

A Bibliometric Analysis of Vegetable Oil-Based Plasticizer Application in Conventional PLA and PVC Plastics

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ABSTRACT: This bibliometric analysis is motivated by the problem created by the drawbacks of Poly-Lactic Acid (PLA) such as high brittleness and low toughness, which limits its application. Polyvinyl Chloride (PVC) has low thermal stability and high glass transition temperature. Plasticizer is needed to enhance the characteristics of the conventional PLA and PVC plastics. This bibliometric review paper helps in providing a clear review of how the research topic gained interest among researchers. In this study, the bibliometric analysis of vegetable-based plasticizer was reviewed from the Scopus Database between 2011 to 2021. This analysis focuses on the publication's trends, keywords used in finding journals, document by affiliation, and document by country. The resulted data gained in this bibliometric review paper helps in motivates and give better understanding among researchers in the current trends of vegetable oil-based plasticizer area.

Keywords: *Bio-based Plasticizer, Vegetable Oil, Poly-lactic Acid (PLA), Polyvinyl Chloride (PVC),*

1. INTRODUCTION

A bio-based plasticizer is one of the most significant additives in the production of polymer materials [1]. These plasticizers improve the workability, durability [2], and flexibility [3] of polymers. When a plasticizer is applied to a polymer, it weakens the intermolecular binding force, reduces crystallinity, and increases relative motion between molecular segments. Conventional phthalate plasticizers are those made from petroleum-based leading to the potential health hazard and environmental risks [1].

Bio-based plasticizers originated from vegetable oil are now gain more attention which aims to reduce the dependence on the petroleum-based plasticizer [4]. Bio-based plasticizers are non-toxic, environmentally friendly, and biodegradable [1]. Vegetable oils are chosen as the feedstock for bio-based plasticizers due to the abundance of benefits such as renewable resources, biodegradable, environment-friendly, widely available, and inexpensively cost [5].

A bibliometrics analysis is carried out to quantify and analyze the information of publications where researchers can use this bibliographic information to

relate authors or papers [6]. Scopus is one of the trusted databases for conducting bibliometric investigations because they are verifiable sources of citation data. Thus, this paper aims to analyze a research trend of bio-based plasticizer originated from vegetable oil based on the Scopus database.

2. PUBLICATIONS TRENDS

The data were gained when the search keywords of "Vegetable Oil AND Plasticizer" were used in the Scopus database. A total of 242 papers were found from 2011 until 2021. However, to make the area more focused in our research group, the keyword "Epoxidized" is added with these two words to find the most related publications to our research topic where the data were reduced to 54. Only 33 publications were chosen which focus on the study. Figure 1 concluded that the bio-based plasticizer has gained lots of interests among researchers throughout the years in terms of journal publications. The highest publication on the research topic was in 2020 with 86% of increment from 2012 in the publications. However, from 2020 to 2021, the publication trends decrease at 57% due to the focus pandemic COVID-19.

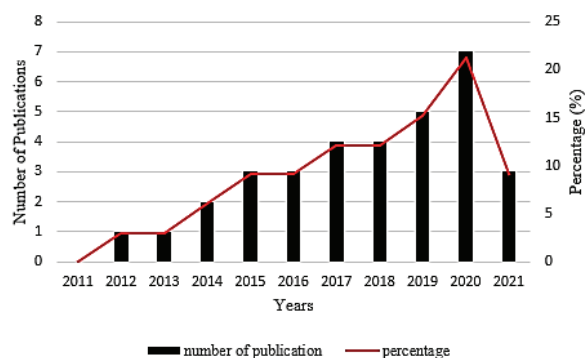


Figure 1: Publications trends

3. ANALYSIS OF KEYWORDS OCCURRENCE

Frequents keywords used in finding articles in this research topic were analyzed where these keywords represent the most relatable according to the study. Table 1 depicts the top 10 keywords are used in search metadata for the research topic 'Plasticizer' and 'Vegetable Oils'

with 23 publications were recorded. These keywords were then used for other analysis which are publication trends, contributions affiliations and countries.

Table 1: Keywords finding

Keywords	Number of Publications
Plasticizers	23
Vegetable oils	23
Polyvinyl Chloride (PVC)	12
Poly-lactic Acid (PLA)	4
Biodegradable polymer	3
Bio-based	2
Plant oil	3
Renewable sources	2
Phthalate plasticizers	3
Mechanical properties	6

4. CONTRIBUTING COUNTRIES

Figure 2 illustrates the top 10 countries in the publication which related to the study. China is leading with 7 publications compared to other countries. In contrast, the lowest publications on the research topic are Vietnam, at one publication throughout the years. Malaysia ranked top 2 in publication. This data indicates that the bio-based plasticizer originated from vegetable oil were also getting interest among these countries.

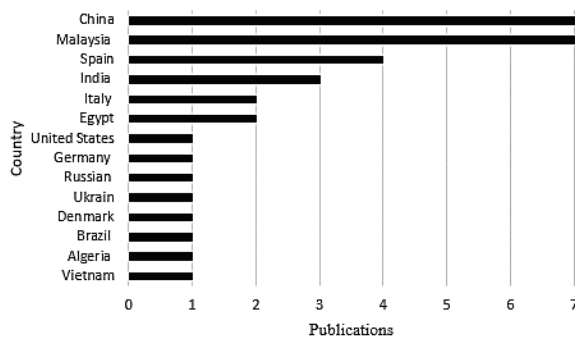


Figure 2: Publications based on country.

5. CONTRIBUTING AFFILIATIONS

The top 10 institutions around the world that contribute to the publications as shown in Table 2. It is recognized that Universiti Putra Malaysia (UPM) scored the highest at 7 publications and followed by the Chinese Academy of Forestry with 6 publications. According to the SCOPUS database, three affiliations from Malaysia were recorded where it indicates that the research topic of bio-based plasticizers has gained great attention among researchers in Malaysia which are Universiti Putra Malaysia (UPM), Universiti Teknologi MARA (UiTM), and Malaysian Palm Oil Board (MPOB).

Table 2: Affiliations

Affiliations	Number of Publications
Universiti Putra Malaysia	7
Chinese Academy of Forestry	6
Universitat Politècnica de Valencia	4
Universiti Teknologi MARA	3
Malaysian Nuclear Agency	3
Nanjing Forestry University	3
Low State University	2
Institute of Chemical Technology	2
Malaysian Palm Oil Board	2

6. CONCLUSION

A systemic bibliometric review of a vegetable oil-based plasticizer from 240 publications from 2011 and 2021 using Scopus database are presented in this study. Increments were spotted in the publication's trends. China, Malaysia, and India contribute most of the publications and UPM shows the highest number of publications. Top keywords for the research topics like "Vegetable Oil", "Plasticizers", and "Epoxidized" are gaining increased public and scientific attention. The data gained in this bibliometric review paper helps in motivates and give better understanding among researchers in the current trends of vegetable oil-based plasticizer area.

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