

CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

CBPs exhibited varying characteristics in terms of their moisture content, antioxidant properties (TPC and DPPH), and physicochemical properties (pH, TSS, SCOBY growth, and color). Both CS and BT contained a lower moisture content compared to CA and PX due to their processing methods. As raw materials, all CBPs showed significantly lower TPC values than BT. Despite that, both CS and CA experienced the highest TPC increase after being utilized in kombucha fermentation, highlighting its high antioxidant potential against conventional black tea kombucha. This trend also applied to the increase of radical scavenging activity of both materials, as the parameter increased proportionally alongside TPC. Interestingly, SCOBY growth of CBP kombuchas did not proportionally align with the reduction of pH and TSS, indicating a possible influence from phenolic compounds. Additionally, most pre-fermentation kombuchas had a darker color compared to post-fermentation kombucha, ranging from yellow to brown values. The color values of pre-fermentation kombucha ranged between 5-8, whereas post-fermentation kombucha ranged between 3-4 on the color intensity chart, with higher numbers indicating a darker value.

The selected formulation based on optimization of CBP kombucha was 10.000 grams of CA, 8.920 grams of CS, 181.080 grams of sugar, with 13 days of fermentation. This combination fitted well within the established standard of kombucha (pH 2.3-3.8 and 0.27-2.03% acetic acid) with a predicted pH of 3.476 and 0.368% acid value. Most of the validated formulation's parameters successfully adhered to the aforementioned standards within a 95% PI, except for acid value that fell slightly outside of the predicted range. Compared to a control kombucha made from black tea, CBP kombucha achieved a significantly higher hedonic acceptance at 6.71 ("like slightly"), indicating the strong potential of CBP kombucha made from CA and CS being a promising non-conventional alternative ingredient to tea kombucha.

5.2. Recommendations

As the acid value of validated optimized CBP kombucha was found outside of the predicted range by Design Expert software, it is recommended to conduct additional replications to verify whether the data remains consistent. Similarly to acid value replications, further sensorial analysis of the CBP kombucha with a larger population may be needed to accurately determine its acceptance and positioning against tea kombucha. It may also be possible to use an alternative method for sensory evaluation, such as Quantitative Descriptive Analysis (QDA), as this method produces a more objective and normally-distributed data fitting with ANOVA analysis in Design Expert. For further commercialization purposes, analysis of antioxidant properties of the optimized CBP kombucha is also encouraged, as the functional aspect of kombucha is largely sought for consumer consideration.



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APPENDICES

Appendix 1. Pre-Screening Form for Sensory Evaluation of Coffee Cascara-Silverskin Kombucha

Section 1 of 7

Pre-Screening Form for Sensory Evaluation of Coffee Cascara-Silverskin Kombucha

Hello there!

I'm Elysia Velin Arsanti from Food Technology semester 8. As part of my thesis project, I have developed several kombuchas made from coffee byproducts (cascara and silverskin), and will be conducting a sensory evaluation to help me better understand the consumer acceptance of my products.

To briefly explain, Kombucha is a fermented beverage commonly made from sweetened tea and SCOBY, and is often perceived to contain functional properties that promote gut health and immune support. In my study, I am substituting the tea substrate with coffee cascara and coffee silverskin. Coffee cascara is the dried skin obtained from coffee cherries during harvesting, whereas coffee silverskin is the thin layer obtained from coffee bean roasting.

Before joining, I would need to collect your personal data to determine whether you are suitable for the sensory evaluation. Your personal data will only be accessed by the panel leader for the purpose of the study.

Thank you for your willingness to participate in this sensory evaluation and please answer all questions below according to your own personal data.

This form is automatically collecting emails from all respondents. [Change settings](#)

Link to Google-Form: <https://forms.gle/wTbPvzRMQb8b5HyR9>

Appendix 2. Consent Form for Sensory Evaluation of Coffee Cascara-Silverskin Kombucha

Consent Form for Sensory Evaluation of Coffee Cascara-Silverskin Kombucha

Hello everyone!

Thank you for your time and willingness to join this sensory evaluation.

Before starting, please take the time to read the consent form below.

Full Name *

Short answer text

Please read the following consent form. By ticking the following box, you consent to participate in the test.

Informed Consent

1. Thesis title	Coffee Byproducts as Functional Ingredients in Kombucha and Their Effect on Antioxidant, Physicochemical, and Sensory Properties
2. Supervisor of study	Affiliation: Swiss German University

Link to Google-Form: <https://forms.gle/6ykMFqkGS9kHvD4Y8>

Appendix 3. Layout of Room and Set-Up of Sensory Evaluation



Appendix 4a. Google Form of Coffee Cascara-Silverskin Kombucha Hedonic Sensory Evaluation (Day 1 Session 1)

Section 1 of 6

Coffee Cascara-Silverskin Kombucha
Sensory Evaluation (Hedonic Test)

Hello everyone!

Thank you for participating in this sensory evaluation.

For this test, you will be evaluating **5 samples** independently using the **Hedonic** scale for overall acceptance. Further instructions will be given in the upcoming section of this form. Before proceeding with the test, please make sure you have already read and filled in the consent form.

This form is automatically collecting emails from all respondents. [Change settings](#)

Full Name *

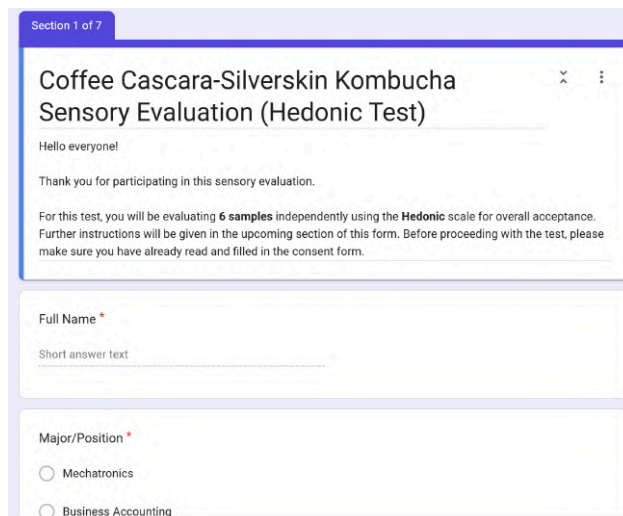
Short answer text

Major/Position *

☐ Mechatronics

Link to Google-Form: <https://forms.gle/p7cYGyfQTztbWcq37>

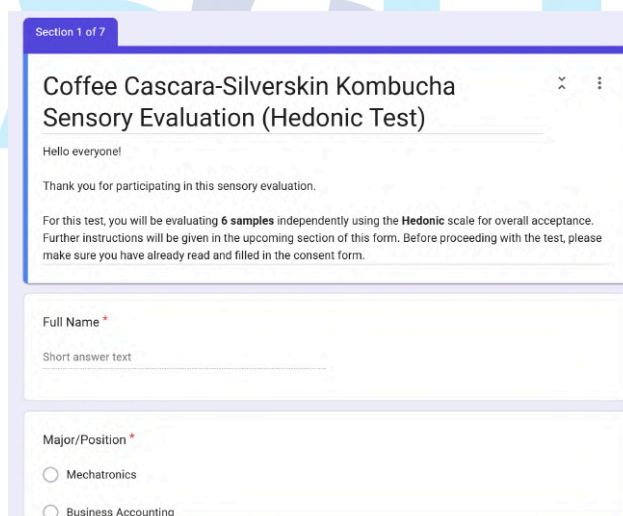
Appendix 4b. Google Form of Coffee Cascara-Silverskin Kombucha Hedonic Sensory Evaluation (Day 1 Session 2)



The screenshot shows the first section of a Google Form. The title is "Coffee Cascara-Silverskin Kombucha Sensory Evaluation (Hedonic Test)". Below the title, there is a greeting "Hello everyone!" and a thank you message "Thank you for participating in this sensory evaluation." followed by instructions: "For this test, you will be evaluating 6 samples independently using the Hedonic scale for overall acceptance. Further instructions will be given in the upcoming section of this form. Before proceeding with the test, please make sure you have already read and filled in the consent form." The form has two required text input fields: "Full Name" and "Major/Position". The "Major/Position" field has two radio button options: "Mechatronics" and "Business Accounting".

Link to Google-Form: <https://forms.gle/Y6dujPSt1tPPEsZd6>

Appendix 4c. Google Form of Coffee Cascara-Silverskin Kombucha Hedonic Sensory Evaluation (Day 2)



This is a duplicate of the form shown in the previous block. It is a Google Form titled "Coffee Cascara-Silverskin Kombucha Sensory Evaluation (Hedonic Test)". It includes a greeting, a thank you message, and instructions for the test. The form contains two required text input fields: "Full Name" and "Major/Position". The "Major/Position" field has two radio button options: "Mechatronics" and "Business Accounting".

Link to Google-Form: <https://forms.gle/MSd6c5MMxhakn2h8>

Appendix 5. Feedback from Panelists on CBP Kombucha (13 day fermentation)

Please state which sample you are evaluating ▾	Please evaluate your overall liking of the sam ▾	Please provide any additional comments abo ▾
174	4	light color. quite acidic and strong taste, but faint
461	4	Strong sweetness
438	4	Too sweet and a bit bitter
174	4	Warna agak bening, asam dan sedikit bau
174	3	Too sour and the color is pale yellow
174	5	Warna kuning pucat, rasa lbh asam
174	6	Rasanya asam manis bau nyengat
174	7	Warna kuning ,rasa asam
828	6	Fruity smell, less sweet, sour
174	1	Very strong bitter honeyness
828	2	Veryvery very very punchy/soury....
828	2	Smells like green tea, tastes VERY sour, I cant eve
352	7	Kayak rasa madu
828	3	Very very strong
828	2	Astringent sour
461	4	Very sour aftertaste



CURRICULUM VITAE

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Work Experience:	February 2025 – August 2025, Internship Program, N'Eis GmbH & CO. KG, Mainz, Germany 1. Supporting ice cream production 2. Arranging delivery stocks and inventory management 3. Handling ingredient and materials log sheet November 2023 – February 2024, Internship Program, PT. Deltomed Laboratories, Tangerang, Indonesia 1. Herbal and taffy candy production 2. Jelly sport nutrition and jelly drink production 3. Herbal drinks (mocktail and refreshing drinks) production
Training and Certifications:	Food Handler Certification, LSP JMKP Good Manufacturing Practices (GMP) Certification, LSP JMKP
Language Skills	
Indonesian:	Mother Tongue
English:	Well-spoken and written
German:	A2