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A Bibliometric Analysis of Nanocrystalline Cellulose Synthesis For Packaging Application Research Using VOSviewer

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ABSTRACT

Nanocrystalline cellulose is a type of renewable nano material that has many beneficial properties and has applications in various fields, one of which is packaging. This study aims to present an analytical map of studies in the manufacture of nanocrystalline cellulose using VOSviewer software. Based on the keywords “synthesis nanocrystalline cellulose” and “packaging application”, there were 500 related articles published in the 2017-2021 range. The results of the analysis show that the number of research articles on nanocrytalline cellulose synthesis has increased significantly every year. This is due to the need for new environmentally friendly and biodegradable materials for packaging. This research is expected to be a reference for researchers in determining the research topic to be carried out

1. Introduction

Bibliometrics is used to observe and evaluate quantitatively a science with research management, such as VOSviewer (Zitt, 2015). VOSviewer is an application or software commonly used to describe bibliographic analysis maps based on topic areas, titles, abstracts, and keywords (Hamidah et al., 2020; Yu et al., 2020).

One of the topics to be analyzed is nanocrystalline cellulose. Nanocrystalline cellulose is a type of renewable nano material that can be applied in various fields such as biomedical engineering, catalysts, food packaging, etc. due to its good physical, mechanical and chemical properties, biodegradability, and low toxicity (Bhat et al., 2017; George & Sabapathi, 2015).

Several studies of nanocrystalline cellulose have been reported, for example the research conducted by Jean Paulo Oliveira et al (Oliveira et al., 2018). where they made nanocrystalline cellulose from rice and oat husks by enzymatic hydrolysis method, research by Yunqing He et al. (He et al., 2020) making nanocrystalline cellulose from pea hull waste by acid hydrolysis method and its application to food packaging, research by Weihui Jiang et al. (Jiang & Li, 2020) made nanocrystalline cellulose from softwood pulp with double oxidation and ultrasonication methods for application in natural rubber composites. However, there is no study that presents bibliometric analysis in nanocrystalline cellulose synthesis research, especially using analysis maps with VOSviewer software in its presentation.

This paper aims to lead bibliometric research on nanopolymers especially in nanocrystalline cellulose by map fusion using VOSviewer software.

2. Methods

The article used in this paper uses journal articles that have been published and indexed by Google Scholar. The reference managers software used is Publish or Perish. The use of Publish or Perish is explained in detail in (Al Husaeni & Nandiyanto, 2022). In this paper, we filter the articles and only take articles related to the synthesis of nanocrystalline cellulose. We search data on Publish or Perish by typing the keywords "Synthesis Nanocrystalline Cellulose" and "Packaging Application". The articles

used are 500 articles published in the 2017-2021 range. The articles are collected in *.ris format. Next, the author uses VOSviewer software to describe and analyze in a bibliometric map. The bibliometric map data that has been obtained contains three data namely network, density, and overlay visualization.

3. Results and dicussion

3.1 Research Developments

Developments in the manufacture of nanocrystalline cellulose from 2017 to 2021 are shown by the curve in Figure 1. Based on Figure 1, research developments in the manufacture of nanocrystalline cellulose have increased significantly in the last 5 years. The number of articles in 2017 is 47 articles, 2018 has 76 articles, 2019 has 103 articles, 2020 has increased to 130 articles, and 2021 has increased to 142 articles.

Based on this curve, the development of this research is increasing because of the interest and need for materials for food packaging from nature that are more environmentally friendly and can replace the massive use of petroleum-based plastic packaging used today (Hortyńska, 2021; Tavassoli-Kafrani et al. , 2016).

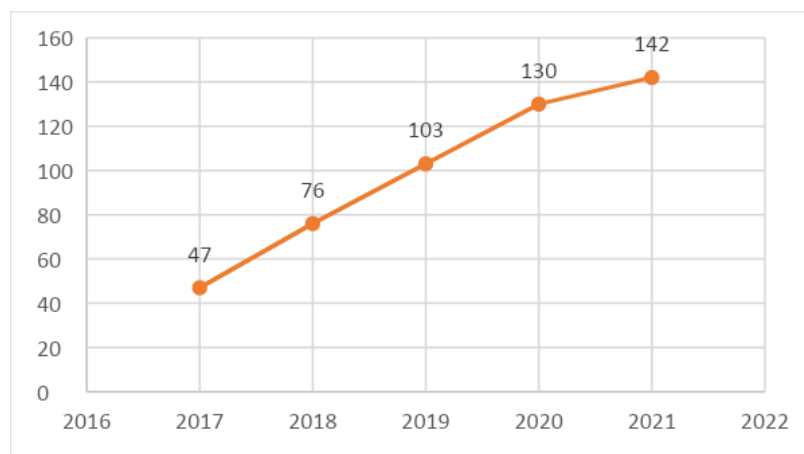


Figure 1. Degree of development of research on synthesis nanocrystalline cellulose

1.2 Visualization Chemical Engineering Topic Area Using Vosviewer

Research related to synthesis nanocrystalline cellulose based on analysis map is divided into 6 clusters, among others:

- (i) Cluster 1 has 34 items, the 34 items are acid, acid hydrolysis, active food packaging, agent, bacterial cellulose, biopolymer, cellulose nanocrystal, cellulose nanofibril, chitosan, cnc, cnf, composite, evaluation, filler, food, food packaging film, food packaging material, isolation, lactic acid, mcc, microcrystalline cellulose , nanocellulose, nanocrystalline cellulose, ncc, paper, pla, polu, polylactic acid, pva, reinforcement, research, shelf life, surface, vinyl alcohol.
- (ii) Cluster 2 has 4 items, the 4 items are antimicrobial property, barrier, carboxymethyl cellulose, cmc.
- (iii) Cluster 3 has 4 items, the 4 items are active packaging, attention, food industry, food product.
- (iv) Cluster 4 has 2 items, the 2 items are polysaccharide, preparation method.
- (v) Cluster 5 has 1 item, the 1 item is physical property.
- (vi) Cluster 6 has 1 item, the 1 item is bacterial nanocellulose.

Cluster 1 is marked with red, cluster 2 is marked with green, cluster 3 is marked with blue, cluster 4 is marked with yellow, cluster 5 is marked with purple, and cluster 6 is marked with light blue.

1.3 The Visualization System Of Synthesis Nanocrystalline Cellulose Keyword

Relationship between terms is shown in Figure 2. Relationships are described by networks or related lines from one term to another. Figure 2 also shows the clusters of each area studied where the synthesis of nanocrystalline cellulose for packaging applications belongs to cluster 1 with a total link strength of 352 and occurrence of 131. It is also connected to cluster 5 (physical property) and cluster 3 (active packaging).

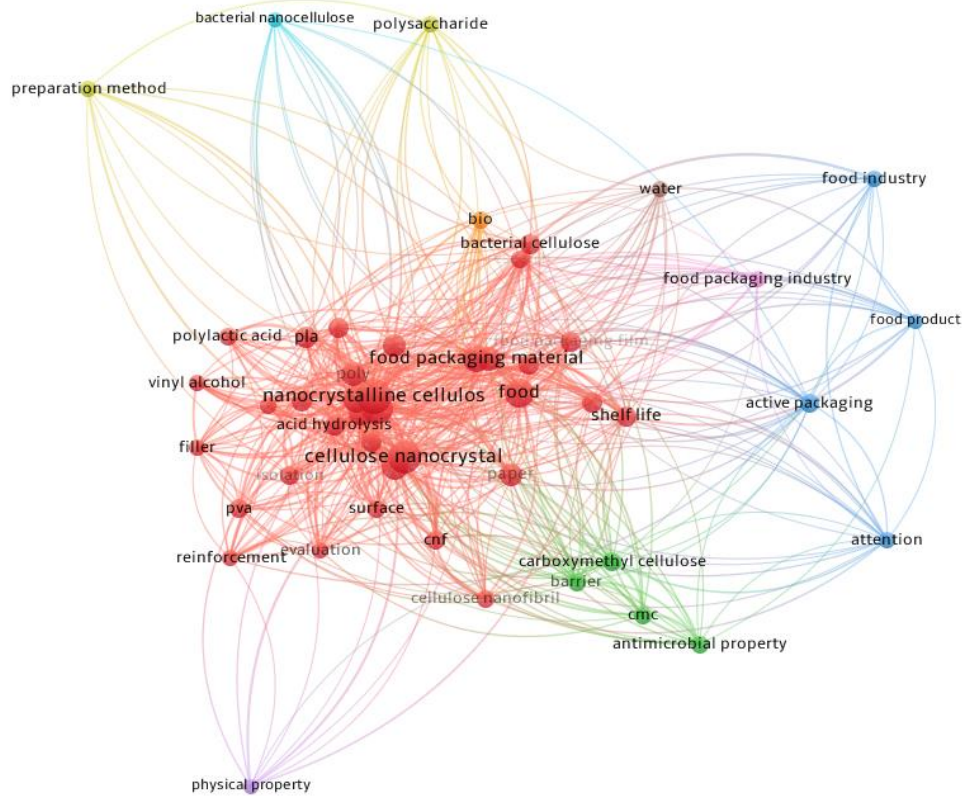


Figure 2. Visualization system of synthesis nanocrystalline cellulose keyword

4. Conclusions

The purpose of this paper is to present an analytical map of research in the synthesis of nanocrystalline cellulose using VOSviewer software. Applications to collect research data are carried out using Publish or Perish, from search results based on the keyword "synthesis nanocrystalline cellulose". The bibliographic data used include publication names, titles, abstracts, and keywords. The result obtained 500 relevant articles published in the 2017-2021 range. From the results of the analysis, it can be concluded that the number of research articles on nanocrystalline cellulose increases significantly every year, and produces 6 clusters based on the keywords used.

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