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Bibliometric Analysis and Challenges in Biofuel Production using Petroplants

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Abstract

A bibliometric analysis based on PubMed database were carried out to provide insights into research activities and tendencies, challenges of global biodiesel from 1997-2020.The document type and language,characteristics of publication output, keywords and most cited articles were emphasized. The biofuel production faces many challenges which include land availability, high cost, plant health and availability of labour. Data visualization using VOS viewer clearly stated that annual output of related scientific articles increased steadily. On analyzing the keywords, network visualization showed 100 lines with biofuel most related to biotechnology field.The most ideal keyword occurrence were visualized for bio-oil followed by co- digestion of biological matter are seen for density visualization. Six clustering of keywords were noted with links 20,6701 among keywords. The relevance score calculated using VOS viewer software generated 2.35 as score for Biodiesel engine and 2.25 for Organic loading rate. The analysis of review papers from pubMed clearly indicated that biofuels showed direct link to biotechnology field, plant oils and ethanol production.

Keywords: Bibliometric, Biofuel, PubMed, Software, Visualizer.

1. Introduction

Energy crops as biofuel are considered more advantages than fossil fuels, including the ability to burn cleaner and emit fewer pollutants. The environment friendly approach in energy corporation frequently put forward in supporting the biofuel to economy [1]. Biodiesel and bio-alcohol are two categories of biofuel. This is basically done by breaking down the starch in corn and other plants with yeast and bacteria. Many research is being undertaken for making soyabean oil and vegetable oil, which are processed with alcohol before being converted into biodiesel [2]. In addition to sugarcane, soyabean, corn and wheat crops such as rapeseed, cotton, palm kernels and even switch grass are processed for biofuel generation around the world. Soya bean, rapeseed, sunflower, cottonseed, palm seed and palm kernels and mustard are common

biofuel in India. Biofuel is the fuel produced from organic products and wastes. The common types of biofuels are bioethanol, biodiesel and biomethane[3]. They are more demanding because of the rising in petroleum price. Hydrocarbons produced from plants are the photosynthetic product like latex. The Angiosperms belonging to Apocynaceae Convolulaceae, Sapotaceae and Euphorbiaceae has lactiferous vesicles for storing thèse products [4]. These hydrocarbons are converted to high efficient transportation fuel called as petrocrop. The main aim of the study is to analyse the importance types of petroplants in Angiosperms. Bibliometric analysis using VOS viewer software will help in understanding about the history and recent developments of Biodiesel, including the different types of biodiesel, the characteristics, processing and economics of Biodiesel industry in the world. Many studies of biofuel have already been published, a bibliometric evaluation of publication could serve as an alternative and innovative way of connecting various aspects of scientific finding and revealing global trends of biofuel research.

2. Materials and methods

The methodology adopted was the initial reviews on plants derived biofuels from the published literature. A cataloguing of Angiosperms with bio-fuel production capability was analyzed using SCI (Scientific Citation Index) indexed publications. The data for the bibliometric analysis of biofuel was downloaded from the PubMed with publications on Biodiesel producing plants. The published papers from 1997-2020 was considered for the study and following fields like Author, Document Title, Keywords, Author Address, References, Times Cited, Published Year, Subject Category and Journal name were created in CSV file format. The VOS viewer software used in study showed the network visualization, overlay visualization and density visualization effects of the published paper.

2.1 VOS viewer 1.6.16

VOS viewer is a software tool for constructing and visualizing bibliometric networks [5]. Network are constructed based on citation, bibliographic coupling and co-authorship relations. It is used to visualize co-occurrence networks of important terms extracted from a body of scientific literature.

3. Results and discussion

8,261 related publications on biodiesel research were analyzed for the period of 1997-2020 from PubMed database. After screening the peer reviewed paper, the dominant 8,261 publications were analyzed in the subsequent study. The plant-based biofuel is more efficient

as the hexane extract contain 8% terpenoid and produces 40 tonnes of dry matter/ha/yr. *Calotropis* of Asclepidaceae family contain high amount of hydrocarbon and algal hydrocarbon like *Botryococcus braunii*, produces 70% of biodiesel called as golden liquid. Hydrogenation was done for algae and it produced 50% biomass that was being converted to oil with less waste [6]. *Jatropha curcas*, an important agro-fuel crop had many beneficial uses in addition to biodiesel production. a minimum but explain all the symbols and abbreviations used (Fig. 1).

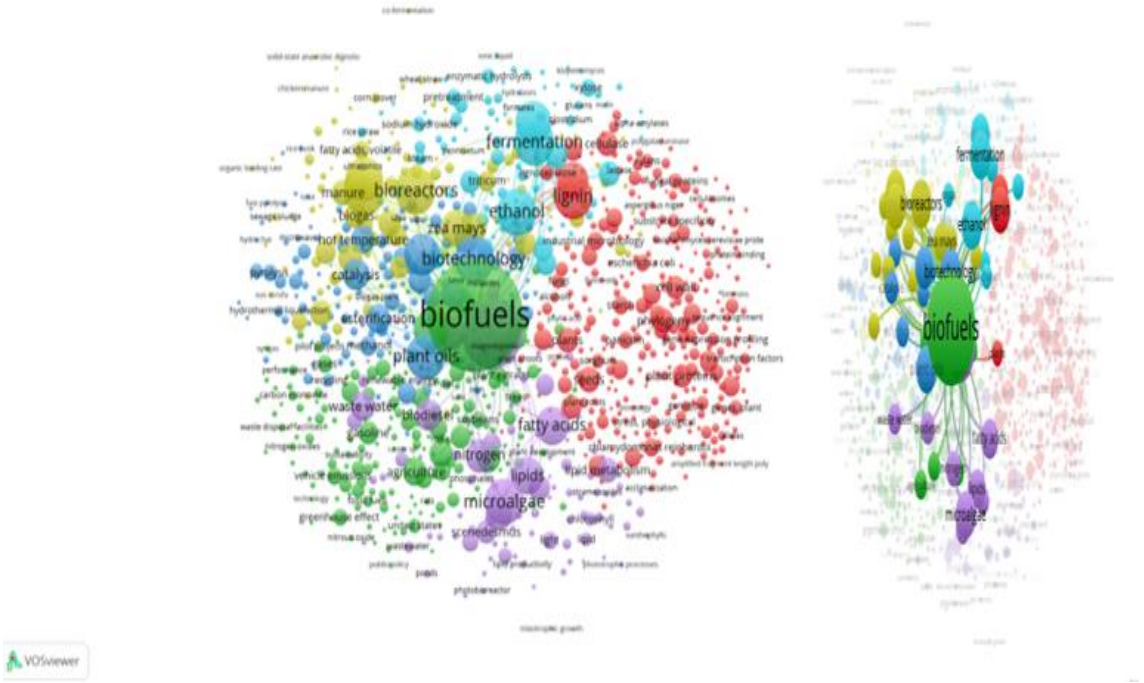

Fig 1. Network visualization with 100 lines were set based on keyword

Tables explains the classification of Petro-plants with respect to the metabolite (Table 1). Classification was done based on oil production, Latex content, resinous material and algal category. Biochemicals are source of energy and plant possessing chemicals are used to be an efficient fuel for green technology [7].

The overlay visualization showed that the development of research in biofuel production Fig 2 showed that there is a drastic increase from 2013-2017 in the production of biodiesel and its application. The application of waste biomass is used for oil production and the study states the use of waste matter from biomass are driven with energy efficient molecule [8]. Keywords like Biofuel, biotechnology, Zea mays, bioreactors, and fermentations were highlighted in 2013-2015. Later in 2017, microalgae and manure in relation to biofuel production were related. Similarly, biodiesel, waste water, lignocellulose was interrelated to biogas production in the paper analyzed.

Table 1. Classification of Petro-plants

Part of Plant metabolites	List of Plants		
Seed Oil Plants	*Ricinus communis*	*Jatropha curcus*	*Calotropis sp. Sapium sp.*
Laticiferous Plants	*Euphorbia antigonum*	*E.nivulia, E.nesifolia*	*Aslepias, Calotropis gigantia*
Resinous Plants	*Pinus Canarium*	*Vateria Cycas*	*Dipterocarpus*
Algae Plants	*Botrococcus*	*Chlorella pyrenoidosa*	*Chlamydomonas*

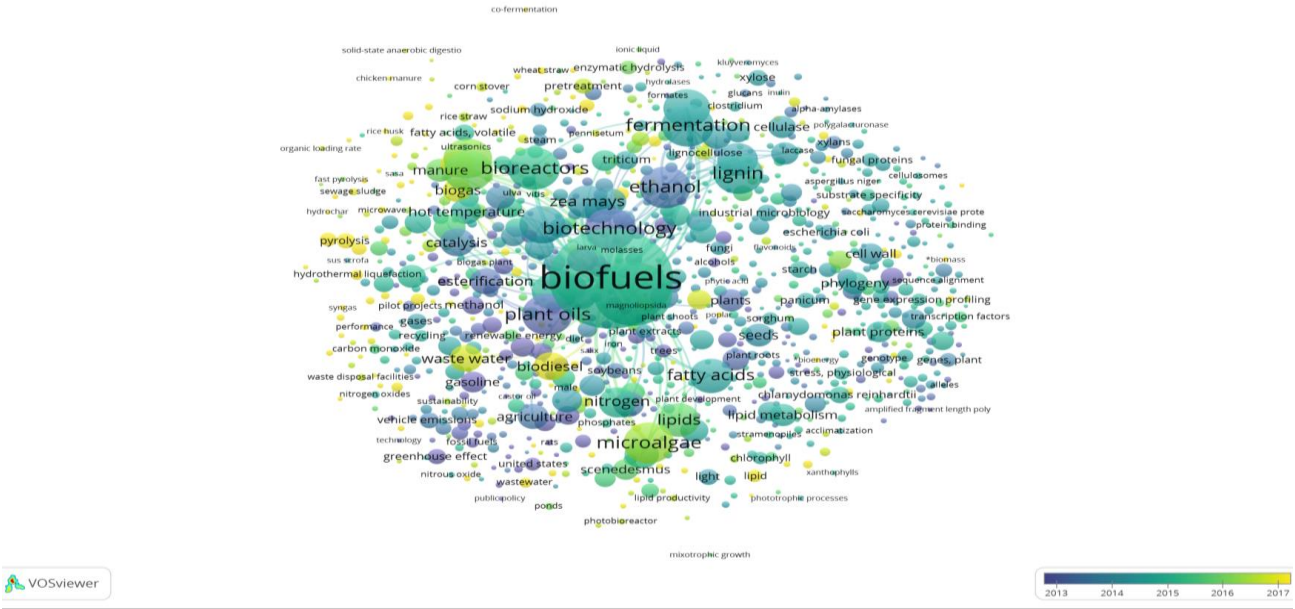

Fig 2. Overlay display network based on keyword during the year 2013-2017

Biofuel production from plants is widely used and researchers are basically focusing on biomass from plant products. Many keywords, especially Bio-oil have more occurrence in a research paper from the PubMed database. Biofuel innovative research and its application are showing a steady trend from linkage analysis using keywords [9]. The next keyword observed from the present study showed that the Co-digestion way of extracting oil from plant biomass was highly embraced.

The relevance score calculated using VOS viewer software generated 2.35 as score for Biodiesel engine and 2.25 for Organic loading rate (Table 2). Previous literature survey [10] showed that microalgae, vegetable oil and waste cooking oil are the most general raw material for biodiesel production. The present study also showed links with microalgae and plant oil for biofuel production. About 8,261 papers were screened from PubMed for the study and these articles showed significant increase in annual output [11].

Table 2. Number of times keywords observed in VOS viewer

Sl. No.	Keywords search in VOS viewer		
	Term	Occurrence	Relevance
1.	Biodiesel Engine	104	2.35
2.	Organic loading rate	138	*2.25*
3.	Co-digestion	183	2.08
4.	Anaerobic co digestion	147	2.05
5.	Volatile solid	112	1.83
6.	Bio-oil	268	1.78

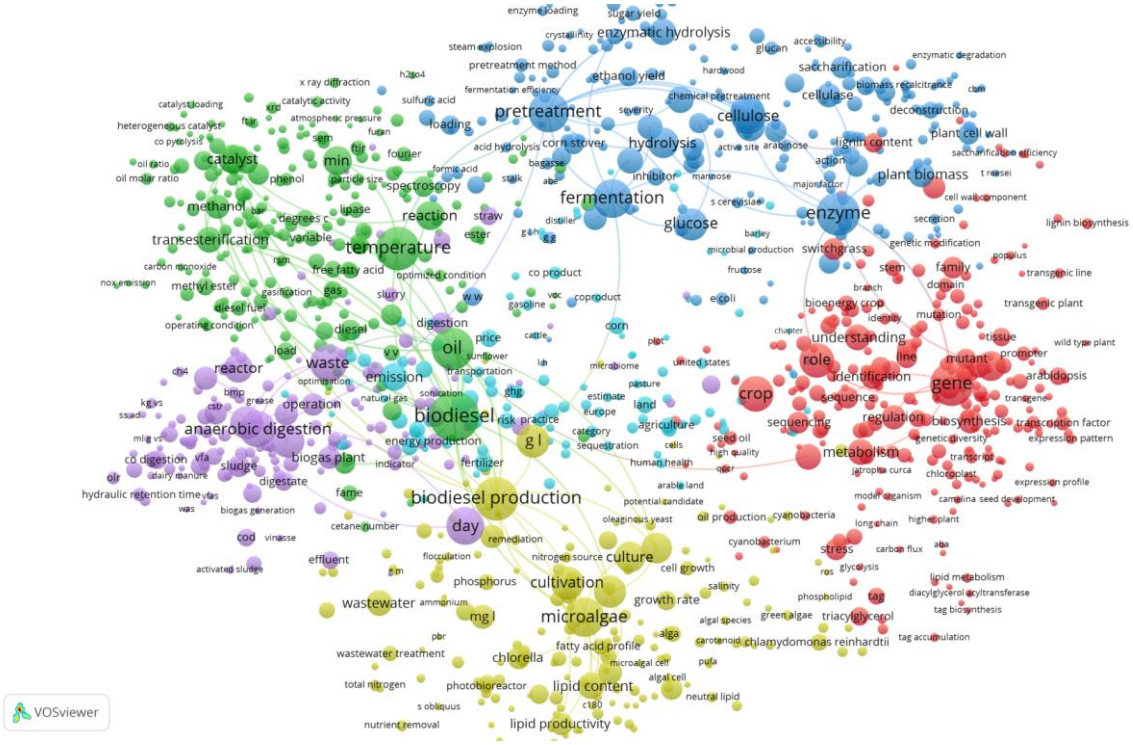

Fig 3. Clustering and links created by keyword search

The study showed that biodiesel production from plants is spreading from the genomic level to proteomic aspects. While analysing the result, the keywords showed six clustering patterns and 20. 6701 links as shown in Fig.3. Each colour depicts the groups and clustering pattern. The green cluster explains the enzyme kinetic reaction of biofuel production whereas, the blue cluster displays the fermentation, hydrolysis of cellulose and glucose in plants to generate fuel. Gene interaction and regulation with their metabolism are observed in the red cluster. Yellow cluster shows the microalgal role in biofuel generation and its cultivation, production, and processing of oil. The last cluster shows that anaerobic digestion and co-digestion play equal roles in synthesizing natural biofuel [12].Bibliometric method is an effective research tool

which has already been widely applied for statistics of scientific production. It has its research trends in science and related disciplines.

4. Conclusion

Bibliometric analysis of biodiesel synthesis from plants showed linkages to the diverse fields. Biofuel showed six clustering patterns especially biodiesel production, biotechnology, and anaerobic digestion. The analysis of review papers from PubMed clearly indicated that biofuels showed a direct link to the biotechnology field, plant oils, and ethanol production. The study reviews the research pattern in biodiesel production and its challenges in future developing countries. The analysis of interdisciplinary network found that biofuel studies have been based on the combination of multi-subject categories. The main advantage of this data analysis was based on massive data which can be simplified and analysed to find the relationship of close keyword and research trends in the field of biofuel.

5. Acknowledgements

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