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On behalf of the **ICFSE** 2025 Committee, we are also pleased to inform you that your paper (ID: 5ICFSE-050) titled "Soft System Methodology Approach for Food Safety Model of Biogenic Silica Powder from Palm Oil Boiler Ash as Food Adsorbent" has been accepted for submission to the Bio Web of Conferences.
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Paper Title: [Soft system methodology approach for food safety model of biogenic silica powder from palm oil boiler ash as food adsorbent](#)

Check point	Assessment (Yes/No, suggestions)
Is the subject matter within the scope of the conference (food science, food processing technology, food safety, nutrition, sustainable food production, and food supply management)?	Yes, food safety
Does the paper contain enough original results to warrant publication?	Yes
Is the paper scientifically sound and free of errors?	No
Is the paper clearly written, concise, well organized, and understandable?	No
Is the length appropriate (3-4 pages min)?	Yes
Are the subject matter and writing format appropriate for Web of Conferences? See Scope of BIO Web of Conference and words template	It does not yet conform to the format. However, after review and revision by the author, it may conform to the format/template.
Does the reference list comply with the publisher guideline? Each article should include no more than 15 references, with a maximum of 3 citations from conference proceedings. All references must include a DOI number.	No. All 18 references in the bibliography are not written in the correct format and do not have DOIs.
Should the written English of the manuscript be edited?	Yes

Referee's recommendation (Please choose one, give yellow highlight color):

- Acceptable without revision
- Minor Revision
- Major Revision**
- Rejected

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silica powder from palm oil boiler ash using soft system methodology

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Abstract. Palm oil is a strategic commodity for Indonesia, accounting for approximately 42% of the global supply. The increase in palm oil production has led to a growing volume of waste, particularly palm oil boiler ash, which contains biogenic silica with potential economic value. This study aims to develop a Soft System Methodology (SSM)-based model for optimizing the production of biogenic silica powder from palm oil boiler ash as an adsorbent to improve food packaging quality. The research applied Soft Systems Methodology, supported by Rich Pictures, Input-Process-Output (IPO) modeling, and the CATWOE framework. A conceptual model integrating biogenic silica characteristics and food safety requirements was developed. The results show that SSM effectively describes the complexity of biogenic silica utilization systems. Rich Picture illustrates relationships among waste sources, production processes, quality testing, risk assessment, and environmental impacts. The IPO model clarifies the transformation of inputs into value-added adsorbent products. The conceptual food safety model includes biogenic silica characteristics (porosity, moisture content, and SiO₂ content) and food safety parameters (microbiological, bacterial, and shelf-life testing). In conclusion, the proposed model supports systematic improvement through process standardization and raw material quality control, contributing to sustainable waste utilization and enhanced food packaging quality.

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1 Introduction

According to data from the Palm Oil Plantation Fund Management Agency (BPDPKS),

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The research objectives are not mentioned in the introduction.

A Conceptual framework for the protection of using biogenic silica as an adsorbent in food packaging is shown in Figure 7.



Figure 7. Conceptual Food Safety Model of Biogenic Silica as an Adsorbent in Food Packaging

The conceptual methods show that the safety of using biogenic silica as an adsorbent in food packaging is determined by two main components: the characteristics of biogenic silica and food safety considerations. The attributes of biogenic silica include porosity, moisture content, and SiO₂ content. These parameters are essential for the effectiveness of biogenic silica in controlling the internal conditions of food packaging. Food safety aspects are evaluated through a series of tests, including bacterial, microbiological, and life shield tests. These tests aim to ensure that the use of biogenic silica does not pose a risk of microbial contamination.

3.5 Comparison

The conceptual models are compared against the real-world situation. Comparing the model with the real problem to find gaps and potential interventions. Comparison of the conceptual model and the real situation is shown in Table 6.

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Conceptual Model (Ideal Condition)	Real-World Condition
Food safety is ensured through integrated characterization of biogenic silica and comprehensive food safety testing	Studies and practices often separate material characterization from food safety assessment.
Adsorption performance is measurable, stable, and reproducible	Adsorption capacity varies between production batches
Controlled porosity optimized for moisture adsorption	Porosity is not precisely controlled.
Low and controlled moisture content	Moisture content fluctuates due to insufficient control over the drying process.
High and consistent SiO ₂ content	SiO ₂ content depends on the composition of palm boiler ash.

Conceptual Model (Ideal Condition)	Real-World Condition
Comprehensive food safety evaluation before application	Food safety testing is often partial or limited.
Systematic testing for major pathogenic bacteria	Bacterial tests are not routinely conducted.
Complete microbiological analysis	Microbial testing is conducted selectively (TPC and <i>Salmonella</i>)
Shelf-life testing using active packaging systems	Shelf-life evaluation remains conventional.

3.6 **Identify feasible and desirable changes:**

A list of changes that are systemically feasible, socially relevant, and acceptable to stakeholders is: raw material and process control, structural variability of pores, moisture management, and utilization of adsorbent functionality.

3.7 **Action:**

Action steps are formulated based on insights gained, enabling iterative improvements to the system, such as process standardization and raw material quality control.

4 **Conclusion**

This study applied the Soft Systems Methodology (SSM) to analyze and design a system for utilizing palm oil boiler ash waste as a raw material for biogenic silica, an adsorbent for sustainable food packaging. Through the Rich Picture approach, the Input-Process-Output (IPO) model, and CATWOE analysis, a comprehensive understanding of the system was obtained, integrating technical, social, economic, and environmental aspects. The analysis results show that Rich Picture can identify process flows from the source of waste to environmentally friendly food packaging products, as well as the relationships between actors and stakeholders. The IPO model emphasizes the importance of integrating biogenic silica extraction processes and product characteristic testing. A CATWOE analysis helps clarify the role of each system component and the environmental and regulatory constraints that must be considered in actual implementation. A conceptual model supports systematic improvement through process standardization and raw material quality control, contributing to sustainable waste utilization and enhanced food packaging quality.

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References

[1] W. L. Liew, K. Muda, Mohd. Azraai Kassim, A. C. Affam, and S. K. Loh, "Agro-Industrial Waste Sustainable Management – A Potential Source Of Economic Benefits To Palm Oil Mills In Malaysia," *J. Urban Environ. Eng.*, **11**, pp. 108–118, May (2017), doi: 10.4090/juee.2017.v11n1.108118

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Detailed scientific report to be communicated to the author(s)		
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Scope and title	Actually within scope, but unclear what is meant from the title.	I have revised the title to make it easier to understand, in line with the objective, which is to develop a food safety model
Abstract	More than 200 words.	I have revised the abstract (199 words)
Introduction	The introduction does not state the purpose of the research.	I have added the research objectives at the end of the introduction.
Materials and methods	Regarding software design or food safety approaches to the use of silicate ash from palm oil, no use of materials was found in the MM section. Perhaps this could be added if necessary. Regarding software design or food safety approaches to the use of silicate ash from palm oil, no use of materials was found in the MM section. Perhaps this could be added if necessary. No statistical analysis was found in the MM section.	I have added a figure of palm oil boiler ash and data from palm oil mills
Results and discussions	The results and discussion tend to be like a literature review, not presenting the results and then discussing why this is the case, comparing them with the results of other studies, and offering suggestions.	I have added data from FGD about the biogenic silica characteristics
Conclusion	The conclusion seems to adequately present the results of the study and suggestions for future research.	I have revised the conclusion, focused on the benefit of conceptual model built by Soft System Methodology
Reference	References not written in the correct format	I have corrected the references according to the correct format and included the DOI.
Others	-	

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Title of the article
Developing a Food Safety Model for Biogenic Silica Powder from Palm Oil Boiler Ash Using Soft System Methodology

Author(s)
Anni Rohimah, Dadang Surjasa, Rina Fitriana, Engelin Shintadewi Julian, Aton-Yullianto, and Hoerudin

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Anni Rohimah

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