, the higher the brazilin content in the peel off gel mask preparation. Brazilin, in  
196 addition to playing a role in the color produced, is also a flavonoid with high antioxidant  
197 activity and is widely used in natural skin care (Faizah et al., 2023). Brazilin is a flavonoid with

198 the ability to ward off free radicals and can inhibit enzymes responsible for the production of  
199 free radicals (Hu et al., 2008). Several previous studies were limited to characterization of the  
200 preparation and did not determine the antioxidant activity in the formulation peel off gel  
201 mask (Ermawati & Adi, 2023). The formulation of sappanwood extract in the peel-off gel mask  
202 preparation was considered appropriate because the IC<sub>50</sub> value of the preparation was close  
203 to the IC<sub>50</sub> of the extract (74.44 µg/mL). However, when compared, vitamin C is still stronger  
204 as a comparative standard in the very strong category 3.04 µg/mL (Tanzaq et al., 2019).

#### 205 4. Conclusion

206 Increasing the concentration of secang wood extract has a significant effect (p-value  
207 <0.05) on increasing the viscosity, adhesiveness and drying time and can reduce pH,  
208 spreadability and IC<sub>50</sub> value. The antioxidant activity of all formulas is included in the strong  
209 category with the IC<sub>50</sub> values of the three formulas respectively being 88, 71 µg/mL; 81.58  
210 µg/mL and 79.04 µg/mL. Peel off gel mask preparation formula with good characteristics and  
211 strong antioxidant activity at a concentration of 7.5% secang wood extract.

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**Table 1.** Formulation of Peel Off Gel Masker Secang Wood Extract

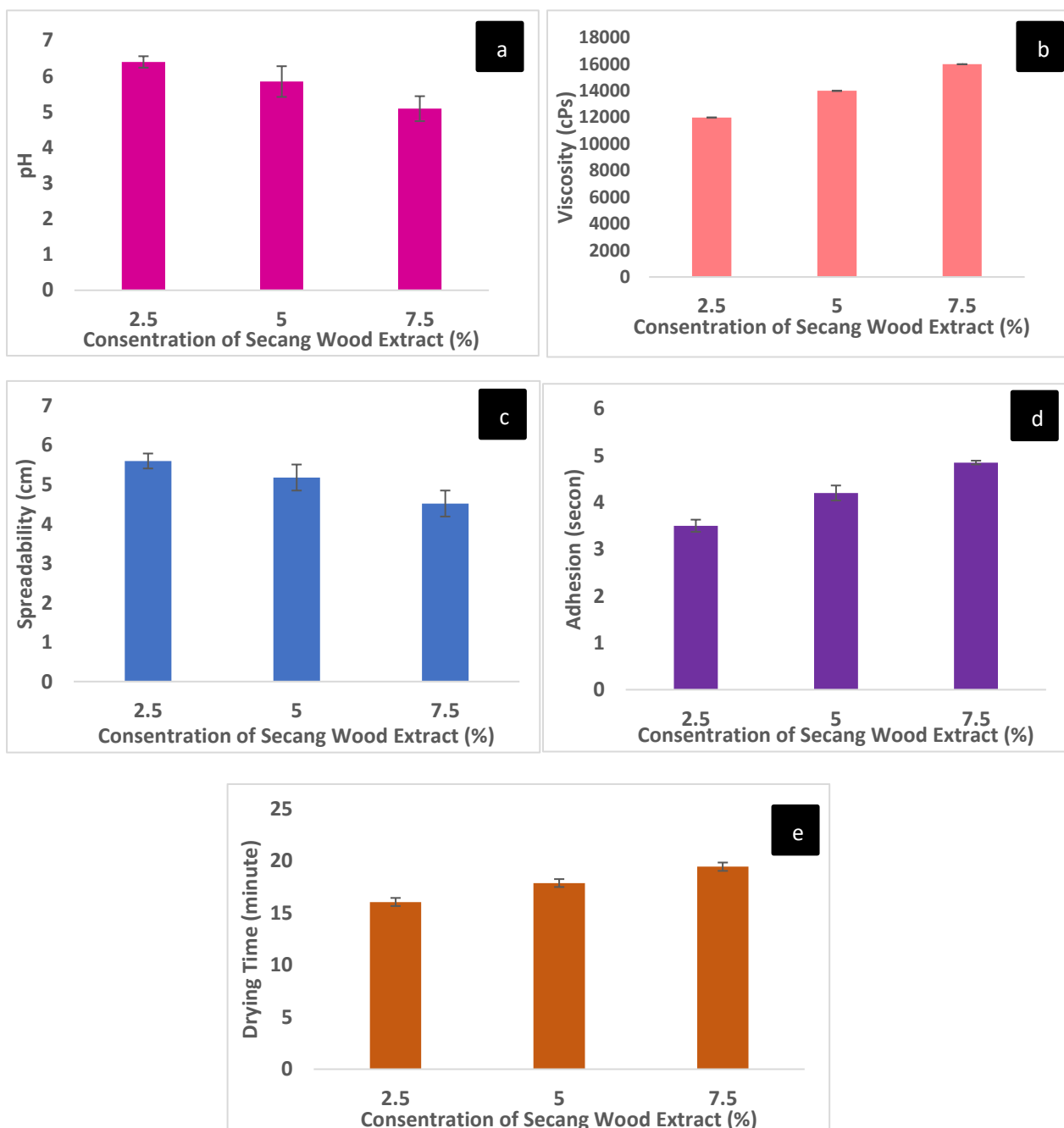
Material	Formula (%)		
	I	II	III
Secang Wood Extract	2,5	5	7,5
CMC Na	1,26	1,26	1,26
PVA	6,74	6,74	6,74
Propilenglikol	4	4	4
Aqua destilata ad	100	100	100

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**Table 2.** Characterization and Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

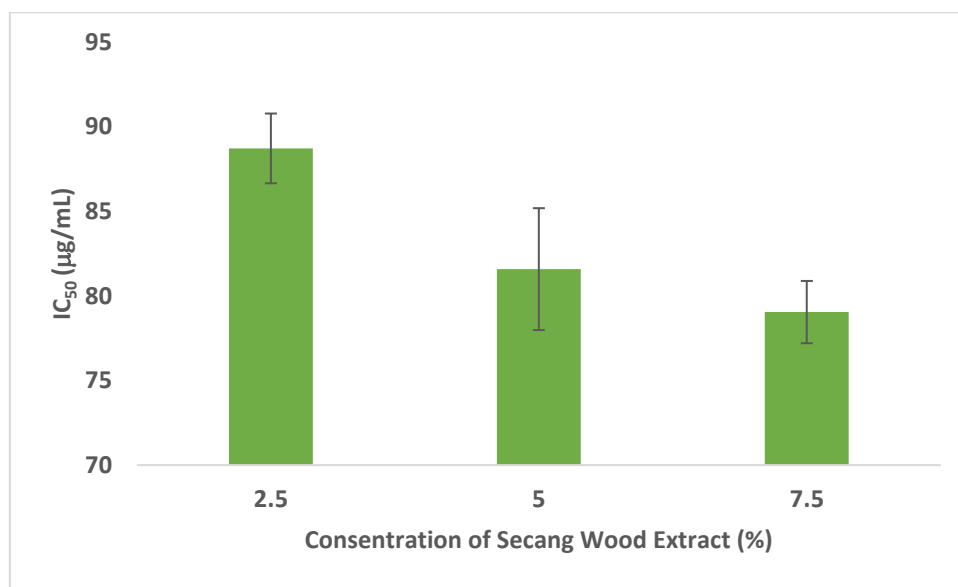
Evaluation	Formula		
	I	II	III
Organoleptic	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell
Homogeneity	Homogeneous	Homogeneous	Homogeneous
pH	6.4 ± 0.16	5.85 ± 0.43	5.09 ± 0.35
Viscosity (cPs)	11986.4 ± 6.02	13992.6 ± 5.13	15993.2 ± 5.36
Spreadability (cm)	5.6 ± 0.19	5.18 ± 0.33	4.52 ± 0.33
Adhesion (secon)	3.5 ± 0.13	4.2 ± 0.16	4.85 ± 0.04
Drying Time (minute)	16.06 ± 0.39	17.88 ± 0.38	19.45 ± 0.40
IC <sub>50</sub> (µg/mL)	88.71 ± 2.06	81.58 ± 3.60	79.04 ± 1.84

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**Figure 1.** Characterization of Peel Off Gel Mask Secang Wood Extract: (a) pH, (b) Viscosity, (c) Spreadability, (d) Adhesion and (e) Drying Time

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**Figure 2.** Antioxidant activity (IC<sub>50</sub>) of Peel Off Gel Mask Secang Wood Extract

**Responses to Reviewers' and Editorial Comments**

Journal name : Journal Jamu Indonesia  
 Manuscript Title : Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization  
 Manuscript No : 403  
 Type of paper : Original Article  
 Authors Name : Intan Martha Cahyani, Tan Tanando Tanzaq, Ruth Ditya Agustina, Kemala Endar Setiawati

Reviewer Code	Original comments of the reviewer	Reply by the author(s)	Changes done on page number and line number
3437	Remove "Sengon" and change with "Secang"	we rewrite as suggested	Line 86
3437	What about the comparative formula?both negative and positive. Should be included in table 1 and discussion	we added to the result and discussion as suggested	Line 160-166
3437	Need to be compared with previous research in the section discussion ” Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract”	we added to the result and discussion as suggested	Line 165-166
3437	Need to be compared with previous research in the section discussion ” Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract”	we added to the result and discussion as suggested	Line 199-204
3438	Remove "Sengon" and change with "Secang"	we rewrite as suggested	Line 86
3438	How is the analysis of vitamin C as a standard against the three formulas?	we added to the result and discussion as suggested	Line 203-204
3438	Remove "Sengon" and change with "Secang"	we rewrite as suggested	Line 194

**BUKTI KORESPONDENSI RESPONSES TO REVIEWERS' AND EDITORIAL COMMENTS**

3440	It has not been stated what the vulnerable value is if it is classified as a strong category in the abstract	we added to the abstract as suggested	Line 25 dan 46
3440	Write down the novelty of this research that distinguishes it from previous studies that used secang wood as a peel off gel mask	we added to the result and discussion as suggested	Line 199-204
3440	explanation for table 1 has not been included in the research results	we added to the result and discussion as suggested	Line 160-166
3440	It has not been explained on what basis the antioxidants obtained are categorized as strong, medium, or weak.	we added to the result and discussion as suggested	Line 188-190

**Note : Highlighted yellow for changes to response reviewer.**

## EDITOR'S COMMENTS ON FIRST REVISED MANUSCRIPT

### 1 Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and 2 Characterization

### 3 Masker Gel Peel Off Ekstrak Kayu Secang sebagai Antioksidan : Formulasi dan 4 Karakterisasi

5 Intan Martha Cahyani<sup>1\*</sup>, Tan Tanando Tanzaq<sup>1</sup>, Ruth Ditya Agustina<sup>1</sup>, Kemala Endar Setiawati<sup>1</sup>

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#### 8 Abstract

9  
10 Secang wood contains active compounds of the flavonoid group, namely brazilin, brazilin, 3'-  
11 O-methylbrazilin, sappanin chalcone, and sappan calchone which can be used as primary  
12 antioxidants or secondary antioxidants. Antioxidants are compounds that can inhibit  
13 oxidation reactions by binding reactive free radicals. Increasing the value of the benefits of  
14 secang wood as an antioxidant can be done by developing a topical preparation formulation.  
15 Peel-off gel mask is the right topical preparation because in addition to maintaining skin  
16 health, it can also increase effectiveness and comfort during use. The study aims to determine  
17 the formula of a peel-off gel mask with secang wood extract as an antioxidant with good  
18 characteristics. The formulation of the peel-off gel mask was made with a concentration of  
19 secang wood extract of 2.5%; 5% and 7.5% using sodium carboxymethyl cellulose, polyvinyl  
20 alcohol and propylene glycol as a base. The preparation of the peel-off gel mask with secang  
21 wood extract produced was then tested with several parameters to determine the physical  
22 characteristics and antioxidant activity. The results showed that the higher the concentration  
23 of secang wood extract, the more significant the effect (p-value <0.05) on increasing viscosity,  
24 adhesiveness and drying time and can reduce pH, spreadability and IC<sub>50</sub> value. The antioxidant  
25 activity of all formulas is included in **the strong category were the IC<sub>50</sub> value (50-100 µg/mL)**  
26 and the third formula respectively are 88, 71 µg/mL; 81.58 µg/mL and 79.04 µg/mL.

27  
28 Keywords: Secang wood, Formulation, Peel off gel mask, Antioxidants, Physical characteristics

#### 29 Abstrak

30 Kayu secang mengandung senyawa aktif golongan flavonoid yaitu brazilin, brazilin, 3'-O-  
31 metilbrazilin, sappanin chalcone, dan sappan calchone yang dapat digunakan sebagai  
32 antioksidan primer maupun antioksidan sekunder. Antioksidan merupakan senyawa yang  
33 dapat menghambat reaksi oksidasi dengan mengikat radikal bebas yang reaktif. Peningkatan  
34 nilai manfaat kayu secang sebagai antioksidan dapat dilakukan dengan pengembangan  
35 formulasi sediaan topikal. Masker gel peel-off merupakan sediaan topikal yang tepat karena  
36 selain dapat menjaga kesehatan kulit juga dapat meningkatkan efektivitas dan kenyamanan  
37 saat penggunaan. Penelitian bertujuan untuk mengetahui formula masker gel peel off ekstrak  
38 kayu secang sebagai antioksidan dengan karakteristik yang baik. Formulasi masker gel peel  
39 off dibuat dengan konsentrasi ekstrak kayu secang 2.5%; 5% dan 7.5% menggunakan natrium  
40 karboksimetil selulosa, polivinil alkohol dan propilen glikol sebagai basis. Sediaan masker gel  
41 peel off ekstrak kayu secang yang dihasilkan selanjutnya dilakukan pengujian dengan  
42 beberapa parameter untuk mengetahui karakteristik fisik dan aktivitas antioksidan. Hasil  
43 menunjukkan semakin tinggi konsentrasi ekstrak kayu secang berpengaruh signifikan (p-value  
44 < 0,05) pada peningkatan viskositas, daya lekat dan waktu mengering serta dapat

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45 menurunkan pH, daya sebar dan nilai IC<sub>50</sub>. Aktivitas antioksidan semua formula termasuk  
46 dalam kategori kuat dimana nilai IC<sub>50</sub> (50-100 µg/mL) dan pada ketiga formula berturut-turut  
47 adalah 88.71 µg/mL; 81.58 µg/mL dan 79.04 µg/mL.

48  
49 **Kata Kunci:** Kayu secang, Formulasi, Masker gel peel off, antioksidan, karakteristik fisik

### 1. Introduction

50  
51 Air pollution is currently experiencing a significant increase, reaching 20%. Low air  
52 quality can have a negative impact because long-term exposure can cause health problems  
53 (Wahdaningsih et al., 2015). One of the mechanisms is the occurrence of oxidative stress in  
54 the body. The high level of air pollution today can cause the formation of free radicals so it  
55 needs to be balanced with natural antioxidant intake to prevent oxidative damage which is a  
56 trigger for various diseases, especially skin disorders (Widowati, 2011). Flavonoids are natural  
57 compounds that have the ability as antioxidants by inhibiting the formation of free radicals  
58 hydroxyl, peroxide, alkoxy, superoxide anions, oxygen singkets and hydrogen peroxide (Utari,  
59 2017).

60 Secang wood contains active compounds of the flavonoid group which can be used as  
61 primary antioxidants or secondary antioxidants. The presence of brazilin components in  
62 secang wood has the effect of protecting the body from poisoning due to free radicals (Rina  
63 et al., 2012). Has reliable antioxidant power with a higher antioxidant index than commercial  
64 antioxidants (BHT and BHA) so it has the potential as a free radical scavenging agent  
65 (Sugiyanto et al., 2013). Secang wood extract has been proven effective as an antioxidant with  
66 an IC<sub>50</sub> value of 74,44 µg/mL (Tanzaq et al., 2019).

67 Mask is one of the cosmetics for facial skin care. However, the use of masks is generally  
68 less efficient. The demands of market needs with today's lifestyle are not only effective but  
69 easy, comfortable and flexible in their use. Peel off gel mask is the result of the development  
70 of facial skin care products that can answer these challenges (Ningsih et al., 2016). Peel off  
71 gel mask is a type of facial mask that has the advantage of being easy to remove or lift like an  
72 elastic membrane (Rahmawanty et al., 2015). Several studies have proven that peel off gel  
73 mask preparations can increase the effectiveness of antioxidants, including Paedaria fotida  
74 extract (Eka et al., 2022), areca seed extract (Dwi Mulyani et al., 2023), red spinach leaves  
75 extract (Welly et al., 2022) and mangrove leaves extract (Hasibuan et al., 2024).

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## 2. Methods

### 2.1 Materials and Tools

80 The materials used in this study were secang wood, ethanol 96% (Merck), Sodium  
81 Carboxymethyl Cellulose (CMC Na), Polyvinil Alcohol (PVA), propilenglicol, vitamin C dan 1,1-  
82 difenil-2-pikrilhidrazil (DPPH) .

83 The tools used in this study were rotary evaporator (Heidolph), alat-alat gelas (Pyrex),  
84 pH meter (Hanna Instrument pH 210 Microprocessor), viskometer (Brookfield DV-I Prime),  
85 and spektrofotometer UV-Vis mini 1240 (Shimadzu).

### 2.2 Secang Wood Extraction

87 The extraction method used is maceration by soaking secang wood powder using 96%  
88 ethanol solvent with a ratio of 1:10. Extraction is carried out for 3x24 hours. The filtrate  
89 obtained is then evaporated with a rotary evaporator until a thick extract is obtained (Tanzaq  
90 et al., 2019).

### 2.3 Formulation of Peel Off Gel Masker Secang Wood Extract

92 Peel-off gel mask of secang wood extract was made by developing PVA and CMC Na (Table  
93 1) in distilled water (80°C) until fully expanded. PVA mass plus expanded propylene glycol and  
94 CMC Na was stirred until homogeneous. Ethanol extract of secang wood was added little by  
95 little into the peel-off gel mask base, distilled water was added until the weight of the  
96 preparation was 100% and stirred until homogeneous (Cahyani et al., 2025).

### 2.4 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

#### Organoleptic

99 Observations were made on the color, odor, and dosage form of the Peel Off Gel Mask  
100 Secang Wood Extract (Syam et al., 2021).

#### Homogeneity

102 Observations are made by preparing a number of preparations on object glass (Cahyani  
103 & Putri, 2017). All particles are evenly dispersed on the object glass indicating a homogeneous  
104 preparation (Syam et al., 2021)

#### pH

105

Commented [WN1]: Tambahkan analisis data bu, misal uji Tukey untuk data-data kuantitatif?

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106 The pH meter electrode is dipped into the preparation until the display on the device  
107 shows a constant pH value (Andini et al., 2017). Results that match the skin pH (4.5-6.5) can  
108 increase acceptability when used (Silvia et al., 2021).

109

### 110 **Viscosity**

111 The viscosity of the preparation was measured using a Brookfield spindle 64 viscometer  
112 at a speed of 1.0 rpm (Cahyani & Putri, 2017). At a viscosity of 2000-50000 cps indicates a  
113 good peel-off gel mask (SNI 16-4399-1996: 1).

### 114 **Spreadability**

115 Observations were made on the spreading ability of 0.5 grams of the preparation placed  
116 in the middle of the spreading power tester, then covered with a glass plate that had  
117 previously been weighed and its weight recorded, left for one minute. The spreading ability  
118 is indicated by measuring the diameter of the four sides of the spread. Do the same steps for  
119 each additional 50 grams of load above it until the diameter of the spread is constant (Cahyani  
120 & Putri, 2017). The ideal spread of the peel off gel mask is 5-7 cm (Silvia et al., 2021).

### 121 **Adhesion**

122 0.25 g preparation on a glass object is given a load pressure of 100 grams for 5 minutes  
123 and then placed on the adhesive strength tester. The adhesive strength is measured by  
124 recording the time when the two glass objects are released. A time of more than 1 second  
125 indicates good adhesive strength of the peel off gel mask (Syam et al., 2021).

### 126 **Drying Time**

127 0.1 g of the preparation is applied to the arm with an area of 2.5 x 2.5 cm, then the time  
128 is observed until the preparation dries (Andini et al., 2017). standard drying time for a peel-  
129 off gel mask is 15-30 minutes (Silvia et al., 2021).

### 130 **2.5 Antioxidant Activity with DPPH (2,2-difeny-1-picrylhydrazyl) Method**

131 The test was carried out in several stages. First, determine the maximum wavelength of  
132 the DPPH 30 solution  $\mu\text{g/mL}$  with a UV-Vis spectrophotometer in the 400-800 nm region.  
133 Determination of operating time is done by measuring the absorption at the maximum  
134 wavelength obtained using a standard solution (vitamin C) and DPPH 30 solution  $\mu\text{g/mL}$  at a  
135 1:1 ratio for 60 minutes.

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136 An amount of 0.05 grams of the preparation was dissolved in methanol up to 50 mL and  
137 diluted to obtain sample solution concentrations of 60,70,80,100 and 120 µg/mL. For each  
138 concentration, DPPH 30 solution was added µg/mL at a ratio of 1:1 and absorbance  
139 measurements were carried out using a UV-Vis spectrophotometer at a maximum  
140 wavelength after being incubated at room temperature for the time obtained from the results  
141 of determining the operating time. The same stage was also carried out on vitamin C solutions  
142 with concentrations of 2.4,6,8,10 µg/mL as a reference standard. Determine the IC<sub>50</sub> value  
143 from the results of measuring the absorbance of the sample solution and the reference  
144 standard obtained (Maharani et al., 2022).

145

146

### 3. Results and Discussion

#### 3.1 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

147 Traditionally, secang wood has many health benefits, including antibacterial, anti-  
148 inflammatory, anti-diabetic, tuberculosis, malaria and tetanus (Setyowati et al., 2023). In  
149 addition, it is also widely used in food and cosmetics as an antioxidant (Rajput et al., 2022).  
150 Secang wood contains active compounds that are included in the flavonoid group, namely  
151 brazilin, brazilin, 3'-o-methylbrazilin, sappanin, chalcone, and sappan chalcone. Brazilin in  
152 secang wood has an antioxidant effect (Ngamwonglumlert & Devahastin, 2023). For the  
153 manufacture of secang wood extract, the maceration method using 96% ethanol (1:1) was  
154 used. The peel-off gel mask has unique characteristics with the formation of a transparent,  
155 elastic and easily removable film layer without rinsing which can increase the comfort of use  
156 and the effectiveness of active compounds. Therefore, this study was designed to make a  
157 peel-off gel mask of secang wood extract as an antioxidant F1 (2.5%) F2 (5%) and F3 (7.5%)  
158 with the results of the physical characteristics test presented in Table 2.

159 Gelling agents used in the peel-off gel mask formulation are PVA and CMC Na (Table 1).

160 PVA is a hydrophilic polymer with adhesive properties that are easy to peel off when dry and  
161 provide a film layer effect called the peel-off effect (Anindhita et al., 2023). However, the film  
162 layer formed tends to be stiff and easily broken (Sinambela & Telaumbanua, 2022).

163 Carboxymethyl Cellulose Sodium (CMC Na) is a hydrophilic polymer with a more stable  
164 viscosity in the long term (Eryani et al., 2023) so that it can increase the elasticity of the PVA  
165 layer formed as reported in previous studies (Cahyani et al., 2025).

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167 Organoleptic and homogeneity testing aims to see the physical appearance and  
168 distribution of each component of a preparation. Based on table 2, the results show that the  
169 three formulas give the same results. The level of comfort of using a preparation is also  
170 influenced by the pH of the preparation. The higher the concentration of secang wood extract,  
171 the lower the pH of the preparation as seen in Figure 1a. This occurs because the ethanol  
172 extract of secang wood has a pH that tends to be acidic (2-6) (Muslimin et al., 2024), so that  
173 by adding the amount of secang wood extract, the pH of the preparation will decrease. The  
174 pH value of secang wood extract can affect the color of the peel-off gel mask preparation  
175 produced. This effect is caused because the stability of brazilin is greatly influenced by its  
176 acidity level where at pH 2-5 (yellow-orange), pH 6-7 (pink) and pH > 7 (red-violet) where the  
177 degradation results of brazilin into brazilein which is red in color (Rina et al., 2017).

178 The results of the viscosity test showed an increase that was proportional to the  
179 increase in the concentration of secang wood extract in the peel-off gel mask formula (Figure  
180 1b). The thick concentration of secang wood extract showed high resistance so that it would  
181 affect the resistance of the preparation to flow. The viscosity of the preparation is closely  
182 related to the spreadability, adhesion and drying time. The higher the viscosity, the lower the  
183 spreadability (Figure 1c) and the higher the adhesion (Figure 1d) of the preparation because  
184 high resistance indicates a stronger bond between particles which causes water to be trapped  
185 and dry longer (Figure 1e) (Cahyani et al., 2025).

### 186 3.2 Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

187 Test results all formulas showed antioxidant activity included in the strong category  
188 as indicated by the IC<sub>50</sub> value. The determination of the antioxidant activity category is based  
189 on IC<sub>50</sub> where it is very strong (<50 µg/mL), strong (50-100 µg/mL), moderate (100-150 µg/mL)  
190 and weak (151-200 µg/mL) (Puspitasari & Wulandari, 2017). IC<sub>50</sub> value of the three formulas  
191 in Table 2. indicated that the selection of the peel off gel mask preparation is right and the  
192 resulting formula can maintain the stability of the active compound. The increase in  
193 antioxidant activity is indicated by a decrease in the IC<sub>50</sub> value along with the increase in  
194 extract concentration (Figure 2). This is because the higher the concentration of secang wood  
195 extract, the higher the brazilin content in the peel off gel mask preparation. Brazilin, in  
196 addition to playing a role in the color produced, is also a flavonoid with high antioxidant  
197 activity and is widely used in natural skin care (Faizah et al., 2023). Brazilin is a flavonoid with

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198 the ability to ward off free radicals and can inhibit enzymes responsible for the production of  
199 free radicals (Hu et al., 2008). Several previous studies were limited to characterization of the  
200 preparation and did not determine the antioxidant activity in the formulation peel off gel  
201 mask (Ermawati & Adi, 2023). The formulation of sappanwood extract in the peel-off gel mask  
202 preparation was considered appropriate because the IC<sub>50</sub> value of the preparation was close  
203 to the IC<sub>50</sub> of the extract (74.44 µg/mL). However, when compared, vitamin C is still stronger  
204 as a comparative standard in the very strong category 3.04 µg/mL (Tanzaq et al., 2019).

### 4. Conclusion

206 Increasing the concentration of secang wood extract has a significant effect (p-value  
207 <0.05) on increasing the viscosity, adhesiveness and drying time and can reduce pH,  
208 spreadability and IC<sub>50</sub> value. The antioxidant activity of all formulas is included in the strong  
209 category with the IC<sub>50</sub> values of the three formulas respectively being 88, 71 µg/mL; 81.58  
210 µg/mL and 79.04 µg/mL. Peel off gel mask preparation formula with good characteristics and  
211 strong antioxidant activity at a concentration of 7.5% secang wood extract.

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**Table 1.** Formulation of Peel Off Gel Masker Secang Wood Extract

Material	Formula (%)		
	I	II	III
Secang Wood Extract	2,5	5	7,5
CMC Na	1,26	1,26	1,26
PVA	6,74	6,74	6,74
Propilenglikol	4	4	4
Aqua destilata ad	100	100	100

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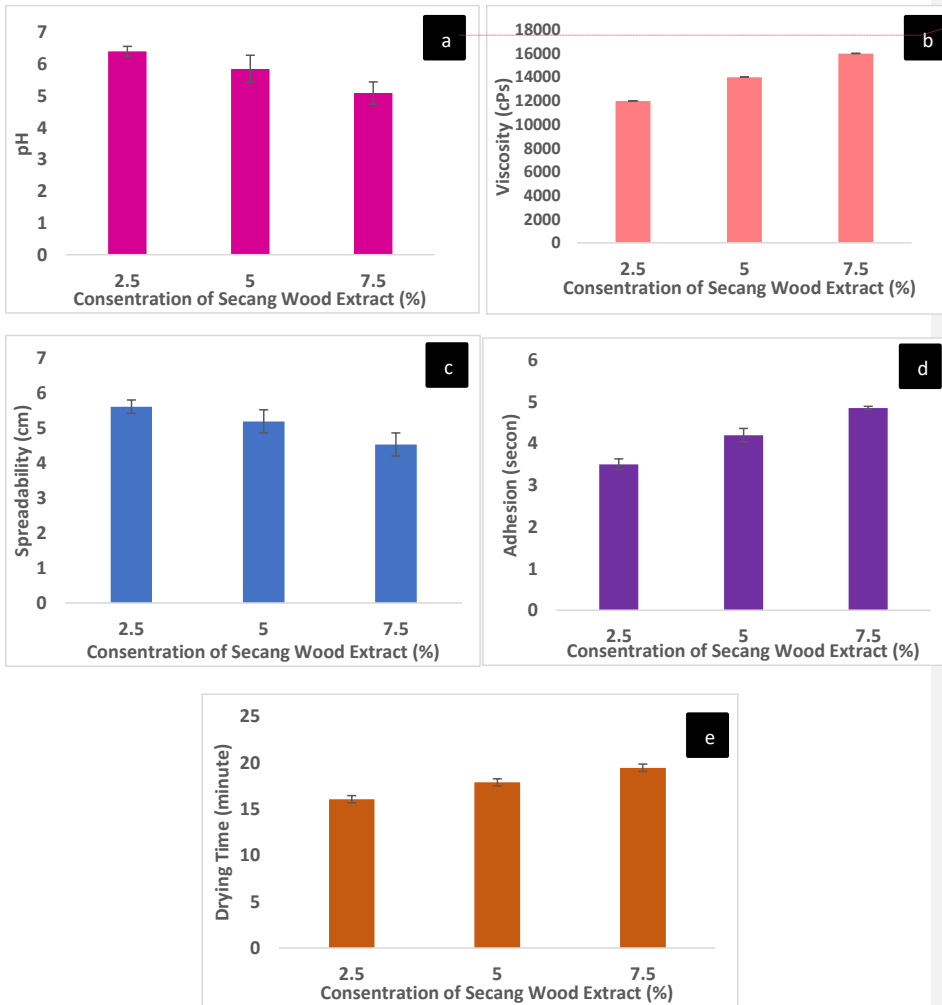
**Table 2.** Characterization and Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

Evaluation	Formula		
	I	II	III
Organoleptic	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell
Homogeneity	Homogeneous	Homogeneous	Homogeneous
pH	6.4 ± 0.16	5.85 ± 0.43	5.09 ± 0.35
Viscosity (cPs)	11986.4 ± 6.02	13992.6 ± 5.13	15993.2 ± 5.36
Spreadability (cm)	5.6 ± 0.19	5.18 ± 0.33	4.52 ± 0.33
Adhesion (secon)	3.5 ± 0.13	4.2 ± 0.16	4.85 ± 0.04
Drying Time (minute)	16.06 ± 0.39	17.88 ± 0.38	19.45 ± 0.40
IC <sub>50</sub> (µg/mL)	88.71 ± 2.06	81.58 ± 3.60	79.04 ± 1.84

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Figure 1. Characterization of Peel Off Gel Mask Secang Wood Extract: (a) pH, (b) Viscosity, (c) Spreadability, (d) Adhesion and (e) Drying Time

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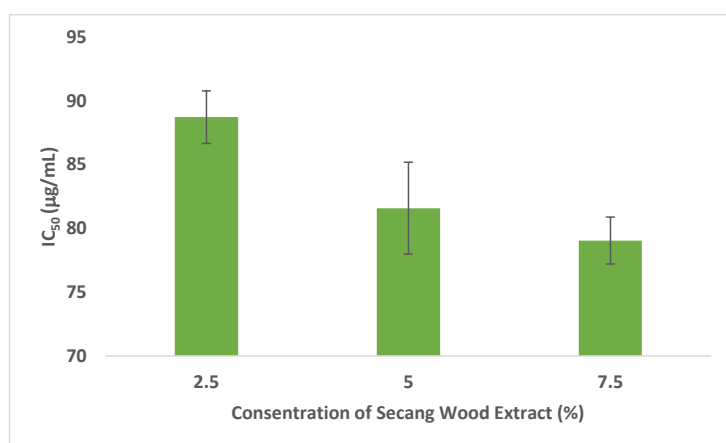


Figure 2. Antioxidant activity (IC<sub>50</sub>) of Peel Off Gel Mask Secang Wood Extract

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## Peel Off Gel Mask Secang Wood Extract as an Antioxidant: Formulation and Characterization

### Masker Gel Peel Off Ekstrak Kayu Secang sebagai Antioksidan : Formulasi dan Karakterisasi

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#### Abstract

Secang wood contains active compounds of the flavonoid group, namely brazilin, brazilin, 3'-O-methylbrazilin, sappanin chalcone, and sappan calchone which can be used as primary antioxidants or secondary antioxidants. Antioxidants are compounds that can inhibit oxidation reactions by binding reactive free radicals. Increasing the value of the benefits of secang wood as an antioxidant can be done by developing a topical preparation formulation. Peel-off gel mask is the right topical preparation because in addition to maintaining skin health, it can also increase effectiveness and comfort during use. The study aims to determine the formula of a peel-off gel mask with secang wood extract as an antioxidant with good characteristics. The formulation of the peel-off gel mask was made with a concentration of secang wood extract of 2.5%; 5% and 7.5% using sodium carboxymethyl cellulose, polyvinyl alcohol and propylene glycol as a base. The preparation of the peel-off gel mask with secang wood extract produced was then tested with several parameters to determine the physical characteristics and antioxidant activity. The results showed that the higher the concentration of secang wood extract, the more significant the effect ( $p$ -value  $< 0.05$ ) on increasing viscosity, adhesiveness and drying time and can reduce pH, spreadability and  $IC_{50}$  value. The antioxidant activity of all formulas is included in the strong category were the  $IC_{50}$  value (50-100  $\mu\text{g/mL}$ ) and the third formula respectively are 88, 71  $\mu\text{g/mL}$ ; 81.58  $\mu\text{g/mL}$  and 79.04  $\mu\text{g/mL}$ .

Keywords: Secang wood, Formulation, Peel off gel mask, Antioxidants, Physical characteristics

#### Abstrak

Kayu secang mengandung senyawa aktif golongan flavonoid yaitu brazilin, brazilin, 3'-O-metilbrazilin, sappanin chalcone, dan sappan calchone yang dapat digunakan sebagai antioksidan primer maupun antioksidan sekunder. Antioksidan merupakan senyawa yang dapat menghambat reaksi oksidasi dengan mengikat radikal bebas yang reaktif. Peningkatan nilai manfaat kayu secang sebagai antioksidan dapat dilakukan dengan pengembangan formulasi sediaan topikal. Masker gel peel-off merupakan sediaan topikal yang tepat karena selain dapat menjaga kesehatan kulit juga dapat meningkatkan efektivitas dan kenyamanan saat penggunaan. Penelitian bertujuan untuk mengetahui formula masker gel peel off ekstrak kayu secang sebagai antioksidan dengan karakteristik yang baik. Formulasi masker gel peel off dibuat dengan konsentrasi ekstrak kayu secang 2.5%; 5% dan 7.5% menggunakan natrium karboksimetil selulosa, polivinil alkohol dan propilen glikol sebagai basis. Sediaan masker gel peel off ekstrak kayu secang yang dihasilkan selanjutnya dilakukan pengujian dengan beberapa parameter untuk mengetahui karakteristik fisik dan aktivitas antioksidan. Hasil menunjukkan semakin tinggi konsentrasi ekstrak kayu secang berpengaruh signifikan ( $p$ -value  $< 0,05$ ) pada peningkatan viskositas, daya lekat dan waktu mengering serta dapat

45 menurunkan pH, daya sebar dan nilai IC<sub>50</sub>. Aktivitas antioksidan semua formula termasuk  
46 dalam kategori kuat dimana nilai IC<sub>50</sub> (50-100 µg/mL) dan pada ketiga formula berturut-turut  
47 adalah 88.71 µg/mL; 81.58 µg/mL dan 79.04 µg/mL.

48

49 **Kata Kunci:** Kayu secang, Formulasi, Masker gel peel off, antioksidan, karakteristik fisik

50

### 1. Introduction

51 Air pollution is currently experiencing a significant increase, reaching 20%. Low air  
52 quality can have a negative impact because long-term exposure can cause health problems  
53 (Wahdaningsih et al., 2015). One of the mechanisms is the occurrence of oxidative stress in  
54 the body. The high level of air pollution today can cause the formation of free radicals so it  
55 needs to be balanced with natural antioxidant intake to prevent oxidative damage which is a  
56 trigger for various diseases, especially skin disorders (Widowati, 2011). Flavonoids are natural  
57 compounds that have the ability as antioxidants by inhibiting the formation of free radicals  
58 hydroxyl, peroxide, alkoxyl, superoxide anions, oxygen singkets and hydrogen peroxide (Utari,  
59 2017).

60 Secang wood contains active compounds of the flavonoid group which can be used as  
61 primary antioxidants or secondary antioxidants. The presence of brazilin components in  
62 secang wood has the effect of protecting the body from poisoning due to free radicals (Rina  
63 et al., 2012). Has reliable antioxidant power with a higher antioxidant index than commercial  
64 antioxidants (BHT and BHA) so it has the potential as a free radical scavenging agent  
65 (Sugiyanto et al., 2013). Secang wood extract has been proven effective as an antioxidant with  
66 an IC<sub>50</sub> value of 74,44 µg/mL (Tanzaq et al., 2019).

67 Mask is one of the cosmetics for facial skin care. However, the use of masks is generally  
68 less efficient. The demands of market needs with today's lifestyle are not only effective but  
69 easy, comfortable and flexible in their use. Peel off gel mask is the result of the development  
70 of facial skin care products that can answer these challenges (Ningsih et al., 2016). Peel off  
71 gel mask is a type of facial mask that has the advantage of being easy to remove or lift like an  
72 elastic membrane (Rahmawanty et al., 2015). Several studies have proven that peel off gel  
73 mask preparations can increase the effectiveness of antioxidants, including Paedaria fotida  
74 extract (Eka et al., 2022), areca seed extract (Dwi Mulyani et al., 2023), red spinach leaves  
75 extract (Welly et al., 2022) and mangrove leaves extract (Hasibuan et al., 2024).

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## 2. Methods

### 2.1 Materials and Tools

The materials used in this study were secang wood, ethanol 96% (Merck), Sodium Carboxymethyl Cellulose (CMC Na), Polyvinil Alcohol (PVA), propilenglicol, vitamin C dan 1,1-difenil-2-pikrilhidrazil (DPPH) .

The tools used in this study were rotary evaporator (Heidolph), alat-alat gelas (Pyrex), pH meter (Hanna Instrument pH 210 Microprocessor), viskometer (Brookfield DV-I Prime), and spektrofotometer UV-Vis mini 1240 (Shimadzu).

### 2.2 Secang Wood Extraction

The extraction method used is maceration by soaking secang wood powder using 96% ethanol solvent with a ratio of 1:10. Extraction is carried out for 3x24 hours. The filtrate obtained is then evaporated with a rotary evaporator until a thick extract is obtained (Tanzaq et al., 2019).

### 2.3 Formulation of Peel Off Gel Masker Secang Wood Extract

Peel-off gel mask of secang wood extract was made by developing PVA and CMC Na (Table 1) in distilled water (80°C) until fully expanded. PVA mass plus expanded propylene glycol and CMC Na was stirred until homogeneous. Ethanol extract of secang wood was added little by little into the peel-off gel mask base, distilled water was added until the weight of the preparation was 100% and stirred until homogeneous (Cahyani et al., 2025).

### 2.4 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract

#### Organoleptic

Observations were made on the color, odor, and dosage form of the Peel Off Gel Mask Secang Wood Extract (Syam et al., 2021).

#### Homogeneity

Observations are made by preparing a number of preparations on object glass (Cahyani & Putri, 2017). All particles are evenly dispersed on the object glass indicating a homogeneous preparation (Syam et al., 2021)

#### pH

106 The pH meter electrode is dipped into the preparation until the display on the device  
107 shows a constant pH value (Andini et al., 2017). Results that match the skin pH (4.5-6.5) can  
108 increase acceptability when used (Silvia et al., 2021).

109

#### 110 **Viscosity**

111 The viscosity of the preparation was measured using a Brookfield spindle 64 viscometer  
112 at a speed of 1.0 rpm (Cahyani & Putri, 2017). At a viscosity of 2000-50000 cps indicates a  
113 good peel-off gel mask (SNI 16-4399-1996: 1).

#### 114 **Spreadability**

115 Observations were made on the spreading ability of 0.5 grams of the preparation placed  
116 in the middle of the spreading power tester, then covered with a glass plate that had  
117 previously been weighed and its weight recorded, left for one minute. The spreading ability  
118 is indicated by measuring the diameter of the four sides of the spread. Do the same steps for  
119 each additional 50 grams of load above it until the diameter of the spread is constant (Cahyani  
120 & Putri, 2017). The ideal spread of the peel off gel mask is 5-7 cm (Silvia et al., 2021).

#### 121 **Adhesion**

122 0.25 g preparation on a glass object is given a load pressure of 100 grams for 5 minutes  
123 and then placed on the adhesive strength tester. The adhesive strength is measured by  
124 recording the time when the two glass objects are released. A time of more than 1 second  
125 indicates good adhesive strength of the peel off gel mask (Syam et al., 2021).

#### 126 **Drying Time**

127 0.1 g of the preparation is applied to the arm with an area of 2.5 x 2.5 cm, then the time  
128 is observed until the preparation dries (Andini et al., 2017). standard drying time for a peel-  
129 off gel mask is 15-30 minutes (Silvia et al., 2021).

#### 130 **2.5 Antioxidant Activity with DPPH (2,2-difenyl-1-picrylhydrazyl) Method**

131 The test was carried out in several stages. First, determine the maximum wavelength of  
132 the DPPH 30 solution  $\mu\text{g/mL}$  with a UV-Vis spectrophotometer in the 400-800 nm region.  
133 Determination of operating time is done by measuring the absorption at the maximum  
134 wavelength obtained using a standard solution (vitamin C) and DPPH 30 solution  $\mu\text{g/mL}$  at a  
135 1:1 ratio for 60 minutes.

136 An amount of 0.05 grams of the preparation was dissolved in methanol up to 50 mL and  
137 diluted to obtain sample solution concentrations of 60,70,80,100 and 120 µg/mL. For each  
138 concentration, DPPH 30 solution was added µg/mL at a ratio of 1:1 and absorbance  
139 measurements were carried out using a UV-Vis spectrophotometer at a maximum  
140 wavelength after being incubated at room temperature for the time obtained from the results  
141 of determining the operating time. The same stage was also carried out on vitamin C solutions  
142 with concentrations of 2.4,6,8,10 µg/mL as a reference standard. Determine the IC<sub>50</sub> value  
143 from the results of measuring the absorbance of the sample solution and the reference  
144 standard obtained (Maharani et al., 2022).

### 145 **2.3 Data Analysis**

146 The results of the physical characteristics of the secang extract peel-off gel mask (pH,  
147 viscosity, spreadability, adhesiveness, drying time) and IC<sub>50</sub> were analyzed quantitatively  
148 using SPSS 23.0 with the one-way ANOVA method and the Kruskal Wallis test at a significance  
149 level of 95%. Descriptive analysis was carried out on the results of organoleptic and  
150 homogeneity tests.

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## **3. Results and Discussion**

### 153 **3.1 Physical Characterization Evaluation of Peel Off Gel Mask Secang Wood Extract**

154 Traditionally, secang wood has many health benefits, including antibacterial, anti-  
155 inflammatory, anti-diabetic, tuberculosis, malaria and tetanus (Setyowati et al., 2023). In  
156 addition, it is also widely used in food and cosmetics as an antioxidant (Rajput et al., 2022).  
157 Secang wood contains active compounds that are included in the flavonoid group, namely  
158 brazilin, brazilin, 3<sup>l</sup>-o-methylbrazilin, sappanin, chalcone, and sappan chalcone. Brazilin in  
159 secang wood has an antioxidant effect (Ngamwonglumlert & Devahastin, 2023). For the  
160 manufacture of secang wood extract, the maceration method using 96% ethanol (1:1) was  
161 used. The peel-off gel mask has unique characteristics with the formation of a transparent,  
162 elastic and easily removable film layer without rinsing which can increase the comfort of use  
163 and the effectiveness of active compounds. Therefore, this study was designed to make a  
164 peel-off gel mask of secang wood extract as an antioxidant F1 (2.5%) F2 (5%0 and F3 (7.5%)  
165 with the results of the physical characteristics test presented in Table 2.

166 Gelling agents used in the peel-off gel mask formulation are PVA and CMC Na (Table 1).  
 167 PVA is a hydrophilic polymer with adhesive properties that are easy to peel off when dry and  
 168 provide a film layer effect called the peel-off effect (Anindhita et al., 2023). However, the film  
 169 layer formed tends to be stiff and easily broken (Sinambela & Telaumbanua, 2022).  
 170 Carboxymethyl Cellulose Sodium (CMC Na) is a hydrophilic polymer with a more stable  
 171 viscosity in the long term (Eryani et al., 2023) so that it can increase the elasticity of the PVA  
 172 layer formed as reported in previous studies (Cahyani et al., 2025) .

173 Organoleptic and homogeneity testing aims to see the physical appearance and  
 174 distribution of each component of a preparation. Based on table 2, the results show that the  
 175 three formulas give the same results. The level of comfort of using a preparation is also  
 176 influenced by the pH of the preparation. The higher the concentration of secang wood extract,  
 177 the lower the pH of the preparation as seen in Figure 1a. This occurs because the ethanol  
 178 extract of secang wood has a pH that tends to be acidic (2-6) (Muslimin et al., 2024), so that  
 179 by adding the amount of secang wood extract, the pH of the preparation will decrease. The  
 180 pH value of secang wood extract can affect the color of the peel-off gel mask preparation  
 181 produced. This effect is caused because the stability of brazilin is greatly influenced by its  
 182 acidity level where at pH 2-5 (yellow-orange), pH 6-7 (pink) and pH> 7 (red-violet) where the  
 183 degradation results of brazilin into brazilein which is red in color (Rina et al., 2017).

184 The results of the viscosity test showed an increase that was proportional to the  
 185 increase in the concentration of secang wood extract in the peel-off gel mask formula (Figure  
 186 1b). The thick concentration of secang wood extract showed high resistance so that it would  
 187 affect the resistance of the preparation to flow. The viscosity of the preparation is closely  
 188 related to the spreadability, adhesion and drying time. The higher the viscosity, the lower the  
 189 spreadability (Figure 1c) and the higher the adhesion (Figure 1d) of the preparation because  
 190 high resistance indicates a stronger bond between particles which causes water to be trapped  
 191 and dry longer (Figure 1e). The same results were also obtained with the kolang kaling peel  
 192 off gel mask (Cahyani et al., 2025). Increasing the concentration of sapanwood extract has a  
 193 significant effect (p-value <0.05) on the physical characteristics including pH, viscosity,  
 194 spreadability, adhesion and drying time of the secang extract peel-off gel mask.

### 195 3.2 Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

196 Test results all formulas showed antioxidant activity included in the strong category  
 197 as indicated by the IC<sub>50</sub> value. The determination of the antioxidant activity category is based

198 on IC<sub>50</sub> where it is very strong (<50 µg/mL), strong (50-100 µg/mL), moderate (100-150 µg/mL)  
 199 and weak (151-200µg/mL) (Puspitasari & Wulandari, 2017). IC<sub>50</sub> value of the three formulas  
 200 in Table 2. indicated that the selection of the peel off gel mask preparation is right and the  
 201 resulting formula can maintain the stability of the active compound. The increase in  
 202 antioxidant activity is indicated by a decrease in the IC<sub>50</sub> value along with the increase in  
 203 extract concentration (Figure 2). This is because the higher the concentration of **secang** wood  
 204 extract, the higher the brazilin content in the peel off gel mask preparation. Brazilin, in  
 205 addition to playing a role in the color produced, is also a flavonoid with high antioxidant  
 206 activity and is widely used in natural skin care (Faizah et al., 2023). Brazilin is a flavonoid with  
 207 the ability to ward off free radicals and can inhibit enzymes responsible for the production of  
 208 free radicals (Hu et al., 2008). Several previous studies were limited to characterization of the  
 209 preparation and did not determine the antioxidant activity in the formulation peel off gel  
 210 mask (Ermawati & Adi, 2023). The formulation of secang wood extract in the peel-off gel mask  
 211 preparation was considered appropriate because the IC<sub>50</sub> value of the preparation was close  
 212 to the IC<sub>50</sub> of the extract (74.44µg/mL) with significant (p-value <0.05) results between  
 213 formulas. However, when compared, vitamin C is still stronger as a comparative standard in  
 214 the very strong category 3.04 µg/mL (Tanzaq et al., 2019).

#### 215 4. Conclusion

216 Increasing the concentration of secang wood extract has a significant effect (p-value  
 217 <0.05) on increasing the viscosity, adhesiveness and drying time and can reduce pH,  
 218 spreadability and IC<sub>50</sub> value. The antioxidant activity of all formulas is included in the strong  
 219 category with the IC<sub>50</sub> values of the three formulas respectively being 88, 71 µg/mL; 81.58  
 220 µg/mL and 79.04 µg/mL. Peel off gel mask preparation formula with good characteristics and  
 221 strong antioxidant activity at a concentration of 7.5% secang wood extract.

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**Table 1.** Formulation of Peel Off Gel Masker Secang Wood Extract

Material	Formula (%)		
	I	II	III
Secang Wood Extract	2,5	5	7,5
CMC Na	1,26	1,26	1,26
PVA	6,74	6,74	6,74
Propilenglikol	4	4	4
Aqua destilata ad	100	100	100

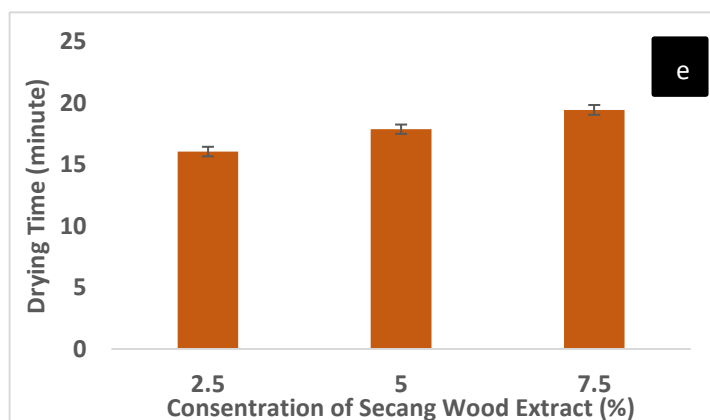
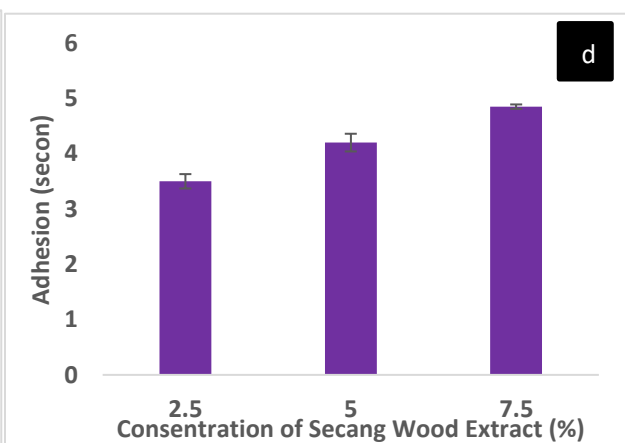
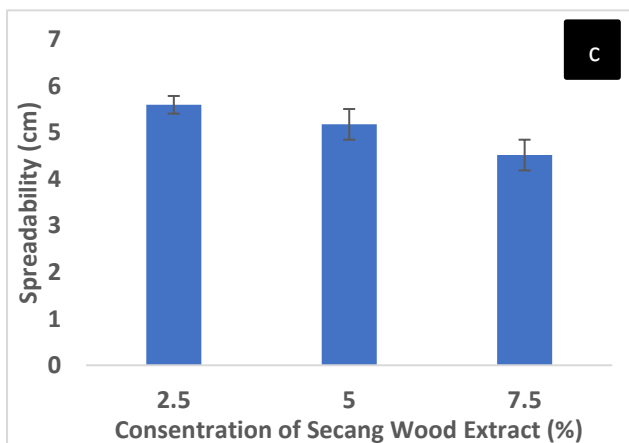
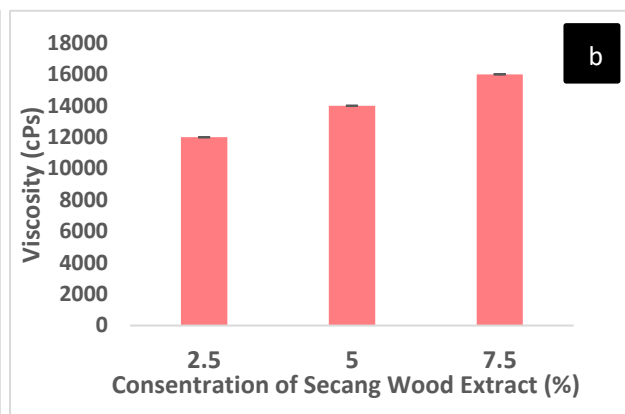
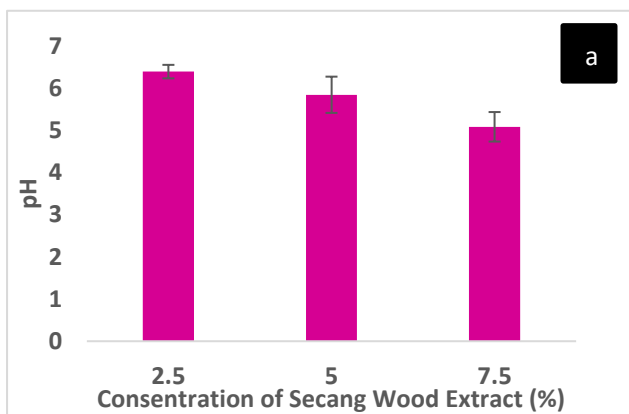
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**Table 2.** Characterization and Antioxidant Activity of Peel Off Gel Mask Secang Wood Extract

Evaluation	Formula		
	I	II	III
Organoleptic	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell	Consistency thick and soft, colour orange, odor secang smell
Homogeneity	Homogeneous	Homogeneous	Homogeneous

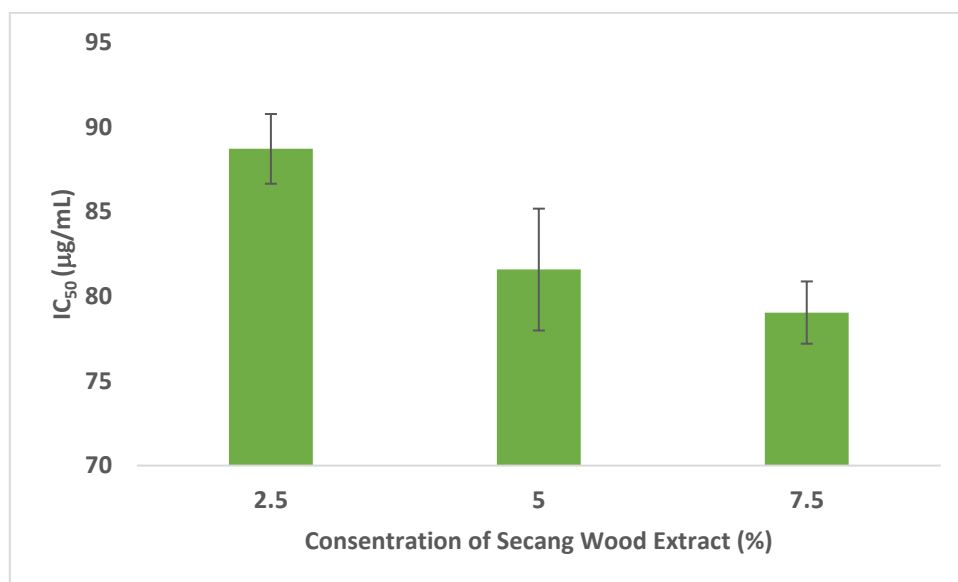
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**Figure 1.** Characterization of Peel Off Gel Mask Secang Wood Extract: (a) pH, (b) Viscosity, (c) Spreadability, (d) Adhesion and (e) Drying Time



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**Figure 2.** Antioxidant activity (IC<sub>50</sub>) of Peel Off Gel Mask Secang Wood Extract

## BUKTI KORESPONDENSI DATA HASIL

Evaluation	Consentration of Secang Wood Extract (%)					
	Formula I		Formula II		Formula III	
	average	SD	average	SD	average	SD
pH	6.4	0.16	5.85	0.48	5.09	0.35
Viscosity (cPs)	11986.4	6.02	13992.6	5.13	15993.2	5.36
Spreadability (cm)	5.6	0.19	5.18	0.33	4.52	0.33
Adhesion (secon)	3.5	0.13	4.2	0.16	4.85	0.04
Drying Time (minute)	16.06	0.39	17.88	0.38	19.45	0.4
IC50 (mg/mL)	88.71	2.06	81.58	3.6	79.04	1.84

**BUKTI KORESPONDENSI MINOR REVISION REQUEST FROM THE  
AUTHOR ON COPYEDITING RESULTS**

**1 Formulation and Characterization of Peel-Off Gel Mask Containing Secang  
2 (Caesalpinia sappan L.) Wood Extract with Strong Antioxidant Activity  
3 Formulasi dan Karakterisasi Masker Gel Peel-Off Mengandung Ekstrak Kayu  
4 Secang (Caesalpinia sappan L.) dengan Aktivitas Antioksidan yang Kuat**

5  
6 Intan Martha Cahyani<sup>1\*</sup>, Tan Tanando Tanzaq<sup>1</sup>, Ruth Ditya Agustina<sup>1</sup>, Kemala Endar Setiawati<sup>1</sup>

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9 **Abstract**

10 Secang (*Caesalpinia sappan* L.) wood contains flavonoid compounds such as brazilin, 3'-O-  
11 methylbrazilin, sappanin chalcone, and sappan chalcone, which act as primary and secondary  
12 antioxidants. Antioxidants are substances that can inhibit oxidation reactions by neutralizing  
13 free radicals. Enhancing the antioxidant potential of *C. sappan* wood can be achieved by  
14 developing a topical dosage form. Peel-off gel masks are an ideal form due to their ability to  
15 improve skin health and provide ease and comfort in application. This study aimed to  
16 formulate a peel-off gel mask containing *C. sappan* extract and evaluate its physical  
17 properties and antioxidant activity. The formulations were prepared using 2.5%, 5%, and 7.5%  
18 extract with sodium carboxymethyl cellulose, polyvinyl alcohol, and propylene glycol as the  
19 base. The resulting masks were assessed for physical characteristics (pH, viscosity,  
20 spreadability, adhesiveness, and drying time) and antioxidant activity using the DPPH method.  
21 The results indicated that increasing the extract concentration significantly ( $p < 0.05$ )  
22 increased viscosity, adhesiveness, and drying time, while decreasing pH, spreadability,  
23 and IC<sub>50</sub> value. All formulations demonstrated strong antioxidant activity (IC<sub>50</sub> between 50–  
24 100 µg/mL), with IC<sub>50</sub> values of 88.71 µg/mL, 81.58 µg/mL, and 79.04 µg/mL, respectively.

25  
26 **Keywords:** *Caesalpinia sappan*, peel-off gel mask, formulation, antioxidant, physical  
27 characterization

28 **Abstrak**

29 Kayu secang (*Caesalpinia sappan* L.) mengandung senyawa flavonoid seperti brazilin, 3'-O-  
30 metilbrazilin, sappanin chalcone, dan sappan chalcone yang berfungsi sebagai antioksidan  
31 primer maupun sekunder. Antioksidan merupakan senyawa yang mampu menghambat reaksi  
32 oksidasi dengan menetralkan radikal bebas. Upaya peningkatan potensi antioksidan kayu *C.*  
33 *sappan* dapat dilakukan melalui pengembangan sediaan topikal. Masker gel peel-off  
34 merupakan bentuk sediaan yang sesuai karena dapat menjaga kesehatan kulit sekaligus  
35 memberikan kenyamanan dan kemudahan saat pemakaian. Penelitian ini bertujuan untuk  
36 merumuskan dan mengevaluasi masker gel peel-off yang mengandung ekstrak kayu *C.*  
37 *sappan* berdasarkan karakteristik fisik dan aktivitas antioksidannya. Formulasi dibuat dengan  
38 konsentrasi ekstrak 2,5%, 5%, dan 7,5% menggunakan natrium karboksimetil selulosa,  
39 polivinil alkohol, dan propilen glikol sebagai basis gel. Evaluasi dilakukan terhadap parameter  
40 fisik (pH, viskositas, daya sebar, daya lekat, dan waktu kering) serta aktivitas antioksidan  
41 menggunakan metode DPPH. Hasil menunjukkan bahwa peningkatan konsentrasi ekstrak  
42 secara signifikan ( $p < 0,05$ ) meningkatkan viskositas, daya lekat, dan waktu kering serta  
43 menurunkan pH, daya sebar, dan nilai IC<sub>50</sub>. Seluruh formula menunjukkan aktivitas

## BUKTI KORESPONDENSI MINOR REVISION REQUEST FROM THE AUTHOR ON COPYEDITING RESULTS

44 antioksidan yang kuat ( $IC_{50}$  antara 50–100  $\mu\text{g/mL}$ ), dengan nilai  $IC_{50}$  berturut-turut  
45 sebesar 88,71  $\mu\text{g/mL}$ , 81,58  $\mu\text{g/mL}$ , dan 79,04  $\mu\text{g/mL}$ .

46  
47 **Kata Kunci:** *Caesalpinia sappan*, masker gel peel-off, formulasi, antioksidan, karakteristik fisik

### 48 1. Introduction

49 Air pollution has increased significantly in recent years, with levels rising by up to 20%,  
50 and has been identified as a major contributor to various health problems due to prolonged  
51 exposure (Wahdaningsih et al., 2015). One of the primary mechanisms through which  
52 pollution causes harm is oxidative stress, a condition arising from an overproduction of free  
53 radicals in the body. These reactive species can damage biological molecules, highlighting the  
54 importance of antioxidants in neutralizing free radicals and preventing oxidative damage,  
55 particularly in the skin (Widowati, 2011).

56 Flavonoids are natural compounds widely recognized for their antioxidant properties.  
57 They are capable of scavenging a variety of free radicals, including hydroxyl, peroxy, alkoxy,  
58 superoxide anions, singlet oxygen, and hydrogen peroxide (Utari, 2017). One promising  
59 source of flavonoids is the wood of secang (*Caesalpinia sappan* L.), which contains active  
60 constituents such as brazilin, 3'-O-methylbrazilin, sappanin, and chalcone. These compounds  
61 act as both primary and secondary antioxidants. Among them, brazilin has shown particularly  
62 strong antioxidant activity, reportedly exceeding that of synthetic antioxidants such as  
63 butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) (Sugiyanto et al., 2013).  
64 In previous studies, the extract of *C. sappan* demonstrated strong antioxidant potential with  
65 an  $IC_{50}$  value of 74.44  $\mu\text{g/mL}$  (Tanzaq et al., 2019).

66 Facial masks are among the most popular cosmetic products for skin care. However,  
67 traditional mask types are often considered less practical due to lengthy application and  
68 removal processes. Peel-off gel masks have emerged as a more efficient alternative, offering  
69 ease of use, user comfort, and the ability to deliver active ingredients effectively without  
70 requiring rinsing (Rahmawanty et al., 2015). Furthermore, peel-off gel formulations have  
71 been shown to enhance antioxidant efficacy when natural extracts are incorporated.  
72 Successful applications have been reported using extracts such as *Paederia foetida* (Eka et al.,  
73 2022), areca seed (*Areca catechu*) (Dwi Mulyani et al., 2023), red spinach (*Amaranthus*

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74 *tricolor*) leaves (Welly et al., 2022), and mangrove (*Avicennia marina*) leaves (Hasibuan et al.,  
75 2024).

76 Despite its promising properties, the application of *C. sappan* extract in peel-off gel  
77 mask formulations remains underexplored. Therefore, the aim of this study was to formulate  
78 and evaluate a peel-off gel mask containing *C. sappan* extract, with a focus on its physical  
79 characteristics and antioxidant activity. This formulation is expected to serve as a natural,  
80 effective skincare solution by maximizing the antioxidant potential of *C. sappan* in a user-  
81 friendly topical preparation.

## 82 2. Methods

### 83 2.1 Materials and Equipment

84 The materials used in this study included *C. sappan* (secang) wood, 96% ethanol  
85 (Merck), sodium carboxymethyl cellulose (CMC-Na), polyvinyl alcohol (PVA), propylene glycol,  
86 vitamin C, and 1,1-diphenyl-2-picrylhydrazyl (DPPH).

87 The instruments employed were a rotary evaporator (Heidolph), standard laboratory  
88 glassware (Pyrex), pH meter (Hanna Instruments pH 210 Microprocessor), viscometer  
89 (Brookfield DV-I Prime), and UV-Vis spectrophotometer (Shimadzu UV-1240 Mini).

### 90 2.2 Extraction of *C. sappan* Wood

91 Secang wood was extracted by maceration. The wood powder was soaked in 96%  
92 ethanol at a ratio of 1:10 (w/v) for 72 hours. The extract was filtered and concentrated using  
93 a rotary evaporator until a thick extract was obtained (Tanzaq et al., 2019).

### 94 2.3 Formulation of Peel-Off Gel Mask

95 The peel-off gel mask was formulated using *C. sappan* extract at concentrations of 2.5%,  
96 5%, and 7.5%, as shown in **Table 1**. The gel base consisted of polyvinyl alcohol (PVA), sodium  
97 carboxymethyl cellulose (CMC-Na), and propylene glycol. PVA and CMC-Na were dispersed in  
98 distilled water heated to 80°C until fully swollen. Afterward, propylene glycol was added and  
99 the mixture was stirred until homogeneous. The ethanol extract of *C. sappan* was then  
100 incorporated gradually into the base while stirring, and distilled water was added to reach  
101 100% total weight. The final mixture was stirred continuously to ensure uniformity (Cahyani  
102 et al., 2025).

103 **Table 1.** Composition of Peel-Off Gel Mask Formulations Containing *C. sappan* Extract

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Ingredient	Formula I (%)	Formula II (%)	Formula III (%)
<i>C. sappan</i> extract	2.5	5.0	7.5
Sodium CMC (CMC-Na)	1.26	1.26	1.26
Polyvinyl alcohol (PVA)	6.74	6.74	6.74
Propylene glycol	4.0	4.0	4.0
Distilled water (ad)	100	100	100

104

105 **2.4 Evaluation of Physical Characteristics**

106 The physical characteristics of the peel-off gel masks were evaluated to assess their  
107 suitability as topical cosmetic formulations. Organoleptic properties including color, odor, and  
108 consistency were observed visually, while homogeneity was examined by spreading a small  
109 sample of the gel on a glass slide to check for uniform dispersion of components (Syam et al.,  
110 2021).

111 The pH of each formulation was measured by immersing the electrode of a calibrated  
112 digital pH meter into the gel and recording the stabilized value (Andini et al., 2017). Viscosity  
113 was determined using a Brookfield viscometer equipped with spindle number 64, operated  
114 at a speed of 1 rpm. A viscosity range of 2000–50000 cps is considered acceptable for peel-  
115 off gel masks (SNI 16-4399-1996).

116 To evaluate spreadability, 0.5 g of the formulation were placed at the center of a glass  
117 plate, then covered with another glass plate of known weight. The diameter of the spread  
118 was measured, and additional weight was added incrementally until the diameter stabilized.  
119 Adhesiveness was assessed by placing a 0.25 g sample between two glass slides, applying a  
120 100 g load for five minutes, and measuring the time it took for the plates to separate after  
121 load removal (Syam et al., 2021).

122 The drying time was tested by applying 0.1 gram of gel to a 2.5 × 2.5 cm area on the  
123 inner forearm. The time required for the film to dry completely at room temperature was  
124 recorded. An ideal drying time for peel-off gel masks ranges from 15 to 30 minutes (Silvia et  
125 al., 2021).

126 **2.5 Antioxidant Activity Test Using DPPH Method**

127 The antioxidant activity of the peel-off gel mask formulations was evaluated using the  
128 DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging method. Initially, the maximum

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129 absorbance wavelength ( $\lambda_{\text{max}}$ ) of the DPPH solution (30  $\mu\text{g}/\text{mL}$ ) was determined using a UV-  
130 Vis spectrophotometer within the 400–800 nm range. The optimal reaction time was also  
131 established by reacting a 1:1 volume ratio of vitamin C (as the standard antioxidant) with the  
132 DPPH solution and measuring the absorbance over a 60-minute period.

133 Each sample (0.05 g) was dissolved in methanol and diluted to 50 mL. From this stock  
134 solution, working concentrations of 60, 70, 80, 100, and 120  $\mu\text{g}/\text{mL}$  were prepared. Equal  
135 volumes of the sample solution and DPPH solution (30  $\mu\text{g}/\text{mL}$ ) were mixed, incubated at room  
136 temperature for the predetermined optimal time, and their absorbance measured at the  
137 previously identified  $\lambda_{\text{max}}$ . The same procedure was applied to vitamin C standard solutions  
138 at concentrations of 2, 4, 6, 8, and 10  $\mu\text{g}/\text{mL}$ .

139 The percentage inhibition of DPPH radicals was calculated for each concentration, and  
140 the  $\text{IC}_{50}$  value—the concentration required to inhibit 50% of the DPPH radicals—was  
141 determined by linear regression analysis of the inhibition percentage versus sample  
142 concentration (Maharani et al., 2022).

### 143 2.6 Data Analysis

144 The evaluation of the peel-off gel mask formulations was conducted using descriptive  
145 analysis. Observational data such as organoleptic characteristics and homogeneity were  
146 assessed qualitatively. Physical parameters including pH, viscosity, spreadability,  
147 adhesiveness, and drying time were compared across formulations to identify trends related  
148 to increasing concentrations of *C. sappan* extract. Similarly, antioxidant activity data were  
149 interpreted by comparing the  $\text{IC}_{50}$  values of each formulation. The significance of observed  
150 changes was discussed in terms of their relative magnitude and consistency rather than based  
151 on formal statistical tests.

152

153

## 3. Results and Discussion

### 154 3.1 Physical Characteristics of Peel Off Gel Mask Containing *C. sappan* Extract

155 *Caesalpinia sappan* has traditionally been recognized for its therapeutic properties,  
156 including antibacterial, anti-inflammatory, antidiabetic, and antioxidant effects. The ethanol  
157 extract of *C. sappan* contains flavonoid compounds such as brazilin, 3'-O-methylbrazilin,  
158 sappanin, and chalcone, which contribute to its strong antioxidant profile (Ngamwonglumlert  
159 & Devahastin, 2023). In this study, peel-off gel mask formulations containing *C.*

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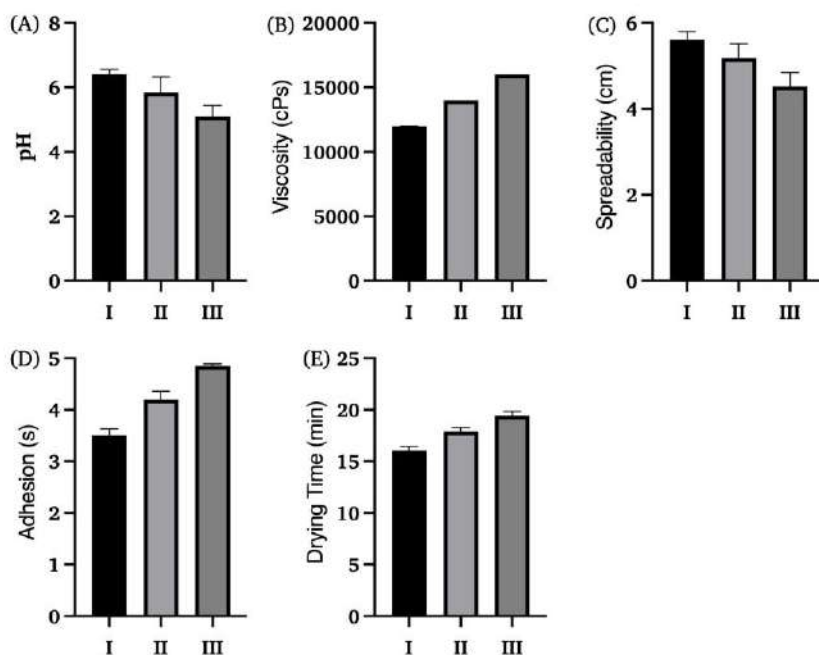
160 *sappan* extract at concentrations of 2.5%, 5%, and 7.5% were developed and evaluated for  
161 their physical properties.

162 The organoleptic and homogeneity observations showed that all formulations had a  
163 consistent orange color, a characteristic *C. sappan* odor, and a smooth, thick consistency.  
164 Each gel was visually homogeneous, indicating even distribution of ingredients throughout  
165 the formulation.

166 **Figure 1** illustrates the physical properties of the three formulations. The pH values  
167 decreased slightly as the extract concentration increased. This trend is attributed to the acidic  
168 nature of *C. sappan* extract (Muslimin et al., 2024), which becomes more influential as the  
169 proportion of extract rises. The viscosity of the gels increased progressively with extract  
170 concentration, affecting other parameters such as spreadability, adhesiveness, and drying  
171 time. A higher viscosity reduced spreadability but enhanced adhesiveness and prolonged the  
172 drying time. These relationships are evident in the trends presented in Figure 1.

173 Such changes in physical characteristics are consistent with the structural influence of  
174 extract constituents and the thickening effect they exert in the gel base. Although no  
175 statistical tests were applied, the consistent trends across all parameters support the  
176 influence of *C. sappan* extract concentration on the physical performance of the peel-off  
177 mask.

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178  
179 **Figure 1.** Physical characteristics of peel-off gel mask containing *C. sappan* extract in  
180 Formulation I (2.5%), Formulation II (5.0%), and Formulation III (7.5%): (a) pH, (b) viscosity, (c)  
181 spreadability, (d) adhesiveness, and (e) drying time.

182

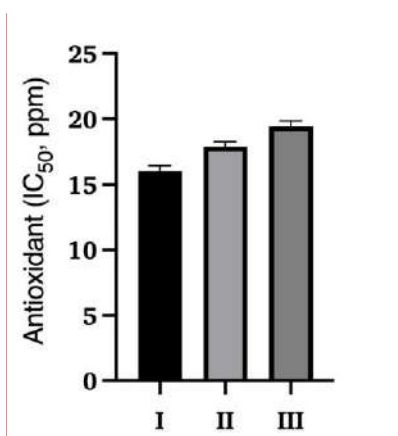
### 183 3.2 Antioxidant Activity of Peel-Off Gel Mask Containing *C. sappan* Extract

184 The antioxidant activity of the peel-off gel mask formulations was evaluated using the  
185 DPPH free radical scavenging assay. All formulations demonstrated strong antioxidant  
186 capacity, with  $IC_{50}$  values within the range of 50–100  $\mu\text{g/mL}$ , indicating effective radical  
187 scavenging potential.

188 As shown in **Figure 2**, the  $IC_{50}$  values decreased with increasing extract  
189 concentration: 88.71  $\mu\text{g/mL}$  for Formulation I (2.5%), 81.58  $\mu\text{g/mL}$  for Formulation II (5.0%),  
190 and 79.04  $\mu\text{g/mL}$  for Formulation III (7.5%). This trend suggests that higher concentrations  
191 of *C. sappan* extract contribute to enhanced antioxidant performance, likely due to increased  
192 levels of flavonoid compounds such as brazilin.

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193 Although statistical testing was not applied, the progressive decrease in  $IC_{50}$  values  
194 clearly indicates the influence of extract concentration on antioxidant activity. These results  
195 are consistent with the literature, which identifies *C. sappan* as a potent natural antioxidant  
196 source (Tanzaq et al., 2019). Compared to its pure extract  $IC_{50}$  value of 74.44  $\mu\text{g/mL}$ , the  
197 formulated gels retained high antioxidant potential. However, when compared to vitamin C  
198 ( $IC_{50} = 3.04 \mu\text{g/mL}$ ), the formulations were less potent, which is expected given the superior  
199 radical scavenging efficiency of pure ascorbic acid.



200  
201 **Figure 2.**  $IC_{50}$  values of peel-off gel mask containing *C. sappan* extract in Formulation I  
202 (2.5%), Formulation II (5.0%), and Formulation III (7.5%).

### 204 4. Conclusion

205 This study demonstrated that peel-off gel masks containing *C. sappan* extract can be  
206 effectively formulated using polyvinyl alcohol, sodium carboxymethyl cellulose, and  
207 propylene glycol as base components. Increasing the extract concentration from 2.5% to 7.5%  
208 affected the physical properties of the formulation by increasing viscosity, adhesiveness, and  
209 drying time, while decreasing pH and spreadability. All formulations exhibited strong  
210 antioxidant activity, with  $IC_{50}$  values ranging from 88.71 to 79.04  $\mu\text{g/mL}$ , indicating that higher  
211 extract concentrations enhance antioxidant performance. Overall, the 7.5% extract  
212 formulation showed the most favorable combination of physical characteristics and  
213 antioxidant activity, supporting its potential as a natural, effective peel-off gel mask for skin  
214 health applications.

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**1 Formulation and Characterization of Peel-Off Gel Mask Containing Secang  
2 (*Caesalpinia sappan* L.) Wood Extract with Strong Antioxidant Activity  
3 Formulasi dan Karakterisasi Masker Gel Peel-Off Mengandung Ekstrak Kayu  
4 Secang (*Caesalpinia sappan* L.) dengan Aktivitas Antioksidan yang Kuat**

5  
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9 **Abstract**

10 Secang (*Caesalpinia sappan* L.) wood contains flavonoid compounds such as brazilin, 3'-O-  
11 methylbrazilin, sappanin chalcone, and sappan chalcone, which act as primary and secondary  
12 antioxidants. Antioxidants are substances that can inhibit oxidation reactions by neutralizing  
13 free radicals. Enhancing the antioxidant potential of *C. sappan* wood can be achieved by  
14 developing a topical dosage form. Peel-off gel masks are an ideal form due to their ability to  
15 improve skin health and provide ease and comfort in application. This study aimed to  
16 formulate a peel-off gel mask containing *C. sappan* extract and evaluate its physical  
17 properties and antioxidant activity. The formulations were prepared using 2.5%, 5%, and 7.5%  
18 extract with sodium carboxymethyl cellulose, polyvinyl alcohol, and propylene glycol as the  
19 base. The resulting masks were assessed for physical characteristics (pH, viscosity,  
20 spreadability, adhesiveness, and drying time) and antioxidant activity using the DPPH method.  
21 The results indicated that increasing the extract concentration significantly ( $p < 0.05$ )  
22 increased viscosity, adhesiveness, and drying time, while decreasing pH, spreadability,  
23 and IC<sub>50</sub> value. All formulations demonstrated strong antioxidant activity (IC<sub>50</sub> between 50–  
24 100 µg/mL), with IC<sub>50</sub> values of 88.71 µg/mL, 81.58 µg/mL, and 79.04 µg/mL, respectively.

25  
26 Keywords: *Caesalpinia sappan*, peel-off gel mask, formulation, antioxidant, physical  
27 characterization

28 **Abstrak**

29 Kayu secang (*Caesalpinia sappan* L.) mengandung senyawa flavonoid seperti brazilin, 3'-O-  
30 metilbrazilin, sappanin chalcone, dan sappan chalcone yang berfungsi sebagai antioksidan  
31 primer maupun sekunder. Antioksidan merupakan senyawa yang mampu menghambat reaksi  
32 oksidasi dengan menetralkan radikal bebas. Upaya peningkatan potensi antioksidan kayu *C.*  
33 *sappan* dapat dilakukan melalui pengembangan sediaan topikal. Masker gel peel-off  
34 merupakan bentuk sediaan yang sesuai karena dapat menjaga kesehatan kulit sekaligus  
35 memberikan kenyamanan dan kemudahan saat pemakaian. Penelitian ini bertujuan untuk  
36 merumuskan dan mengevaluasi masker gel peel-off yang mengandung ekstrak kayu *C.*  
37 *sappan* berdasarkan karakteristik fisik dan aktivitas antioksidannya. Formulasi dibuat dengan  
38 konsentrasi ekstrak 2,5%, 5%, dan 7,5% menggunakan natrium karboksimetil selulosa,  
39 polivinil alkohol, dan propilen glikol sebagai basis gel. Evaluasi dilakukan terhadap parameter  
40 fisik (pH, viskositas, daya sebar, daya lekat, dan waktu kering) serta aktivitas antioksidan  
41 menggunakan metode DPPH. Hasil menunjukkan bahwa peningkatan konsentrasi ekstrak  
42 secara signifikan ( $p < 0,05$ ) meningkatkan viskositas, daya lekat, dan waktu kering serta  
43 menurunkan pH, daya sebar, dan nilai IC<sub>50</sub>. Seluruh formula menunjukkan aktivitas

## BUKTI KORESPONDENSI CONFIRMATION OF REVISION – FIGURE 2 ADJUSTMENT AND UNIT CORRECTION

44 antioksidan yang kuat ( $IC_{50}$  antara 50–100  $\mu\text{g/mL}$ ), dengan nilai  $IC_{50}$  berturut-turut  
45 sebesar 88,71  $\mu\text{g/mL}$ , 81,58  $\mu\text{g/mL}$ , dan 79,04  $\mu\text{g/mL}$ .

46

47 **Kata Kunci:** *Caesalpinia sappan*, masker gel peel-off, formulasi, antioksidan, karakteristik fisik

48

### 1. Introduction

49 Air pollution has increased significantly in recent years, with levels rising by up to 20%,  
50 and has been identified as a major contributor to various health problems due to prolonged  
51 exposure (Wahdaningsih et al., 2015). One of the primary mechanisms through which  
52 pollution causes harm is oxidative stress, a condition arising from an overproduction of free  
53 radicals in the body. These reactive species can damage biological molecules, highlighting the  
54 importance of antioxidants in neutralizing free radicals and preventing oxidative damage,  
55 particularly in the skin (Widowati, 2011).

56 Flavonoids are natural compounds widely recognized for their antioxidant properties.  
57 They are capable of scavenging a variety of free radicals, including hydroxyl, peroxide, alkoxyl,  
58 superoxide anions, singlet oxygen, and hydrogen peroxide (Utari, 2017). One promising  
59 source of flavonoids is the wood of secang (*Caesalpinia sappan* L.), which contains active  
60 constituents such as brazilin, 3'-O-methylbrazilin, sappanin, and chalcone. These compounds  
61 act as both primary and secondary antioxidants. Among them, brazilin has shown particularly  
62 strong antioxidant activity, reportedly exceeding that of synthetic antioxidants such as  
63 butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) (Sugiyanto et al., 2013).  
64 In previous studies, the extract of *C. sappan* demonstrated strong antioxidant potential with  
65 an  $IC_{50}$  value of 74.44  $\mu\text{g/mL}$  (Tanzaq et al., 2019).

66 Facial masks are among the most popular cosmetic products for skin care. However,  
67 traditional mask types are often considered less practical due to lengthy application and  
68 removal processes. Peel-off gel masks have emerged as a more efficient alternative, offering  
69 ease of use, user comfort, and the ability to deliver active ingredients effectively without  
70 requiring rinsing (Rahmawanty et al., 2015). Furthermore, peel-off gel formulations have  
71 been shown to enhance antioxidant efficacy when natural extracts are incorporated.  
72 Successful applications have been reported using extracts such as *Paederia foetida* (Eka et al.,  
73 2022), areca seed (*Areca catechu*) (Dwi Mulyani et al., 2023), red spinach (*Amaranthus*

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74 *tricolor*) leaves (Welly et al., 2022), and mangrove (*Avicennia marina*) leaves (Hasibuan et al.,  
75 2024).

76 Despite its promising properties, the application of *C. sappan* extract in peel-off gel  
77 mask formulations remains underexplored. Therefore, the aim of this study was to formulate  
78 and evaluate a peel-off gel mask containing *C. sappan* extract, with a focus on its physical  
79 characteristics and antioxidant activity. This formulation is expected to serve as a natural,  
80 effective skincare solution by maximizing the antioxidant potential of *C. sappan* in a user-  
81 friendly topical preparation.

### 82 2. Methods

#### 83 2.1 Materials and Equipment

84 The materials used in this study included *C. sappan* (secang) wood, 96% ethanol  
85 (Merck), sodium carboxymethyl cellulose (CMC-Na), polyvinyl alcohol (PVA), propylene glycol,  
86 vitamin C, and 1,1-diphenyl-2-picrylhydrazyl (DPPH).

87 The instruments employed were a rotary evaporator (Heidolph), standard laboratory  
88 glassware (Pyrex), pH meter (Hanna Instruments pH 210 Microprocessor), viscometer  
89 (Brookfield DV-I Prime), and UV-Vis spectrophotometer (Shimadzu UV-1240 Mini).

#### 90 2.2 Extraction of *C. sappan* Wood

91 Secang wood was extracted by maceration. The wood powder was soaked in 96%  
92 ethanol at a ratio of 1:10 (w/v) for 72 hours. The extract was filtered and concentrated using  
93 a rotary evaporator until a thick extract was obtained (Tanzaq et al., 2019).

#### 94 2.3 Formulation of Peel-Off Gel Mask

95 The peel-off gel mask was formulated using *C. sappan* extract at concentrations of 2.5%,  
96 5%, and 7.5%, as shown in **Table 1**. The gel base consisted of polyvinyl alcohol (PVA), sodium  
97 carboxymethyl cellulose (CMC-Na), and propylene glycol. PVA and CMC-Na were dispersed in  
98 distilled water heated to 80°C until fully swollen. Afterward, propylene glycol was added and  
99 the mixture was stirred until homogeneous. The ethanol extract of *C. sappan* was then  
100 incorporated gradually into the base while stirring, and distilled water was added to reach  
101 100% total weight. The final mixture was stirred continuously to ensure uniformity (Cahyani  
102 et al., 2025).

103 **Table 1.** Composition of Peel-Off Gel Mask Formulations Containing *C. sappan* Extract

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Ingredient	Formula I (%)	Formula II (%)	Formula III (%)
<i>C. sappan</i> extract	2.5	5.0	7.5
Sodium CMC (CMC-Na)	1.26	1.26	1.26
Polyvinyl alcohol (PVA)	6.74	6.74	6.74
Propylene glycol	4.0	4.0	4.0
Distilled water (ad)	100	100	100

104

105 **2.4 Evaluation of Physical Characteristics**

106 The physical characteristics of the peel-off gel masks were evaluated to assess their  
107 suitability as topical cosmetic formulations. Organoleptic properties including color, odor, and  
108 consistency were observed visually, while homogeneity was examined by spreading a small  
109 sample of the gel on a glass slide to check for uniform dispersion of components (Syam et al.,  
110 2021).

111 The pH of each formulation was measured by immersing the electrode of a calibrated  
112 digital pH meter into the gel and recording the stabilized value (Andini et al., 2017). Viscosity  
113 was determined using a Brookfield viscometer equipped with spindle number 64, operated  
114 at a speed of 1 rpm. A viscosity range of 2000–50000 cps is considered acceptable for peel-  
115 off gel masks (SNI 16-4399-1996).

116 To evaluate spreadability, 0.5 g of the formulation were placed at the center of a glass  
117 plate, then covered with another glass plate of known weight. The diameter of the spread  
118 was measured, and additional weight was added incrementally until the diameter stabilized.  
119 Adhesiveness was assessed by placing a 0.25 g sample between two glass slides, applying a  
120 100 g load for five minutes, and measuring the time it took for the plates to separate after  
121 load removal (Syam et al., 2021).

122 The drying time was tested by applying 0.1 gram of gel to a 2.5 × 2.5 cm area on the  
123 inner forearm. The time required for the film to dry completely at room temperature was  
124 recorded. An ideal drying time for peel-off gel masks ranges from 15 to 30 minutes (Silvia et  
125 al., 2021).

126 **2.5 Antioxidant Activity Test Using DPPH Method**

127 The antioxidant activity of the peel-off gel mask formulations was evaluated using the  
128 DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging method. Initially, the maximum

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129 absorbance wavelength ( $\lambda_{\max}$ ) of the DPPH solution (30  $\mu\text{g}/\text{mL}$ ) was determined using a UV-  
130 Vis spectrophotometer within the 400–800 nm range. The optimal reaction time was also  
131 established by reacting a 1:1 volume ratio of vitamin C (as the standard antioxidant) with the  
132 DPPH solution and measuring the absorbance over a 60-minute period.

133 Each sample (0.05 g) was dissolved in methanol and diluted to 50 mL. From this stock  
134 solution, working concentrations of 60, 70, 80, 100, and 120  $\mu\text{g}/\text{mL}$  were prepared. Equal  
135 volumes of the sample solution and DPPH solution (30  $\mu\text{g}/\text{mL}$ ) were mixed, incubated at room  
136 temperature for the predetermined optimal time, and their absorbance measured at the  
137 previously identified  $\lambda_{\max}$ . The same procedure was applied to vitamin C standard solutions  
138 at concentrations of 2, 4, 6, 8, and 10  $\mu\text{g}/\text{mL}$ .

139 The percentage inhibition of DPPH radicals was calculated for each concentration, and  
140 the  $\text{IC}_{50}$  value—the concentration required to inhibit 50% of the DPPH radicals—was  
141 determined by linear regression analysis of the inhibition percentage versus sample  
142 concentration (Maharani et al., 2022).

### 143 **2.6 Data Analysis**

144 The evaluation of the peel-off gel mask formulations was conducted using descriptive  
145 analysis. Observational data such as organoleptic characteristics and homogeneity were  
146 assessed qualitatively. Physical parameters including pH, viscosity, spreadability,  
147 adhesiveness, and drying time were compared across formulations to identify trends related  
148 to increasing concentrations of *C. sappan* extract. Similarly, antioxidant activity data were  
149 interpreted by comparing the  $\text{IC}_{50}$  values of each formulation. The significance of observed  
150 changes was discussed in terms of their relative magnitude and consistency rather than based  
151 on formal statistical tests.

152

## 153 **3. Results and Discussion**

### 154 **3.1 Physical Characteristics of Peel Off Gel Mask Containing *C. sappan* Extract**

155 *Caesalpinia sappan* has traditionally been recognized for its therapeutic properties,  
156 including antibacterial, anti-inflammatory, antidiabetic, and antioxidant effects. The ethanol  
157 extract of *C. sappan* contains flavonoid compounds such as brazilin, 3'-O-methylbrazilin,  
158 sappanin, and chalcone, which contribute to its strong antioxidant profile (Ngamwonglumlert  
159 & Devahastin, 2023). In this study, peel-off gel mask formulations containing *C.*

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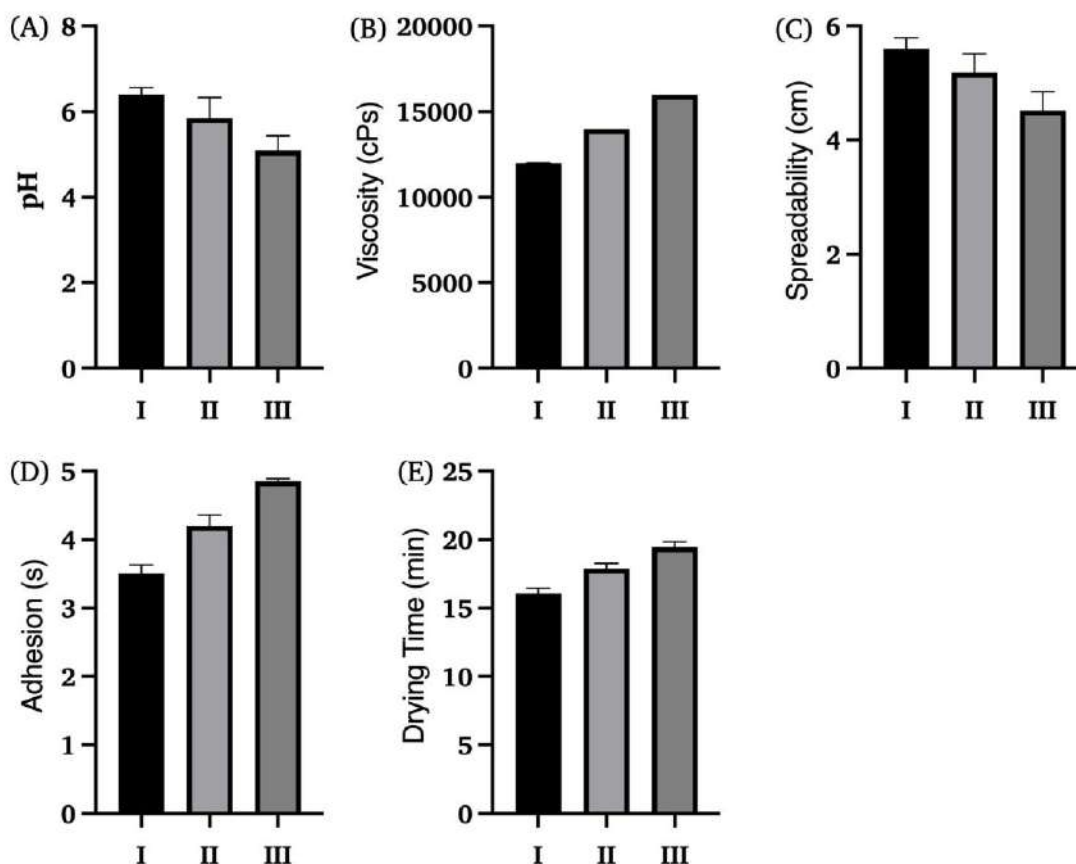
160 *sappan* extract at concentrations of 2.5%, 5%, and 7.5% were developed and evaluated for  
161 their physical properties.

162 The organoleptic and homogeneity observations showed that all formulations had a  
163 consistent orange color, a characteristic *C. sappan* odor, and a smooth, thick consistency.  
164 Each gel was visually homogeneous, indicating even distribution of ingredients throughout  
165 the formulation.

166 **Figure 1** illustrates the physical properties of the three formulations. The pH values  
167 decreased slightly as the extract concentration increased. This trend is attributed to the acidic  
168 nature of *C. sappan* extract (Muslimin et al., 2024), which becomes more influential as the  
169 proportion of extract rises. The viscosity of the gels increased progressively with extract  
170 concentration, affecting other parameters such as spreadability, adhesiveness, and drying  
171 time. A higher viscosity reduced spreadability but enhanced adhesiveness and prolonged the  
172 drying time. These relationships are evident in the trends presented in Figure 1.

173 Such changes in physical characteristics are consistent with the structural influence of  
174 extract constituents and the thickening effect they exert in the gel base. Although no  
175 statistical tests were applied, the consistent trends across all parameters support the  
176 influence of *C. sappan* extract concentration on the physical performance of the peel-off  
177 mask.

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178  
179 **Figure 1.** Physical characteristics of peel-off gel mask containing *C. sappan* extract in  
180 Formulation I (2.5%), Formulation II (5.0%), and Formulation III (7.5%): (a) pH, (b) viscosity, (c)  
181 spreadability, (d) adhesiveness, and (e) drying time.

182

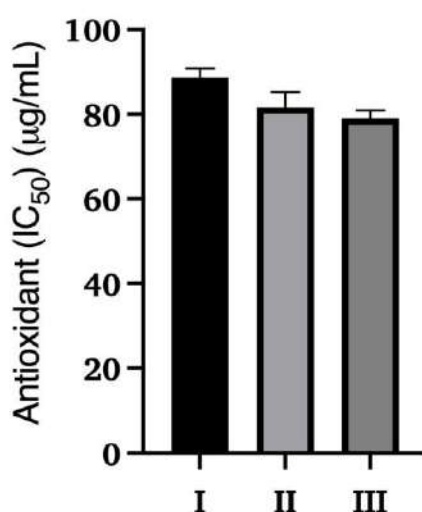
### 183 **3.2 Antioxidant Activity of Peel-Off Gel Mask Containing *C. sappan* Extract**

184 The antioxidant activity of the peel-off gel mask formulations was evaluated using the  
185 DPPH free radical scavenging assay. All formulations demonstrated strong antioxidant  
186 capacity, with  $IC_{50}$  values within the range of 50–100  $\mu\text{g}/\text{mL}$ , indicating effective radical  
187 scavenging potential.

188 As shown in **Figure 2**, the  $IC_{50}$  values decreased with increasing extract  
189 concentration: 88.71  $\mu\text{g}/\text{mL}$  for Formulation I (2.5%), 81.58  $\mu\text{g}/\text{mL}$  for Formulation II (5.0%),  
190 and 79.04  $\mu\text{g}/\text{mL}$  for Formulation III (7.5%). This trend suggests that higher concentrations  
191 of *C. sappan* extract contribute to enhanced antioxidant performance, likely due to increased  
192 levels of flavonoid compounds such as brazilin.

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193 Although statistical testing was not applied, the progressive decrease in  $IC_{50}$  values  
194 clearly indicates the influence of extract concentration on antioxidant activity. These results  
195 are consistent with the literature, which identifies *C. sappan* as a potent natural antioxidant  
196 source (Tanzaq et al., 2019). Compared to its pure extract  $IC_{50}$  value of 74.44  $\mu\text{g}/\text{mL}$ , the  
197 formulated gels retained high antioxidant potential. However, when compared to vitamin C  
198 ( $IC_{50} = 3.04 \mu\text{g}/\text{mL}$ ), the formulations were less potent, which is expected given the superior  
199 radical scavenging efficiency of pure ascorbic acid.



200  
201 **Figure 2.**  $IC_{50}$  values of peel-off gel mask containing *C. sappan* extract in Formulation I  
202 (2.5%), Formulation II (5.0%), and Formulation III (7.5%).

### 204 4. Conclusion

205 This study demonstrated that peel-off gel masks containing *C. sappan* extract can be  
206 effectively formulated using polyvinyl alcohol, sodium carboxymethyl cellulose, and  
207 propylene glycol as base components. Increasing the extract concentration from 2.5% to 7.5%  
208 affected the physical properties of the formulation by increasing viscosity, adhesiveness, and  
209 drying time, while decreasing pH and spreadability. All formulations exhibited strong  
210 antioxidant activity, with  $IC_{50}$  values ranging from 88.71 to 79.04  $\mu\text{g}/\text{mL}$ , indicating that higher  
211 extract concentrations enhance antioxidant performance. Overall, the 7.5% extract  
212 formulation showed the most favorable combination of physical characteristics and  
213 antioxidant activity, supporting its potential as a natural, effective peel-off gel mask for skin  
214 health applications.

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## Formulation and Characterization of Peel-Off Gel Mask Containing Secang (*Caesalpinia sappan* L.) Wood Extract with Strong Antioxidant Activity

[Formulasi dan Karakterisasi Masker Gel Peel-Off Mengandung Ekstrak Kayu Secang (*Caesalpinia sappan* L.) dengan Aktivitas Antioksidan yang Kuat]

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### ABSTRACT

Secang (*Caesalpinia sappan* L.) wood contains flavonoid compounds such as brazilin, 3'-O-methylbrazilin, sappanin chalcone, and sappan chalcone, which act as primary and secondary antioxidants. Antioxidants are substances that can inhibit oxidation reactions by neutralizing free radicals. Enhancing the antioxidant potential of *C. sappan* wood can be achieved by developing a topical dosage form. Peel-off gel masks are an ideal form due to their ability to improve skin health and provide ease and comfort in application. This study aimed to formulate a peel-off gel mask containing *C. sappan* extract and evaluate its physical properties and antioxidant activity. The formulations were prepared using 2.5%, 5%, and 7.5% extract with sodium carboxymethyl cellulose, polyvinyl alcohol, and propylene glycol as the base. The resulting masks were assessed for physical characteristics (pH, viscosity, spreadability, adhesiveness, and drying time) and antioxidant activity using the DPPH method. The results indicated that increasing the extract concentration significantly ( $p < 0.05$ ) increased viscosity, adhesiveness, and drying time, while decreasing pH, spreadability, and  $IC_{50}$  value. All formulations demonstrated strong antioxidant activity ( $IC_{50}$  between 50–100  $\mu\text{g/mL}$ ), with  $IC_{50}$  values of 88.71  $\mu\text{g/mL}$ , 81.58  $\mu\text{g/mL}$ , and 79.04  $\mu\text{g/mL}$ , respectively.

### ABSTRAK

Kayu secang (*Caesalpinia sappan* L.) mengandung senyawa flavonoid seperti brazilin, 3'-O-metilbrazilin, sappanin chalcone, dan sappan chalcone yang berfungsi sebagai antioksidan primer maupun sekunder. Antioksidan merupakan senyawa yang mampu menghambat reaksi oksidasi dengan menetralkan radikal bebas. Upaya peningkatan potensi antioksidan kayu *C. sappan* dapat dilakukan melalui pengembangan sediaan topikal. Masker gel peel-off merupakan bentuk sediaan yang sesuai karena dapat menjaga kesehatan kulit sekaligus memberikan kenyamanan dan kemudahan saat pemakaian. Penelitian ini bertujuan untuk merumuskan dan mengevaluasi masker gel peel-off yang mengandung ekstrak kayu *C. sappan* berdasarkan karakteristik fisik dan aktivitas antioksidannya. Formulasi dibuat dengan konsentrasi ekstrak 2,5%, 5%, dan 7,5% menggunakan natrium karboksimetil selulosa, polivinil alkohol, dan propilen glikol sebagai basis gel. Evaluasi dilakukan terhadap parameter fisik (pH, viskositas, daya sebar, daya lekat, dan waktu kering) serta aktivitas antioksidan menggunakan metode DPPH. Hasil menunjukkan bahwa peningkatan konsentrasi ekstrak secara signifikan ( $p < 0,05$ ) meningkatkan viskositas, daya lekat, dan waktu kering serta menurunkan pH, daya sebar, dan nilai  $IC_{50}$ . Seluruh formula menunjukkan aktivitas antioksidan yang kuat ( $IC_{50}$  antara 50–100  $\mu\text{g/mL}$ ), dengan nilai  $IC_{50}$  berturut-turut sebesar 88,71  $\mu\text{g/mL}$ , 81,58  $\mu\text{g/mL}$ , dan 79,04  $\mu\text{g/mL}$ .

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## 1. INTRODUCTION

Air pollution has increased significantly in recent years, with levels rising by up to 20%, and has been identified as a major contributor to various health problems due to prolonged exposure (Wahdaningsih et al., 2015). One of the primary mechanisms through which pollution causes harm is oxidative stress, a condition arising from an overproduction of free radicals in the body. These reactive species can damage biological molecules, highlighting the importance of antioxidants in neutralizing free radicals and preventing oxidative damage, particularly in the skin (Widowati, 2011).

Flavonoids are natural compounds widely recognized for their antioxidant properties. They are capable of scavenging a variety of free radicals, including hydroxyl, peroxide, alkoxyl, superoxide anions, singlet oxygen, and hydrogen peroxide (Utari, 2017). One promising source of

flavonoids is the wood of secang (*Caesalpinia sappan* L.), which contains active constituents such as brazilin, 3'-O-methylbrazilin, sappanin, and chalcone. These compounds act as both primary and secondary antioxidants. Among them, brazilin has shown particularly strong antioxidant activity, reportedly exceeding that of synthetic antioxidants such as butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) (Sugiyanto et al., 2013). In previous studies, the extract of *C. sappan* demonstrated strong antioxidant potential with an  $IC_{50}$  value of 74.44  $\mu\text{g/mL}$  (Tanzaq et al., 2019).

Facial masks are among the most popular cosmetic products for skin care. However, traditional mask types are often considered less practical due to lengthy application and removal processes. Peel-off gel masks have emerged as a more efficient alternative, offering ease of use, user comfort, and the ability to deliver active ingredients effectively without requiring rinsing (Rahmawanti et al., 2015). Furthermore, peel-off gel



formulations have been shown to enhance antioxidant efficacy when natural extracts are incorporated. Successful applications have been reported using extracts such as *Paederia foetida* (Eka et al., 2022), areca seed (*Areca catechu*) (Dwi Mulyani et al., 2023), red spinach (*Amaranthus tricolor*) leaves (Welly et al., 2022), and mangrove (*Avicennia marina*) leaves (Hasibuan et al., 2024).

Despite its promising properties, the application of *C. sappan* extract in peel-off gel mask formulations remains underexplored. Therefore, the aim of this study was to formulate and evaluate a peel-off gel mask containing *C. sappan* extract, with a focus on its physical characteristics and antioxidant activity. This formulation is expected to serve as a natural, effective skincare solution by maximizing the antioxidant potential of *C. sappan* in a user-friendly topical preparation.

## 2. METHOD

### 2.1. Materials and Equipment

The materials used in this study included *C. sappan* (secang) wood, 96% ethanol (Merck), sodium carboxymethyl cellulose (CMC-Na), polyvinyl alcohol (PVA), propylene glycol, vitamin C, and 1,1-diphenyl-2-picrylhydrazyl (DPPH).

**Table 1.** Composition of Peel-Off Gel Mask Formulations Containing *C. sappan* Extract

Ingredient	Formula I (%)	Formula II (%)	Formula III (%)
<i>C. sappan</i> extract	2.5	5.0	7.5
Sodium CMC (CMC-Na)	1.26	1.26	1.26
Polyvinyl alcohol (PVA)	6.74	6.74	6.74
Propylene glycol	4.0	4.0	4.0
Distilled water (ad)	100	100	100

### 2.4. Evaluation of Physical Characteristics

The physical characteristics of the peel-off gel masks were evaluated to assess their suitability as topical cosmetic formulations. Organoleptic properties including color, odor, and consistency were observed visually, while homogeneity was examined by spreading a small sample of the gel on a glass slide to check for uniform dispersion of components (Syam et al., 2021).

The pH of each formulation was measured by immersing the electrode of a calibrated digital pH meter into the gel and recording the stabilized value (Andini et al., 2017). Viscosity was determined using a Brookfield viscometer equipped with spindle number 64, operated at a speed of 1 rpm. A viscosity range of 2000–50000 cps is considered acceptable for peel-off gel masks (SNI 16-4399-1996).

To evaluate spreadability, 0.5 g of the formulation were placed at the center of a glass plate, then covered with another glass plate of known weight. The diameter of the spread was measured, and additional weight was added incrementally until the diameter stabilized. Adhesiveness was assessed by placing a 0.25 g sample between two glass slides, applying a 100 g load for five minutes, and measuring the time it took for the plates to separate after load removal (Syam et al., 2021).

The drying time was tested by applying 0.1 gram of gel to a 2.5 × 2.5 cm area on the inner forearm. The time required for the film to dry completely at room temperature was recorded. An ideal drying time for peel-off gel masks ranges from 15 to 30 minutes (Silvia et al., 2021).

### 2.5. Antioxidant Activity Test Using DPPH Method

The antioxidant activity of the peel-off gel mask formulations was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging method. Initially, the maximum absorbance wavelength ( $\lambda_{max}$ ) of the DPPH solution (30  $\mu\text{g}/\text{mL}$ ) was determined using a UV-Vis spectrophotometer within the 400–800 nm range. The optimal reaction time was also established by reacting a 1:1 volume ratio of vitamin C (as the standard antioxidant) with the DPPH solution and measuring the absorbance over a 60-minute period.

Each sample (0.05 g) was dissolved in methanol and diluted to 50 mL. From this stock solution, working concentrations of 60, 70, 80, 100, and 120  $\mu\text{g}/\text{mL}$  were prepared. Equal volumes of the sample solution and

The instruments employed were a rotary evaporator (Heidolph), standard laboratory glassware (Pyrex), pH meter (Hanna Instruments pH 210 Microprocessor), viscometer (Brookfield DV-I Prime), and UV-Vis spectrophotometer (Shimadzu UV-1240 Mini).

### 2.2. Extraction of *C. sappan* Wood

Secang wood was extracted by maceration. The wood powder was soaked in 96% ethanol at a ratio of 1:10 (w/v) for 72 hours. The extract was filtered and concentrated using a rotary evaporator until a thick extract was obtained (Tanzaq et al., 2019).

### 2.3. Formulation of Peel-Off Gel Mask

The peel-off gel mask was formulated using *C. sappan* extract at concentrations of 2.5%, 5%, and 7.5%, as shown in **Table 1**. The gel base consisted of polyvinyl alcohol (PVA), sodium carboxymethyl cellulose (CMC-Na), and propylene glycol. PVA and CMC-Na were dispersed in distilled water heated to 80°C until fully swollen. Afterward, propylene glycol was added and the mixture was stirred until homogeneous. The ethanol extract of *C. sappan* was then incorporated gradually into the base while stirring, and distilled water was added to reach 100% total weight. The final mixture was stirred continuously to ensure uniformity (Cahyani et al., 2025).

DPPH solution (30  $\mu\text{g}/\text{mL}$ ) were mixed, incubated at room temperature for the predetermined optimal time, and their absorbance measured at the previously identified  $\lambda_{max}$ . The same procedure was applied to vitamin C standard solutions at concentrations of 2, 4, 6, 8, and 10  $\mu\text{g}/\text{mL}$ .

The percentage inhibition of DPPH radicals was calculated for each concentration, and the  $\text{IC}_{50}$  value—the concentration required to inhibit 50% of the DPPH radicals—was determined by linear regression analysis of the inhibition percentage versus sample concentration (Maharani et al., 2022).

### 2.6. Data Analysis

The evaluation of the peel-off gel mask formulations was conducted using descriptive analysis. Observational data such as organoleptic characteristics and homogeneity were assessed qualitatively. Physical parameters including pH, viscosity, spreadability, adhesiveness, and drying time were compared across formulations to identify trends related to increasing concentrations of *C. sappan* extract. Similarly, antioxidant activity data were interpreted by comparing the  $\text{IC}_{50}$  values of each formulation. The significance of observed changes was discussed in terms of their relative magnitude and consistency rather than based on formal statistical tests.

## 3. RESULTS AND DISCUSSION

### 3.1. Physical Characteristics of Peel Off Gel Mask Containing *C. sappan* Extract

*Caesalpinia sappan* has traditionally been recognized for its therapeutic properties, including antibacterial, anti-inflammatory, antidiabetic, and antioxidant effects. The ethanol extract of *C. sappan* contains flavonoid compounds such as brazilin, 3'-O-methylbrazilin, sappanin, and chalcone, which contribute to its strong antioxidant profile (Ngamwonglumlert & Devahastin, 2023). In this study, peel-off gel mask formulations containing *C. sappan* extract at concentrations of 2.5%, 5%, and 7.5% were developed and evaluated for their physical properties.

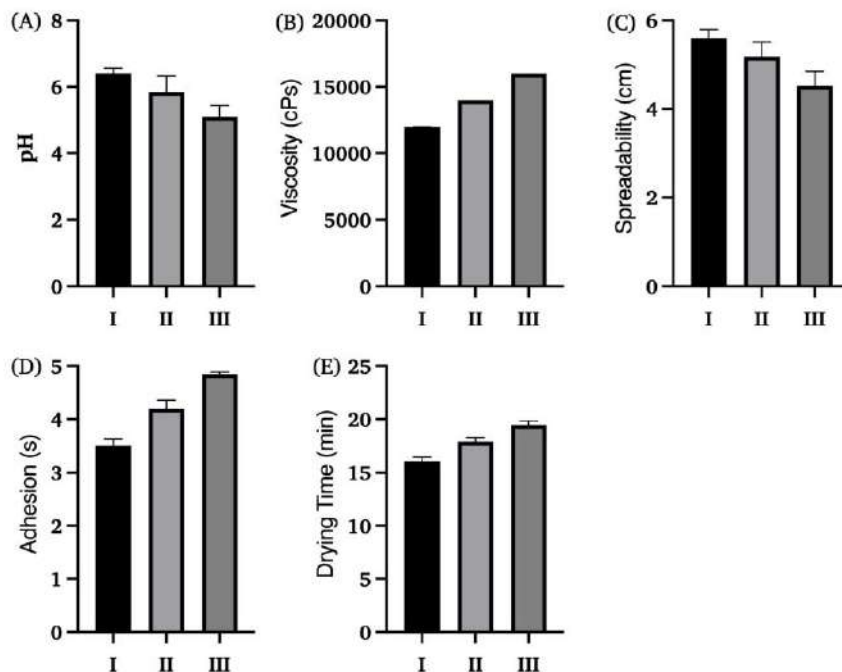
The organoleptic and homogeneity observations showed that all formulations had a consistent orange color, a characteristic *C. sappan* odor, and a smooth, thick consistency. Each gel was visually

homogeneous, indicating even distribution of ingredients throughout the formulation.

**Figure 1** illustrates the physical properties of the three formulations. The pH values decreased slightly as the extract concentration increased. This trend is attributed to the acidic nature of *C. sappan* extract (Muslimin et al., 2024), which becomes more influential as the proportion of extract rises. The viscosity of the gels increased progressively with extract concentration, affecting other parameters such as spreadability, adhesiveness, and drying time. A higher viscosity reduced spreadability

but enhanced adhesiveness and prolonged the drying time. These relationships are evident in the trends presented in Figure 1.

Such changes in physical characteristics are consistent with the structural influence of extract constituents and the thickening effect they exert in the gel base. Although no statistical tests were applied, the consistent trends across all parameters support the influence of *C. sappan* extract concentration on the physical performance of the peel-off mask.



**Figure 1.** Physical characteristics of peel-off gel mask containing *C. sappan* extract in Formulation I (2.5%), Formulation II (5.0%), and Formulation III (7.5%): (a) pH, (b) viscosity, (c) spreadability, (d) adhesiveness, and (e) drying time.

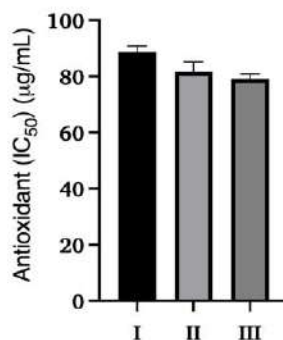
### 3.2. Antioxidant Activity of Peel-Off Gel Mask Containing *C. sappan* Extract

The antioxidant activity of the peel-off gel mask formulations was evaluated using the DPPH free radical scavenging assay. All formulations demonstrated strong antioxidant capacity, with  $IC_{50}$  values within the range of 50–100  $\mu\text{g/mL}$ , indicating effective radical scavenging potential.

As shown in **Figure 2**, the  $IC_{50}$  values decreased with increasing extract concentration: 88.71  $\mu\text{g/mL}$  for Formulation I (2.5%), 81.58  $\mu\text{g/mL}$  for Formulation II (5.0%), and 79.04  $\mu\text{g/mL}$  for Formulation III (7.5%). This trend suggests that higher concentrations of *C. sappan* extract

contribute to enhanced antioxidant performance, likely due to increased levels of flavonoid compounds such as brazilin.

Although statistical testing was not applied, the progressive decrease in  $IC_{50}$  values clearly indicates the influence of extract concentration on antioxidant activity. These results are consistent with the literature, which identifies *C. sappan* as a potent natural antioxidant source (Tanzaq et al., 2019). Compared to its pure extract  $IC_{50}$  value of 74.44  $\mu\text{g/mL}$ , the formulated gels retained high antioxidant potential. However, when compared to vitamin C ( $IC_{50} = 3.04 \mu\text{g/mL}$ ), the formulations were less potent, which is expected given the superior radical scavenging efficiency of pure ascorbic acid.



**Figure 2.**  $IC_{50}$  values of peel-off gel mask containing *C. sappan* extract in Formulation I (2.5%), Formulation II (5.0%), and Formulation III (7.5%).

## CONCLUSION

This study demonstrated that peel-off gel masks containing *C. sappan* extract can be effectively formulated using polyvinyl alcohol, sodium carboxymethyl cellulose, and propylene glycol as base

components. Increasing the extract concentration from 2.5% to 7.5% affected the physical properties of the formulation by increasing viscosity, adhesiveness, and drying time, while decreasing pH and spreadability. All formulations exhibited strong antioxidant activity, with  $IC_{50}$  values ranging from 88.71 to 79.04  $\mu\text{g/mL}$ , indicating that higher

extract concentrations enhance antioxidant performance. Overall, the 7.5% extract formulation showed the most favorable combination of physical characteristics and antioxidant activity, supporting its potential as a natural, effective peel-off gel mask for skin health applications.

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## Research Article

Doi: <https://doi.org/10.29244/jji.v10i2.403>

# Formulation and Characterization of Peel-Off Gel Mask Containing Secang (*Caesalpinia sappan* L.) Wood Extract with Strong Antioxidant Activity

[Formulasi dan Karakterisasi Masker Gel Peel-Off Mengandung Ekstrak Kayu Secang (*Caesalpinia sappan* L.) dengan Aktivitas Antioksidan yang Kuat]

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### ABSTRACT

Secang (*Caesalpinia sappan* L.) wood contains flavonoid compounds such as brazilin, 3'-O-methylbrazilin, sappanin chalcone, and sappan chalcone, which act as primary and secondary antioxidants. Antioxidants are substances that can inhibit oxidation reactions by neutralizing free radicals. Enhancing the antioxidant potential of *C. sappan* wood can be achieved by developing a topical dosage form. Peel-off gel masks are an ideal form due to their ability to improve skin health and provide ease and comfort in application. This study aimed to formulate a peel-off gel mask containing *C. sappan* extract and evaluate its physical properties and antioxidant activity. The formulations were prepared using 2.5%, 5%, and 7.5% extract with sodium carboxymethyl cellulose, polyvinyl alcohol, and propylene glycol as the base. The resulting masks were assessed for physical characteristics (pH, viscosity, spreadability, adhesiveness, and drying time) and antioxidant activity using the DPPH method. The results indicated that increasing the extract concentration significantly ( $p < 0.05$ ) increased viscosity, adhesiveness, and drying time, while decreasing pH, spreadability, and  $IC_{50}$  value. All formulations demonstrated strong antioxidant activity ( $IC_{50}$  between 50–100  $\mu\text{g/mL}$ ), with  $IC_{50}$  values of 88.71  $\mu\text{g/mL}$ , 81.58  $\mu\text{g/mL}$ , and 79.04  $\mu\text{g/mL}$ , respectively.

### ABSTRAK

Kayu secang (*Caesalpinia sappan* L.) mengandung senyawa flavonoid seperti brazilin, 3'-O-metilbrazilin, sappanin chalcone, dan sappan chalcone yang berfungsi sebagai antioksidan primer maupun sekunder. Antioksidan merupakan senyawa yang mampu menghambat reaksi oksidasi dengan menetralkan radikal bebas. Upaya peningkatan potensi antioksidan kayu *C. sappan* dapat dilakukan melalui pengembangan sediaan topikal. Masker gel peel-off merupakan bentuk sediaan yang sesuai karena dapat menjaga kesehatan kulit sekaligus memberikan kenyamanan dan kemudahan saat pemakaian. Penelitian ini bertujuan untuk merumuskan dan mengevaluasi masker gel peel-off yang mengandung ekstrak kayu *C. sappan* berdasarkan karakteristik fisik dan aktivitas antioksidannya. Formulasi dibuat dengan konsentrasi ekstrak 2,5%, 5%, dan 7,5% menggunakan natrium karboksimetil selulosa, polivinil alkohol, dan propilen glikol sebagai basis gel. Evaluasi dilakukan terhadap parameter fisik (pH, viskositas, daya sebar, daya lekat, dan waktu kering) serta aktivitas antioksidan menggunakan metode DPPH. Hasil menunjukkan bahwa peningkatan konsentrasi ekstrak secara signifikan ( $p < 0,05$ ) meningkatkan viskositas, daya lekat, dan waktu kering serta menurunkan pH, daya sebar, dan nilai  $IC_{50}$ . Seluruh formula menunjukkan aktivitas antioksidan yang kuat ( $IC_{50}$  antara 50–100  $\mu\text{g/mL}$ ), dengan nilai  $IC_{50}$  berturut-turut sebesar 88,71  $\mu\text{g/mL}$ , 81,58  $\mu\text{g/mL}$ , dan 79,04  $\mu\text{g/mL}$ .



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## 1. INTRODUCTION

Air pollution has increased significantly in recent years, with levels rising by up to 20%, and has been identified as a major contributor to various health problems due to prolonged exposure (Wahdaningsih et al., 2015). One of the primary mechanisms through which pollution causes harm is oxidative stress, a condition arising from an overproduction of free radicals in the body. These reactive species can damage biological molecules, highlighting the importance of antioxidants in neutralizing free radicals and preventing oxidative damage, particularly in the skin (Widowati, 2011).

Flavonoids are natural compounds widely recognized for their antioxidant properties. They are capable of scavenging a variety of free radicals, including hydroxyl, peroxide, alkoxy, superoxide anions, singlet oxygen, and hydrogen peroxide (Utari, 2017). One promising source of flavonoids is the wood of secang (*Caesalpinia sappan* L.), which contains active constituents such as brazilin, 3'-O-methylbrazilin, sappanin, and chalcone. These compounds act as both primary and secondary antioxidants. Among them, brazilin has shown particularly strong antioxidant activity, reportedly exceeding that of synthetic antioxidants such as butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) (Sugiyanto et al., 2013). In previous studies, the extract of *C. sappan* demonstrated strong antioxidant potential with an IC<sub>50</sub> value of 74.44 µg/mL (Tanzaq et al., 2019).

Facial masks are among the most popular cosmetic products for skin care. However, traditional mask types are often considered less practical due to lengthy application and removal processes. Peel-off gel masks have emerged as a more efficient alternative, offering ease of use, user comfort, and the ability to deliver active ingredients effectively without requiring rinsing (Rahmawanty et al., 2015). Furthermore, peel-off gel formulations have been

shown to enhance antioxidant efficacy when natural extracts are incorporated. Successful applications have been reported using extracts such as *Paederia foetida* (Eka et al., 2022), areca seed (*Areca catechu*) (Dwi Mulyani et al., 2023), red spinach (*Amaranthus tricolor*) leaves (Welly et al., 2022), and mangrove (*Avicennia marina*) leaves (Hasibuan et al., 2024).

Despite its promising properties, the application of *C. sappan* extract in peel-off gel mask formulations remains underexplored. Therefore, the aim of this study was to formulate and evaluate a peel-off gel mask containing *C. sappan* extract, with a focus on its physical characteristics and antioxidant activity. This formulation is expected to serve as a natural, effective skincare solution by maximizing the antioxidant potential of *C. sappan* in a user-friendly topical preparation.

## 2. METHOD

### 2.1. Materials and Equipment

The materials used in this study included *C. sappan* (secang) wood, 96% ethanol (Merck), sodium carboxymethyl cellulose (CMC-Na), polyvinyl alcohol (PVA), propylene glycol, vitamin C, and 1,1-diphenyl-2-picrylhydrazyl (DPPH).

The instruments employed were a rotary evaporator (Heidolph), standard laboratory glassware (Pyrex), pH meter (Hanna Instruments pH 210 Microprocessor), viscometer (Brookfield DV-I Prime), and UV-Vis spectrophotometer (Shimadzu UV-1240 Mini).

### 2.2. Extraction of *C. sappan* Wood

Secang wood was extracted by maceration. The wood powder was soaked in 96% ethanol at a ratio of 1:10 (w/v) for 72 hours. The extract was filtered and concentrated using a rotary evaporator until a thick extract was obtained (Tanzaq et al., 2019).

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Ingredient	Formula I (%)	Formula II (%)	Formula III (%)
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Polyvinyl alcohol (PVA)	6.74	6.74	6.74
Propylene glycol	4.0	4.0	4.0
Distilled water (ad)	100	100	100

### 2.3. Formulation of Peel-Off Gel Mask

The peel-off gel mask was formulated using *C. sappan* extract at concentrations of 2.5%, 5%, and 7.5%, as shown in **Table 1**. The gel base consisted of polyvinyl alcohol (PVA), sodium carboxymethyl cellulose (CMC-Na), and propylene glycol. PVA and CMC-Na were dispersed in distilled water heated to 80°C until fully swollen. Afterward, propylene glycol was added and the mixture was stirred until homogeneous. The ethanol extract of *C.*

*sappan* was then incorporated gradually into the base while stirring, and distilled water was added to reach 100% total weight. The final mixture was stirred continuously to ensure uniformity (Cahyani et al., 2025).

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The physical characteristics of the peel-off gel masks were evaluated to assess their suitability as topical cosmetic formulations. Organoleptic properties including color, odor, and

consistency were observed visually, while homogeneity was examined by spreading a small sample of the gel on a glass slide to check for uniform dispersion of components (Syam et al., 2021).

The pH of each formulation was measured by immersing the electrode of a calibrated digital pH meter into the gel and recording the stabilized value (Andini et al., 2017). Viscosity was determined using a Brookfield viscometer equipped with spindle number 64, operated at a speed of 1 rpm. A viscosity range of 2000–50000 cps is considered acceptable for peel-off gel masks (SNI 16-4399-1996).

To evaluate spreadability, 0.5 g of the formulation were placed at the center of a glass plate, then covered with another glass plate of known weight. The diameter of the spread was measured, and additional weight was added incrementally until the diameter stabilized. Adhesiveness was assessed by placing a 0.25 g sample between two glass slides, applying a 100 g load for five minutes, and measuring the time it took for the plates to separate after load removal (Syam et al., 2021).

The drying time was tested by applying 0.1 gram of gel to a 2.5 × 2.5 cm area on the inner forearm. The time required for the film to dry completely at room temperature was recorded. An ideal drying time for peel-off gel masks ranges from 15 to 30 minutes (Silvia et al., 2021).

### 2.5. Antioxidant Activity Test Using DPPH Method

The antioxidant activity of the peel-off gel mask formulations was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging method. Initially, the maximum absorbance wavelength ( $\lambda_{max}$ ) of the DPPH solution (30  $\mu\text{g/mL}$ ) was determined using a UV-Vis spectrophotometer within the 400–800 nm range. The optimal reaction time was also established by reacting a 1:1 volume ratio of vitamin C (as the standard antioxidant) with the DPPH solution and measuring the absorbance over a 60-minute period.

Each sample (0.05 g) was dissolved in methanol and diluted to 50 mL. From this stock solution, working concentrations of 60, 70, 80, 100, and 120  $\mu\text{g/mL}$  were prepared. Equal volumes of the sample solution and DPPH solution (30  $\mu\text{g/mL}$ ) were mixed, incubated at room temperature for the predetermined optimal time, and their absorbance measured at the previously identified  $\lambda_{max}$ . The same procedure was applied to vitamin C standard solutions at concentrations of 2, 4, 6, 8, and 10  $\mu\text{g/mL}$ .

The percentage inhibition of DPPH radicals was calculated for each concentration, and the  $\text{IC}_{50}$  value—the concentration required to inhibit 50% of the DPPH radicals—was determined by linear regression analysis of the inhibition percentage versus sample concentration (Maharani et al., 2022).

### 2.6. Data Analysis

The evaluation of the peel-off gel mask formulations was conducted using descriptive analysis. Observational data such as organoleptic characteristics and homogeneity were assessed qualitatively. Physical parameters including pH, viscosity,

spreadability, adhesiveness, and drying time were compared across formulations to identify trends related to increasing concentrations of *C. sappan* extract. Similarly, antioxidant activity data were interpreted by comparing the  $\text{IC}_{50}$  values of each formulation. The significance of observed changes was discussed in terms of their relative magnitude and consistency rather than based on formal statistical tests.

## 3. RESULTS AND DISCUSSION

### 3.1. Physical Characteristics of Peel Off Gel Mask Containing *C. sappan* Extract

*Caesalpinia sappan* has traditionally been recognized for its therapeutic properties, including antibacterial, anti-inflammatory, antidiabetic, and antioxidant effects. The ethanol extract of *C. sappan* contains flavonoid compounds such as brazilin, 3'-O-methylbrazilin, sappanin, and chalcone, which contribute to its strong antioxidant profile (Ngamwonglumlert & Devahastin, 2023). In this study, peel-off gel mask formulations containing *C. sappan* extract at concentrations of 2.5%, 5%, and 7.5% were developed and evaluated for their physical properties.

The organoleptic and homogeneity observations showed that all formulations had a consistent orange color, a characteristic *C. sappan* odor, and a smooth, thick consistency. Each gel was visually homogeneous, indicating even distribution of ingredients throughout the formulation.

**Figure 1** illustrates the physical properties of the three formulations. The pH values decreased slightly as the extract concentration increased. This trend is attributed to the acidic nature of *C. sappan* extract (Muslimin et al., 2024), which becomes more influential as the proportion of extract rises. The viscosity of the gels increased progressively with extract concentration, affecting other parameters such as spreadability, adhesiveness, and drying time. A higher viscosity reduced spreadability but enhanced adhesiveness and prolonged the drying time. These relationships are evident in the trends presented in **Figure 1**.

Such changes in physical characteristics are consistent with the structural influence of extract constituents and the thickening effect they exert in the gel base. Although no statistical tests were applied, the consistent trends across all parameters support the influence of *C. sappan* extract concentration on the physical performance of the peel-off mask.

### 3.2. Antioxidant Activity of Peel-Off Gel Mask Containing *C. sappan* Extract

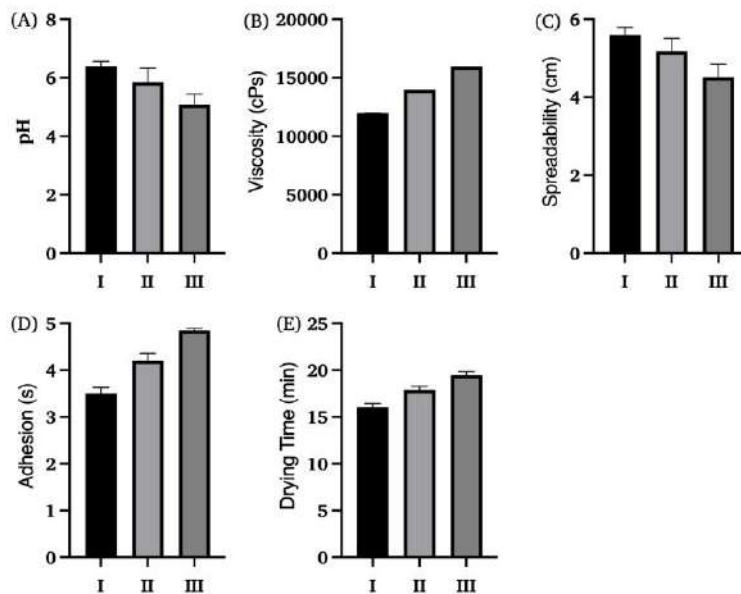
The antioxidant activity of the peel-off gel mask formulations was evaluated using the DPPH free radical scavenging assay. All formulations demonstrated strong antioxidant capacity, with  $\text{IC}_{50}$  values within the range of 50–100  $\mu\text{g/mL}$ , indicating effective radical scavenging potential.

As shown in **Figure 2**, the  $\text{IC}_{50}$  values decreased with increasing extract concentration: 88.71  $\mu\text{g/mL}$  for Formulation I (2.5%), 81.58  $\mu\text{g/mL}$  for Formulation II (5.0%), and 79.04  $\mu\text{g/mL}$

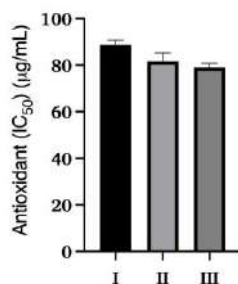
for Formulation III (7.5%). This trend suggests that higher concentrations of *C. sappan* extract contribute to enhanced antioxidant performance, likely due to increased levels of flavonoid compounds such as brazilin.

Although statistical testing was not applied, the progressive decrease in  $IC_{50}$  values clearly indicates the influence of extract concentration on antioxidant activity. These results are consistent

with the literature, which identifies *C. sappan* as a potent natural antioxidant source (Tanzaq et al., 2019). Compared to its pure extract  $IC_{50}$  value of 74.44  $\mu\text{g/mL}$ , the formulated gels retained high antioxidant potential. However, when compared to vitamin C ( $IC_{50} = 3.04 \mu\text{g/mL}$ ), the formulations were less potent, which is expected given the superior radical scavenging efficiency of pure ascorbic acid.



**Figure 1.** Physical characteristics of peel-off gel mask containing *C. sappan* extract in Formulation I (2.5%), Formulation II (5.0%), and Formulation III (7.5%): (a) pH, (b) viscosity, (c) spreadability, (d) adhesiveness, and (e) drying time.



**Figure 2.**  $IC_{50}$  values of peel-off gel mask containing *C. sappan* extract in Formulation I (2.5%), Formulation II (5.0%), and Formulation III (7.5%).

## CONCLUSION

This study demonstrated that peel-off gel masks containing *C. sappan* extract can be effectively formulated using polyvinyl alcohol, sodium carboxymethyl cellulose, and propylene glycol as base components. Increasing the extract concentration from 2.5% to 7.5% affected the physical properties of the formulation by increasing viscosity, adhesiveness, and drying time, while decreasing pH and spreadability. All formulations exhibited strong antioxidant activity, with  $IC_{50}$  values ranging from 88.71 to 79.04  $\mu\text{g/mL}$ , indicating that higher extract concentrations enhance antioxidant performance. Overall, the 7.5% extract formulation showed the most favorable combination of physical characteristics and antioxidant activity, supporting its potential as a natural, effective peel-off gel mask for skin health applications.

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