

A Bibliometric Analysis of Used Cooking Oil Purification using Organic Waste

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ABSTRACT: Improper disposal of used cooking oil (UCO) will cause environmental pollution as it contains harmful compounds to nature and humans. At the same time, dumping activities of organic waste (i.e., agricultural waste, fruit waste and kitchen waste) result in aesthetic problems and complicate solid waste management. With green technology, UCO can be recycled using organic waste to solve the mentioned problems. This paper using a quantitative method to analyse the related publications from Jan 2011 to June 2021 based on the Scopus database. The results signified that the trend of this field is growing and developing, with Indonesia, India and Malaysia are the top contributing countries and affiliations. Specific interest search keywords stated in this paper will help researchers gain prospects in the related research topics.

Keywords: *Used Cooking Oil (UCO); Purification; Organic Waste*

1. INTRODUCTION

Fatberg is the biggest problem resulting from draining used cooking oil (UCO) into the sewerage system. Therefore, initiatives have been explored to recycle UCO into value-added products (i.e., biofuel and biomaterials). However, the impurities in UCO, such as solid particles, oligomers, volatiles and oxidised compounds, need to be removed before UCO turns into value-added products.

There are various efforts to purify UCO; one of those is the adsorption process [1]. Organic waste such as agricultural waste (i.e., coconut fiber [2]), fruit waste (i.e., banana peel [3]), and kitchen waste (i.e., tea waste [4]) have been used for the adsorption process of UCO purification. A preliminary study shows the capability of organic waste to remove the impurities of UCO and increase the market value as a feedstock for biofuel. Furthermore, the proximate analysis of organic waste shows high fixed carbon content. Thus, the carbon content in organic waste meets the requirement to be used as the raw material for activated carbon to purify UCO.

Research on UCO purification using organic waste has received extensive attention, but the literature on this topic never analysed their research trends. This paper uses bibliometric analysis, an efficient technique for reviewing publications from the Scopus database.

2. ANALYSIS OF SEARCH KEYWORDS

The collected data in this analysis originated from the Scopus database. The search keywords were set as “used cooking oil” AND “purification”, with a limit year range from 2011 to 2021. There were 220 related documents based on these two keywords. However, the volume of such publications also covers other UCO purification methods. Some methods use a catalyst to produce biodiesel through the transesterification process, while the other is purified UCO using minerals (i.e., silica, zeolite and clay) which are unrelated to our interest topic. Therefore, refine search keywords were used as an additional keyword for search within the results to focus only on the UCO purification using organic waste.

The number of publications using the refine search keywords of organic waste is arranged in descending order with a total value of 73, as shown in Table 1. The data showed that more attention is given to the purification of UCO using agricultural waste. The following analysis on publication year, country and affiliation are using these data.

Table 1 Number of publications based on the refine search keywords

Refine search keywords	Number of publications
Rice husk	15
Bagasse	12
Eggshell	9
Tea waste	8
Coconut fiber	5
Banana peel	5
Orange peel	4
Jatropha leaf	4
Pineapple	3
Nutshell	3
Durian peel	2
Black olive stone	1
Cocoa pod husk	1
Salacca zalacca	1
TOTAL	73

3. ANALYSIS OF PUBLICATION YEAR

Figure 1 elucidates the publication increase for the first three years from 2011 to 2013, from 1.4 % to 5.5%. But, the next three years from 2014 to 2016 shows fluctuating trends. However, the publications are kept arising from 2016 to 2020 with an average of 5.1% increment. The lowest publications are in 2011 and 2014, with the same percentage of 1.4% while, the highest publications are in 2020 with 23.3%.

The downturn trend from 2020 to 2021 is due to data collected only until June 2021, where publications may be higher by the end of 2021. The ascending trends throughout 10 years show this topic is a significant research interest in producing a sustainable method to recycle UCO and optimise the usage of organic waste to reduce environmental pollution.



Figure 1 Publication Trends from Jan 2011 to June 2021

4. ANALYSIS OF PUBLICATION BY COUNTRY

Fourteen (14) countries are contributed to the related research topics of a total of 73 publications, as indicated in Figure 2. Indonesia is the top rank with 20 publications, India published 17 documents in the second rank, followed by Malaysia in the third rank with 8 documents. These three most contributors countries are located in the Asian region and categorised as developing countries. These data indicate that they pay more attention to the research field in reducing and recycled domestic waste to achieve sustainable development.

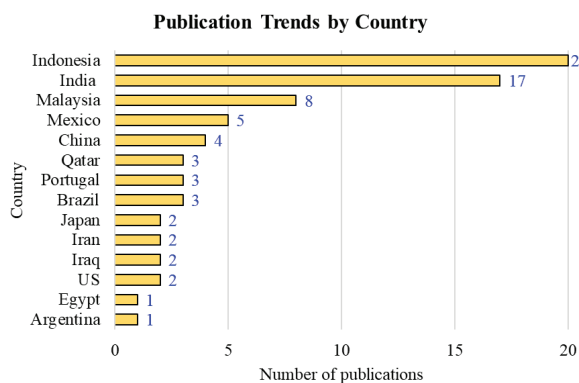


Figure 2 Top countries by document count in related research topics

5. ANALYSIS OF PUBLICATION BY AFFILIATION

The number of publications by research institutions was sorted into the top five and tabulated in Table 2. The top five research institutions that publish the most are comprised of the three biggest contributors countries: Indonesia, India, and Malaysia.

Affiliations	Publications
Universitas Negeri Medan, Indonesia	2
Polytechnic State of Lhokseumawe, Indonesia	2
Shoolini University, India	2
Universiti Teknologi Petronas, Malaysia	2
Universiti Putra Malaysia	2

6. CONCLUSION

This paper analysed 73 related publications collected from Jan 2011 to June 2021 from the Scopus database. The ascending trend of annual publications can be seen based on the collected data. Indonesia, India, and Malaysia are the top three contributing countries that published work in this field. The additional refine search keywords prove that UCO purification techniques using organic waste are evolving and provide further exploration opportunities for researchers to strengthen the study of energy and environmental sustainability.

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REFERENCES

- [1] A. Petračić, A. Sander, and M. Cvetnić, "A novel approach for the removal of trace elements from waste fats and oils", *Separation Science and Technology*, vol. 55, no. 18, pp. 3487-3501, 2020.
- [2] R. Oktavian, B. Poerwadi, M. R. Pahleva, M. Wahyu, and S. Muharyanto, "Synthesis and performance assessment of coconut fiber solid adsorbent for waste cooking oil purification as biodiesel feedstock", *Carbon*, vol. 70, p. 75, 2020.
- [3] Z. Zulkifli, T. Rihayat, S. Suryani, F. Facraniah, U. Habibah, N. Audina, T. Fauzi, N. Nurhanifa, Z. Zaimahwati, and R. Rosalina, "Purification process of jelantah oil using active chorcoal kepok's banana", in *AIP Conference Proceedings*, vol. 2049, no. 1, p. 020022, 2018.
- [4] I. Aziz, R. C. Sulistina, and L. Adhani, "Purification of Crude Glycerol from Acidification Using Tea Waste", in *IOP Conference Series: Earth and Environmental Science*, vol. 175, no. 1, p. 012010, 2018.