Sciences du Nord Nature Science and Technology
Vol. 1, No. 02, July – December: pp. 51 - 60
E-ISSN: 3046-6504
P-ISSN: 3047-4922
DOI: https://doi.org/10.58812/xny47g49

Contribution of Agricultural Waste to Eco-Friendly Agriculture: A Bibliometric Analysis

Loso Judijanto [1], Eko Sutrisno [2], Joni Wilson Sitopu [3], Tirta Yoga [4], M. Ali Mauludin[5]

[1] IPOSS Jakarta and losojudijantobumn@gmail.com
[2] Universitas Islam Majapahit and ekosudrun@yahoo.com
[3] Universitas Simalungun and jwsitopu@gmail.com
[4] Universitas Tribhuwana Tunggadewi and tirtayoga13@gmail.com
[5] Universitas Padjadjaran and mali.mauludin@unpad.ac.id

Coresponding Author: losojudijantobumn@gmail.com

ARTICLE HISTORY

Received July, 2024 **Revised October, 2024** **Accepted October, 2024**

ABSTRACT

The contribution of agricultural waste to eco-friendly agriculture is increasingly recognized as a critical aspect of sustainability efforts worldwide. This study conducts a comprehensive bibliometric analysis of research focusing on the role of agricultural waste in promoting environmentally sustainable practices. Using data sourced from the Google Scholar database and analyzed with VOSviewer, this study identifies key trends, influential research, and emerging themes within the field. The findings reveal that agricultural waste plays a vital role in biomass production, bioenergy, biodegradable polymers, and environmental protection, while newer research focuses on applications such as bioremediation and wastewater treatment. However, significant challenges remain in scaling up agricultural waste utilization, particularly due to technical, financial, and policy barriers. The results provide a valuable overview of the global research landscape and suggest future directions for expanding the use of agricultural waste in eco-friendly agriculture.

Keywords: Agricultural waste, eco-friendly agriculture, biomass, bioenergy, biodegradable polymers, Bibliometric Analysis.

INTRODUCTION

The transition to sustainable agriculture techniques has emerged as a global necessity owing to escalating concerns regarding environmental degradation, climate change, and food security. Eco-friendly agriculture, which aims to minimize the environmental impact of farming practices, is crucial for achieving long-term sustainability. A main method to advance sustainable agriculture is through the utilization of agricultural waste. Agricultural waste, encompassing crop leftovers, animal manure, and other organic by-products, can be efficiently repurposed to improve soil fertility, diminish chemical inputs, and foster circular economies in the agricultural sector [1], [2], [3], [4].

Globally, agricultural waste has historically been seen as a by-product with minimal economic worth, frequently resulting in its disposal by incineration or landfilling. These disposal methods substantially contribute to environmental pollution, encompassing greenhouse gas emissions and the polluting of aquatic ecosystems. Recent advancements have underscored the potential of agricultural waste as a useful resource in sustainable practices, including composting, bioenergy generation, and biofertilizer development. These measures not only reduce environmental harm but also enhance resource efficiency and provide economic advantages for farmers [5], [6], [7], [8].

The usage of agricultural waste has garnered significant attention in numerous areas, especially in developing nations where smallholder farmers have issues relating to resource constraint and environmental sustainability. Integrating agricultural waste into sustainable farming practices enables farmers to diminish reliance on synthetic inputs, decrease production expenses, and enhance soil health. This method adheres to the tenets of sustainable agriculture, highlighting the necessity for ecological equilibrium, economic feasibility, and social justice [9], [10], [11].

Despite the growing interest in the role of agricultural waste in eco-friendly agriculture, there remains a gap in the systematic understanding of its contributions across different regions and agricultural systems. A bibliometric analysis is a valuable tool for assessing the current state of research on this topic, identifying key trends, and providing insights into future directions. Bibliometric analysis allows researchers to map the intellectual structure of a field, analyze co-authorship networks, and examine citation patterns . This study aims to conduct a bibliometric analysis of the contribution of agricultural waste to eco-friendly agriculture, shedding light on the global research landscape and highlighting areas that require further investigation.

While the potential benefits of utilizing agricultural waste in eco-friendly agriculture are widely acknowledged, the existing body of research on this topic is fragmented and lacks a comprehensive overview. Different regions and agricultural systems have explored the use of agricultural waste in various ways, yet there is no consolidated understanding of the common themes, challenges, and opportunities. Furthermore, the role of agricultural waste in promoting circular agriculture and reducing environmental impacts is often overlooked in favour of more traditional approaches to sustainability. As a result, policymakers, researchers, and practitioners may lack the necessary insights to make informed decisions about the most effective strategies for integrating agricultural waste into eco-friendly practices.

LITERATURE REVIEW

Overview of Agricultural Waste in Eco-Friendly Agriculture

Agricultural waste has long been regarded as a by-product of farming activities with limited use beyond its initial purpose. However, with the growing emphasis on sustainability, particularly in the context of eco-friendly agriculture, researchers have increasingly explored the potential of repurposing agricultural waste into valuable inputs. This shift represents a movement towards circular agriculture, where waste products are reused within the system, promoting resource efficiency and environmental sustainability [12], [13]. Crop residues, manure, and other organic by-products are now seen as critical components in reducing reliance on synthetic inputs such as fertilizers and pesticides, which have been shown to contribute to soil degradation and water contamination.

In the last two decades, a substantial body of literature has emerged that highlights various ways agricultural waste can be repurposed to support eco-friendly farming. For example, composting agricultural waste enriches the soil with organic matter, improving soil fertility and structure while enhancing its water retention capabilities [14], [15]. Moreover, agricultural waste can be transformed into biochar, a soil amendment that sequesters carbon and enhances soil productivity. The literature also underscores the environmental benefits of utilizing waste in bioenergy production, thus reducing greenhouse gas emissions and contributing to cleaner energy alternatives [16], [17].

Circular Economy in Agriculture and the Role of Waste

The concept of the circular economy has gained momentum in various industries, including agriculture, as a sustainable alternative to the traditional linear "take-make-dispose" economic model. In a circular agricultural system, waste is not discarded but is instead reintegrated into the system as valuable resources. Agricultural waste plays a pivotal role in this model, as it can be processed into inputs such as compost, biofertilizers, or even energy, closing the loop and reducing waste disposal issues [18]. This aligns with eco-friendly agricultural practices, which aim to reduce environmental impact while maintaining productivity and profitability.

Several studies have highlighted the growing adoption of circular economy principles in agriculture, particularly in regions facing resource constraints. In developing countries, smallholder farmers have begun to recognize the economic and environmental advantages of utilizing agricultural waste. For instance, the reuse of crop residues as mulch not only enhances soil health but also reduces the need for chemical herbicides by suppressing weed growth [12]. In more advanced agricultural systems, agricultural waste is increasingly used for bioenergy production, which reduces fossil fuel consumption and enhances energy security for rural communities [14]. Despite these advancements, challenges remain in scaling up waste utilization due to technical, financial, and policy barriers that need to be addressed in future research.

Types of Agricultural Waste and Their Applications

The types of agricultural waste vary widely depending on the farming system, crop types, and local environmental conditions. Common types of agricultural waste include crop residues (stalks, leaves, husks), animal manure, and agro-industrial by-products such as fruit peels and seed husks. Each type of waste has different potential applications within eco-friendly agriculture, ranging from soil amendments to renewable energy production.

Crop residues are the most abundant type of agricultural waste and can be utilized in several ways to enhance sustainability in agriculture. In addition to their use as mulch or compost, they can also be processed into biochar, a stable form of carbon that can sequester carbon dioxide for hundreds of years [18]. Biochar application to agricultural soils has been shown to improve crop yields, particularly in degraded soils, while reducing the need for chemical fertilizers [16]. Animal manure, another significant waste product, is widely used as organic fertilizer, contributing to soil nutrient cycling and reducing the environmental footprint of synthetic fertilizers. Recent innovations have explored anaerobic digestion of animal manure to produce biogas, a renewable source of energy that can be used for heating or electricity generation.

Agro-industrial by-products, such as fruit peels, seed husks, and sugarcane bagasse, also hold promise in eco-friendly agricultural practices. These by-products can be processed into biofuels or bio-based materials, contributing to cleaner energy sources and reducing waste disposal issues in agro-industrial operations. For example, sugarcane bagasse is commonly used in Brazil as a feedstock for bioethanol production, a renewable fuel that can replace gasoline and reduce greenhouse gas emissions [12]. Overall, the literature highlights the versatility of agricultural waste and its potential to support multiple eco-friendly applications in agriculture.

Challenges in Agricultural Waste Utilization

Despite the recognized benefits of utilizing agricultural waste, several challenges hinder its widespread adoption in eco-friendly agriculture. First, technical challenges related to the collection, transportation, and processing of agricultural waste remain significant. Many types of waste are bulky, scattered across wide areas, and highly perishable, making efficient collection and transport difficult and costly. Furthermore, processing agricultural waste into valuable products such as biochar or biofuels often requires advanced technologies that may not be accessible to small-scale farmers, particularly in developing countries [18]. Second, financial barriers can impede the implementation of agricultural waste utilization projects. In many regions, the initial investment required for waste processing facilities or composting operations can be prohibitive, particularly for smallholder farmers who already operate on thin profit margins [16]. Without sufficient financial incentives or subsidies, farmers may be reluctant to invest in waste utilization technologies, opting instead for more conventional practices that do not prioritize sustainability.

Third, policy and regulatory challenges must also be addressed to promote the widespread use of agricultural waste in eco-friendly agriculture. In some regions, regulations governing waste disposal and reuse are either absent or poorly enforced, leading to continued environmental degradation through improper waste management practices [12]. Moreover, there is often a lack of coherent policies that support the integration of waste utilization into broader agricultural sustainability strategies. Policymakers must address these regulatory gaps and develop comprehensive frameworks that incentivize farmers and agro-industrial businesses to adopt waste utilization practices.

METHODS

This study employs a bibliometric analysis to examine the contribution of agricultural waste to eco-friendly agriculture. The analysis is based on scholarly articles sourced from the Google Scholar database, covering publications from the year 2011 to 2024. The data were extracted using specific keywords such as "agricultural waste," "eco-friendly agriculture," "sustainability," and "circular economy." VOSviewer software was used to analyze co-authorship, keyword co-occurrence, and citation networks, allowing the identification of major research themes, influential authors, and trends in agricultural waste utilization. The inclusion criteria for the study focused on peer-reviewed journal articles, conference papers, and reviews, ensuring the relevance and quality of the literature.

RESULTS AND DISCUSSION

Bibliometric Overview

Table 1. Bibliometric Overview

Publication Years	2011-2024
Citation Years	13 (2011-2024
Papers	1000
Citations	6932
Cites/Year	533,23

Cites/Paper	69,32
Cites/Author	2198,15
Papers/Author	29,98
Authors/Paper	3,94
h-index	44
g-index	82
hI, norm	22
hI, annual	1,69
hA-index	25
Papers with ACC >= 1,2,5,10,20: 93, 87, 75, 56, 35	

Source: Publish or Perish, 2024

Table 1 provides a bibliometric overview of research on the contribution of agricultural waste to eco-friendly agriculture between 2011 and 2024. Over this period, 1,000 papers were published, accumulating 6,932 citations. On average, these papers received 533.23 citations per year, with an average of 69.32 citations per paper, indicating a high level of influence and recognition within the academic community. The table shows an h-index of 44, meaning 44 papers have been cited at least 44 times, while the g-index of 82 suggests that the most cited papers have received substantial attention. The hI, norm and hI, annual scores of 22 and 1.69, respectively, measure the consistency of author impact over time. Additionally, the hA-index of 25 indicates a strong citation performance among the most impactful authors. The table also shows a significant level of collaborative research, with an average of 3.94 authors per paper. Finally, papers with high citation counts (e.g., those cited more than 1, 2, 5, 10, and 20 times) demonstrate strong engagement, with 35 papers receiving at least 20 citations.

Keyword Co-Occurrence

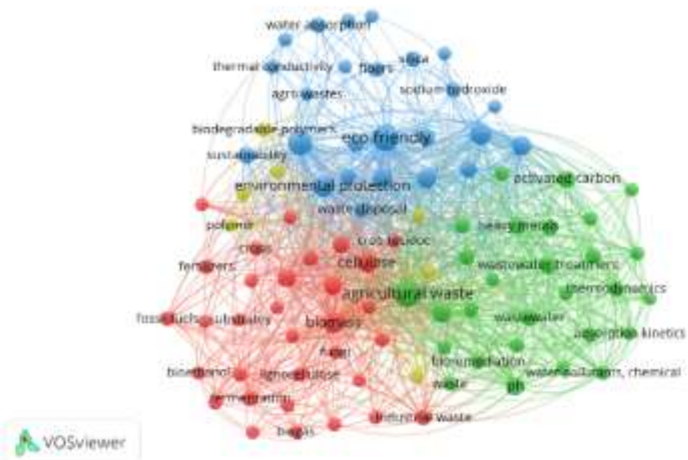

Figure 1. Network Visualization
Source: Data Analysis, 2024

The VOSviewer network visualization presents a co-occurrence map of keywords related to the contribution of agricultural waste to eco-friendly agriculture. The nodes in the network represent the various terms, while the edges connecting them reflect the co-occurrence relationships in the academic literature. Larger nodes indicate more frequent terms, and the thickness of the edges signifies the strength of co-occurrence between terms. The terms are grouped into clusters, each denoted by a different color, showing how different themes are interconnected within the broader research field.

In the red cluster, terms such as “agricultural waste,” “biomass,” “cellulose,” “bioethanol,” and “lignocellulose” dominate. This cluster is focused on the various uses of agricultural waste in biomass production, biofuels, and renewable energy. It emphasizes how agricultural residues, such as crop residues and lignocellulose, are processed into valuable bioenergy products like bioethanol and biogas. The connections between these terms indicate the growing interest in converting agricultural waste into energy sources, a core concept in eco-friendly agriculture.

The blue cluster is centered around terms like “eco-friendly,” “environmental protection,” “biodegradable polymers,” and “sustainability.” This cluster focuses on the environmental implications of agricultural waste utilization, particularly in developing eco-friendly materials and practices. The strong connections between terms like “sustainability” and “environmental protection” indicate that a significant portion of the research is devoted to understanding how agricultural waste can contribute to broader sustainability goals. This includes creating biodegradable materials that reduce environmental pollution and integrating agricultural waste into eco-friendly industrial processes.

In the green cluster, keywords such as “wastewater treatment,” “heavy metals,” “bioremediation,” and “ph” are prominent. This indicates research on the role of agricultural waste in environmental remediation, particularly in treating industrial and agricultural pollutants. Agricultural waste materials are increasingly being studied for their potential in absorbing heavy metals and other contaminants from wastewater. The connections in this cluster highlight the role of agricultural waste in bioremediation techniques, which help reduce environmental damage and contribute to cleaner ecosystems.

Overall, this visualization reveals the multidisciplinary nature of agricultural waste research, spanning energy production, material development, and environmental protection. The connections between these clusters suggest a highly interconnected field where innovations in one area, such as bioenergy, are influencing advances in eco-friendly materials and environmental remediation techniques. This comprehensive view underscores the importance of agricultural waste in achieving sustainable agriculture goals and highlights the growing research interest in leveraging waste to solve global environmental challenges.

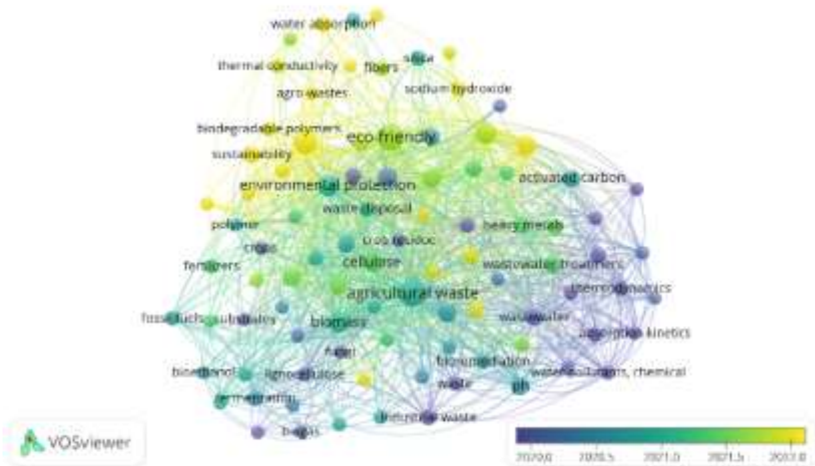

Figure 2. Overlay Visualization

Source: Data Analysis, 2024

The VOSviewer overlay visualization illustrates the evolution of research keywords related to agricultural waste and eco-friendly agriculture over time, as indicated by the color gradient from purple (older publications, around 2020) to yellow (more recent publications, closer to 2022). The color-coded network shows that key topics such as "agricultural waste," "biomass," and "cellulose" have been foundational areas of research since around 2020, as indicated by their purple and blue hues. These terms reflect the early focus on utilizing agricultural waste in biomass production and bioenergy, which has remained a central theme over the past few years.

As we move towards the more recent years, represented by yellow and green nodes, there is an emerging focus on terms like "eco-friendly," "biodegradable polymers," and "sustainability." This trend suggests a growing interest in exploring the potential of agricultural waste in developing environmentally sustainable practices and materials. Recent research, particularly from 2021 onward, highlights the development of biodegradable materials and their integration into eco-friendly agricultural systems. The use of agricultural waste for environmental protection, as shown by terms like "waste disposal" and "environmental protection," is also gaining prominence.

Additionally, the more recent keywords such as "water absorption," "sodium hydroxide," and "fibers" signal a shift towards more specialized applications of agricultural waste in industrial processes, particularly in the context of material science and environmental remediation. These emerging topics are marked by yellow nodes, indicating their increasing relevance in 2022. The combination of traditional topics such as biomass with newer themes related to eco-friendly innovations illustrates the broadening scope of agricultural waste research, transitioning from energy production to a more holistic view of environmental sustainability and circular economy principles.

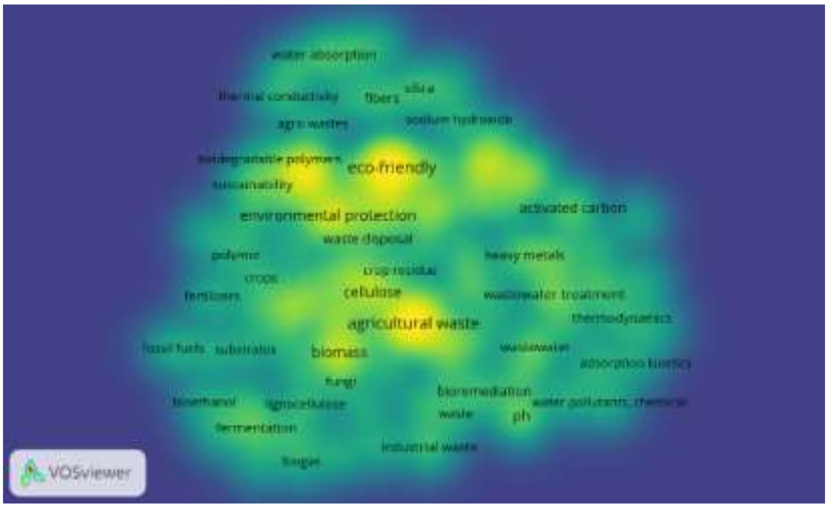

Figure 3. Heatmap Visualization
Source: Data Analysis, 2024

The heatmap visualization represents the density of research activity on various topics related to agricultural waste and eco-friendly agriculture. The yellow and green areas highlight where the research focus is most concentrated. The terms "agricultural waste," "eco-friendly," "biomass," and "cellulose" show the highest density of co-occurrence, indicating that these topics are central to the research field. These terms are associated with key themes in agricultural waste utilization, particularly its role in biomass energy production, circular economy applications, and sustainable farming practices.

The surrounding green areas, such as "environmental protection," "biodegradable polymers," "wastewater treatment," and "activated carbon," show moderately high research interest, signaling their growing importance. These terms reflect the expanding applications of agricultural waste in environmental protection and remediation, as well as the development of biodegradable materials and wastewater management solutions. The lower-density blue regions, including terms like "thermal conductivity" and "fibers," indicate emerging areas of research with potential for further exploration. This heatmap demonstrates a research field that is evolving from foundational topics in biomass production towards more diversified applications in eco-friendly agriculture and environmental sustainability.

Citation Analysis

Table 2. Top Cited Documents

Citation	Author	Title
857	[19]	Agricultural Waste Peels as Versatile Biomass for Water Purification-A Review
544	[20]	Agricultural Waste Management Strategies for Environmental Sustainability
309	[21]	Agricultural Waste Annona Squamosa Peel Extract" Biosynthesis of Silver Nanoparticles
295	[22]	A Research Challenge Vision Regarding Management of Agricultural Waste in A Circular Bio-Based Economy
274	[23]	Production of Sustainable and Biodegradable Polymers from Agricultural Waste
227	[24]	Eco-Friendly Geopolymer Prepared from Solid Wastes: A Critical Review
192	[25]	Removal of Dyes by Agricultural Waste
153	[26]	Current Approaches and Methodologies to Explore the Perspective Absorption Mechanism of Dyes on Low-Cost Agricultural Waste: A Review
151	[27]	Agricultural Waste-Derived Superabsorbent hydrogels: Preparation, Performance, and Socioeconomic Impacts
150	[28]	Agricultural Waste Biorefinery Development Towards Circular Bioeconomy

Source: Publish or Perish, 2024

CONCLUSION

In conclusion, this study highlights the significant role that agricultural waste plays in promoting eco-friendly agriculture through various sustainable practices. The bibliometric analysis reveals a growing body of research focused on utilizing agricultural waste in biomass production, bioenergy, biodegradable materials, and environmental protection. The co-occurrence and density visualizations indicate a shift towards more diverse applications, such as bioremediation and wastewater treatment, underscoring the evolving nature of the field. Despite these advancements, challenges remain in scaling up the utilization of agricultural waste, particularly in developing regions. Future research should focus on addressing technical, financial, and policy barriers to fully unlock the potential of agricultural waste in contributing to global sustainability efforts and the circular economy. This study provides a comprehensive overview of the current research landscape and offers insights into future directions for leveraging agricultural waste in eco-friendly agriculture.

REFERENCES

[1] N. O. da Costa Monteiro *et al.*, "Sustainable practices in brazilian and global agriculture in the 21st century," *CONTRIBUCIONES A LAS CIENCIAS SOCIALES*, vol. 17, no. 8, pp. e9520–e9520, 2024.

[2] J. Zhao, Q. Luo, H. Deng, and Y. Yan, "Opportunities and challenges of sustainable agricultural development in China," *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 363, no. 1492, pp. 893–904, 2008.

[3] P. Makinde, "A Comprehensive Review on Transitioning into Organic Farming," *Asian Journal of Research in Agriculture and Forestry*, vol. 10, no. 3, pp. 45–59, 2024.

[4] I. Zambon, M. Cecchini, E. M. Mosconi, and A. Colantoni, "Revolutionizing Towards Sustainable Agricultural Systems: The Role of Energy," *Energies*, vol. 12, no. 19, p. 3659, 2019.

[5] F. Mekunye and P. Makinde, "Production of Biofuels from Agricultural Waste," *Asian Journal of Agricultural and Horticultural Research*, vol. 11, no. 3, pp. 37–49, 2024.

[6] K. Kaur, P. Kaur, and S. Sharma, "Management of crop residue through various techniques," *J Pharmacogn Phytochem*, vol. 8, no. 1S, pp. 618–620, 2019.

[7] M. A. Bhat, A. W. Adil, B. M. Sikander, Y. Lone, and J. A. Malik, "Waste management technology for sustainable agriculture: Waste management," in *Research Anthology on Strategies for Achieving Agricultural Sustainability*, IGI Global, 2022, pp. 379–398.

[8] I. Agustina, H. Khuan, B. Aditi, S. A. Sitorus, and T. P. Nugrahanti, "Renewable energy mix enhancement: the power of foreign investment and green policies," *International Journal of Energy Economics and Policy*, vol. 13, no. 6, pp. 370–380, 2023.

[9] R. Kumar, A. Kaur, S. Sharma, H. Bharti, and R. Kumar, "Advancements And Challenges In Agriculture Waste Management: A Comprehensive," *Educational Administration: Theory and Practice*, vol. 30, no. 5, pp. 7253–7273, 2024.

[10] M. Zielińska and K. Bułkowska, "Agricultural Wastes and Their By-Products for the Energy Market," *Energies (Basel)*, vol. 17, no. 9, p. 2099, 2024.

[11] T. P. Nugrahanti and A. S. Jahja, "Audit judgment performance: The effect of performance incentives, obedience pressures and ethical perceptions," *Journal of Environmental Accounting and Management*, vol. 6, no. 3, pp. 225–234, 2018.

[12] A. Verma, A. Gupta, and P. Rajamani, "Application of wastewater in agriculture: benefits and detriments," in *River Conservation and Water Resource Management*, Springer, 2023, pp. 53–75.

[13] H. Ashari, T. P. Nugrahanti, and B. J. Santoso, "The role of microfinance institutions during the COVID-19 pandemic," *Global Business and Economics Review*, vol. 30, no. 2, pp. 210–233, 2024.

[14] T.-H. Chang, Y.-C. Lu, M.-J. Yang, J.-W. Huang, P.-F. L. Chang, and H.-Y. Hsueh, "Multibranched flower-like ZnO particles from eco-friendly hydrothermal synthesis as green antimicrobials in agriculture," *J Clean Prod*, vol. 262, p. 121342, 2020.

[15] H. Ashari and T. P. Nugrahanti, "Household economy challenges in fulfilling life needs during the Covid-19 pandemic," *Global Business and Economics Review*, vol. 25, no. 1, pp. 21–39, 2021.

[16] N. Kim and K. Lee, "Environmental consciousness, purchase intention, and actual purchase behavior of eco-friendly products: the moderating impact of situational context," *Int J Environ Res Public Health*, vol. 20, no. 7, p. 5312, 2023.

[17] T. P. Nugrahanti and A. S. Pratiwi, "The Remote Auditing and Information Technology," *Journal of Accounting and Business Education*, vol. 8, no. 1, pp. 15–39, 2023.

[18] O. M. Smith *et al.*, "Identifying farming strategies associated with achieving global agricultural sustainability," *Frontiers in Sustainable Food Systems*, vol. 6, p. 882503, 2022.

[19] A. Bhatnagar, M. Sillanpää, and A. Witek-Krowiak, "Agricultural waste peels as versatile biomass for water purification–A review," *Chemical engineering journal*, vol. 270, pp. 244–271, 2015.

[20] B. Koul, M. Yakoob, and M. P. Shah, "Agricultural waste management strategies for environmental sustainability," *Environmental Research*, vol. 206, p. 112285, 2022.

[21] R. Kumar, S. M. Roopan, A. Prabhakarn, V. G. Khanna, and S. Chakroborty, "Agricultural waste Annona squamosa peel extract: biosynthesis of silver nanoparticles," *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, vol. 90, pp. 173–176, 2012.

[22] N. Gontard *et al.*, "A research challenge vision regarding management of agricultural waste in a circular bio-based economy," *Critical reviews in environmental science and technology*, vol. 48, no. 6, pp. 614–654, 2018.

[23] C. Maraveas, "Production of sustainable and biodegradable polymers from agricultural waste," *Polymers*, vol. 12, no. 5, p. 1127, 2020.

[24] B. Ren, Y. Zhao, H. Bai, S. Kang, T. Zhang, and S. Song, "Eco-friendly geopolymer prepared from solid wastes: A critical review," *Chemosphere*, vol. 267, p. 128900, 2021.

[25] M. Kadhom, N. Albayati, H. Alalwan, and M. Al-Furaiji, "Removal of dyes by agricultural waste," *Sustainable Chemistry and Pharmacy*, vol. 16, p. 100259, 2020.

[26] R. Bushra, S. Mohamad, Y. Alias, Y. Jin, and M. Ahmad, "Current approaches and methodologies to explore the perceptive adsorption mechanism of dyes on low-cost agricultural waste: A review," *Microporous and Mesoporous Materials*, vol. 319, p. 111040, 2021.
[27] S. Li and G. Chen, "Agricultural waste-derived superabsorbent hydrogels: Preparation, performance, and socioeconomic impacts," *Journal of Cleaner Production*, vol. 251, p. 119669, 2020.
[28] M. K. Awasthi *et al.*, "Agricultural waste biorefinery development towards circular bioeconomy," *Renewable and sustainable energy reviews*, vol. 158, p. 112122, 2022.