

Study on Preparation of Photocatalytic Degradation Materials for Organic Pollutants based on Fecal Biochar: A Bibliometric Analysis based on VOSviewer

Yunlu Cao^{1,a}, Jinna Lu^{1,b}, Can Zheng^{1,c}, Mingyuan Li^{1,d}, Sen Zhang^{1,e}, Wencong Hu^{1,f} and Haowei Yang^{1,g}

¹School of Marine and Environmental Science, Tianjin University of Science and Technology, Tianjin 300457, China.

^a2496583797@qq.com, ^b2712561146@qq.com, ^c1259034044@qq.com,

^d1010947793@qq.com, ^e1590425785@qq.com, ^f917845855@qq.com,

^gyanghwei@tust.edu.cn

Abstract

To summarize the specific content, development status and research focus of photocatalyst. The specific content of photocatalyst was summarized through literature review. VOSviewer was used to analyze the literature of photocatalyst from 2000 to 2021 in web of science database. The degradation, titanium dioxide, photocatalyst and nanoparticles are the focus of research in the field of photocatalyst; At present, the main raw materials for the preparation of photocatalyst are bamboo charcoal and core-shell. We should strengthen the reasonable development and research of insect excrement in the preparation of photocatalyst, and expand the source of biomass raw materials.

Keywords

Water Pollution; Photocatalyst; Biochar; Feces; VOSviewer.

1. Introduction

Water is the source of life. Protecting water resources from pollution is the top priority of environmental protection. At present, water pollution is mainly caused by industrial wastewater, domestic wastewater and livestock wastewater, which has the comprehensive characteristics of wide range, complex types and high concentration, and has a great impact on people's production, life and health [1]. At the same time, China's livestock and poultry breeding industry is also rapidly improving. With the continuous growth of the industry, a large number of feces are nowhere to be absorbed, causing certain pollution to soil, atmosphere, especially water body [2]. In recent years, in the face of severe water environment pollution situation, all levels take the fight of water pollution prevention and control as the starting point, firmly establish and practice the concept of "green water and green mountains are golden mountains and silver mountains" [3], strengthen the comprehensive treatment of water pollution, and vigorously develop a variety of refractory organic substances in highly efficient degradation wastewater [4]. In this paper, from the perspective of bibliometrics [5], through the visual knowledge discovery tool VOSviewer, we will conduct text mining on the research literature of photocatalyst, draw the map of scientific knowledge, discuss the hot spots of photocatalyst research and the situation of researchers and research institutions, so as to provide reference for the further Research of photocatalyst.

2. Experiment

2.1 Data sources

Web of science was used as the data source for subject retrieval. The key words were single "Photocatalyst" and the intersection of "Photocatalyst" and "biochar". The publication time of the literature was in the user-defined age range from 2000 to 2021. The retrieval time was June 26, 2021. A total of 1338 and 3 related articles were retrieved. The literature information includes author, unit, title, abstract, key words and so on. And create a new folder for standby.

2.2 Analysis Method

VOSviewer is a knowledge discovery tool jointly developed by van Eyck and Waterman of Erasmus University in the Netherlands. It is good at topic mining, literature coupling, CO citation analysis and cooperation network analysis [4], especially in clustering analysis [5]. In this paper, VOSviewer 1.6.16 network view, overlay view and density view are used to show the research hotspots of photocatalyst and biochar and the author's time sequence.

3. Results

3.1 Analysis of "Photocatalyst"

3.1.1 Research Hotspots

The text document format file is imported into VOSviewer 1.6.16, co-occurrence is selected for type of analysis, keywords is selected for unit of analysis, and full counting is selected by default for counting method. After debugging, the threshold of keyword frequency in VOSviewer 1.6.16 is finally set as 5, that is, keywords with total frequency no less than 5 will enter the visualization analysis, The software shows that 351 of the 3872 keywords have reached the threshold. The generated keyword co-occurrence analysis visual network is shown in Figure 1. Degradation, photocatalyst, titanium dioxide, water, properties, nanoparticles, oxidation, adsorption and so on are the focus of researchers in this field.

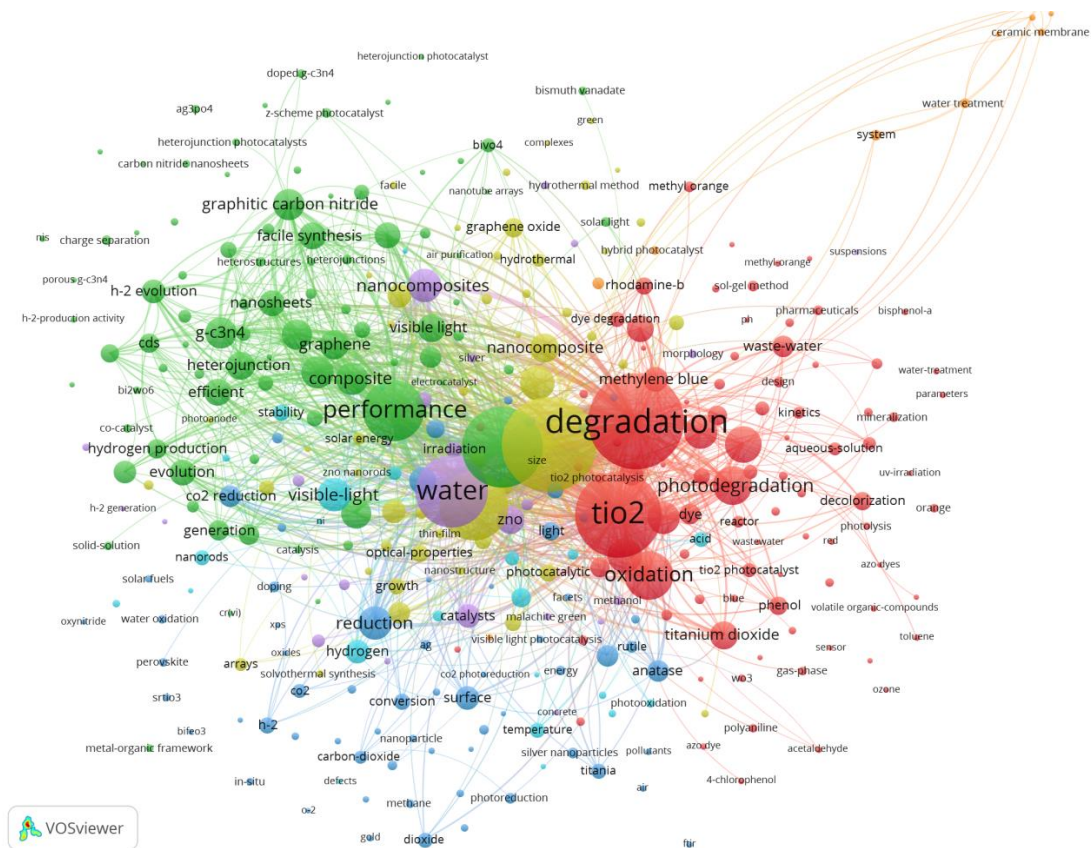


Fig. 1 Keyword co-occurrence analysis visualization network

3.1.2 Author Sequence

Import the text document format file into VOSviewer 1.6.16, select co authorship for type of analysis, select authors for unit of analysis, and select the default full counting for counting method. After debugging, the threshold of keyword frequency in VOSviewer 1.6.16 is finally set as 5, that is, the name of the author whose total frequency is not less than 5 will enter the visualization analysis, The software shows that 55 out of 4894 authors have reached the threshold, and the generated visualization time sequence of author co-occurrence analysis is shown in Figure 2. As can be seen from the time line of color gradient at the bottom right, the transition from dark purple to positive yellow represents the span of time from 2016 to 2019. From the author's collinear label view, we can see that the author's publishing time is mainly from 2017 to 2018, and the collinearity of Jung, sang Chul and other authors is the most prominent.

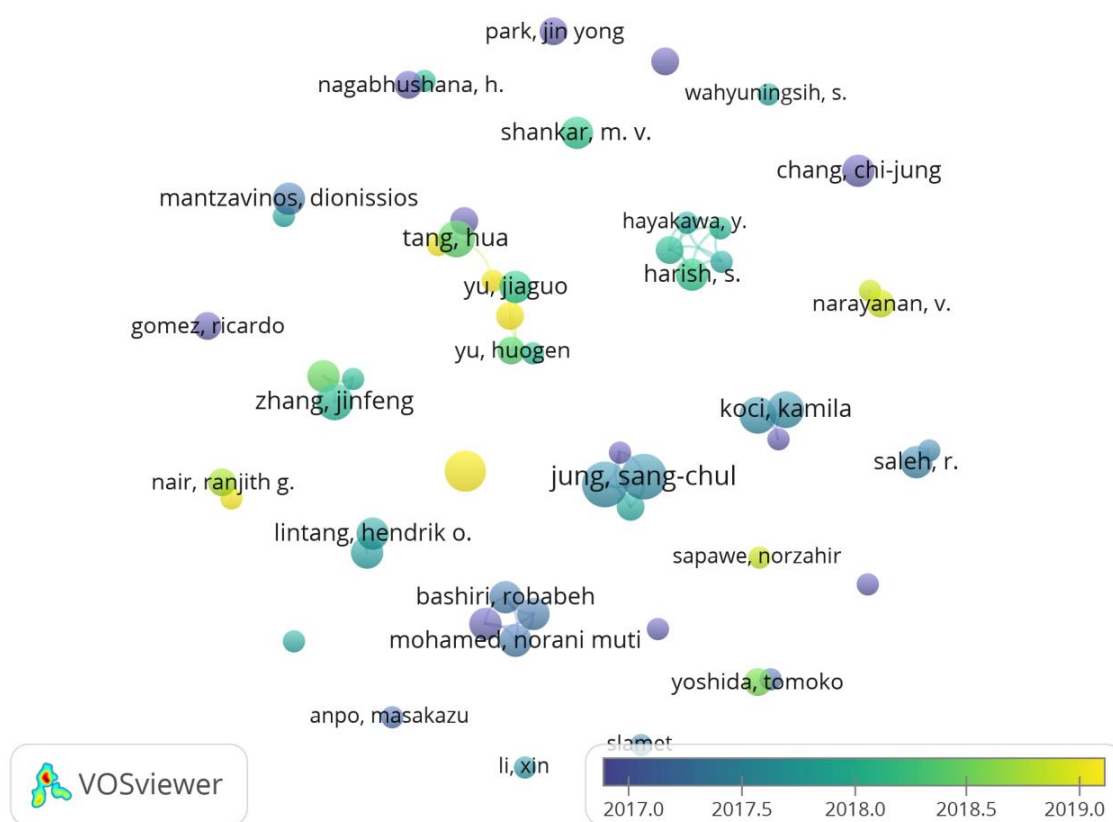


Fig. 2 Author co-occurrence analysis visualization time series

3.1.3 National Attention

Import the text document format file into VOSviewer 1.6.16, select co authorship for type of analysis, select countries for unit of analysis, and select the default full counting for counting method. After debugging, the threshold of keyword frequency in VOSviewer 1.6.16 is finally set as 3, that is, countries with total frequency of no less than 3 enter the visualization analysis. The software shows that 47 countries in all 84 countries have reached the threshold, and the generated visual network of country co-occurrence analysis is shown in Figure 3. It can be seen from the network visualization that in the selected years, China published the most literatures related to photocatalyst, followed by India. The degree of collinearity shows the close relationship between different countries in the field of photocatalyst research. According to the figure, in this field, China actively exchanges and discusses with many countries, among which technology sharing with the United States, Japan, India and Australia is the most frequent.

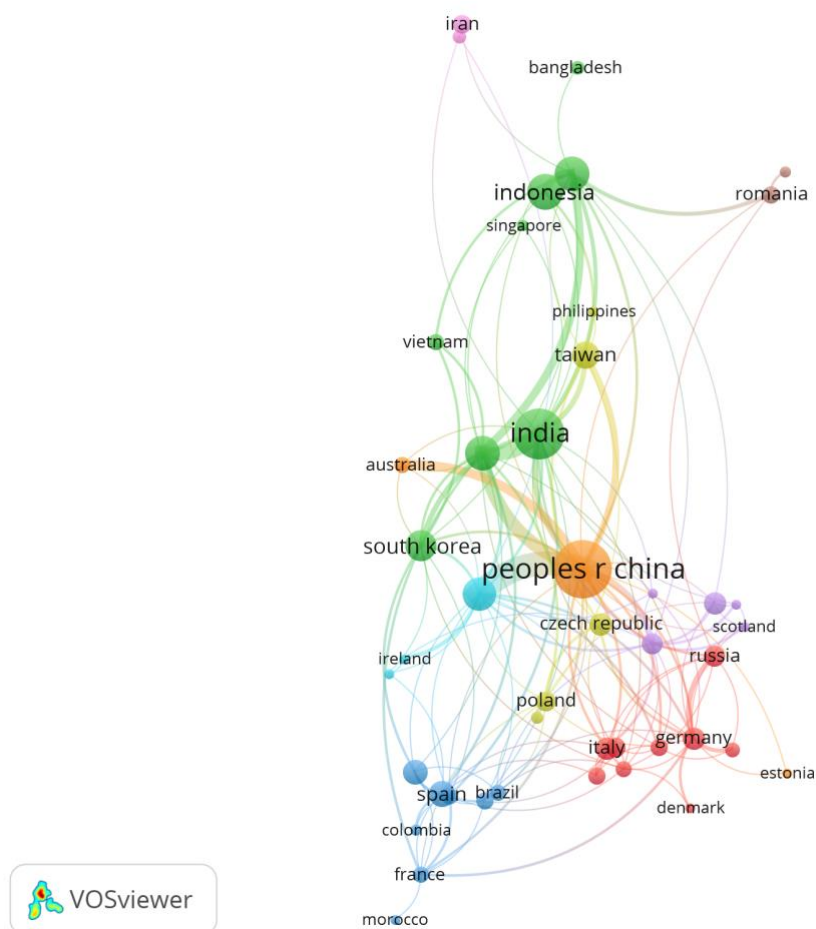


Fig. 3 National co-occurrence analysis visualization network

3.2 Analysis of "Photocatalyst" and "biochar"

3.2.1 Research Hotspots

The text document format file is imported into VOSviewer 1.6.16, co occurrence is selected for type of analysis, keywords is selected for unit of analysis, and full counting is selected by default for counting method. After debugging, the threshold of keyword frequency in VOSviewer 1.6.16 is finally set as 1, that is, the keyword with total frequency no less than 1 will enter the visualization analysis, The software shows that 19 of the 19 keywords have reached the threshold, and the generated keyword co-occurrence analysis visualization density is shown in Figure 4. In the graph, the size of the node represents the force between the two keywords, and the distance between the nodes reflects the degree of similarity between objects. The closer the distance is, the higher the degree of similarity is, and vice versa. It can be seen from the spectrum that degradation, titanium dioxide, photocatalyst, nanoparticles and so on are the focus of researchers in this field. Among them, only biochar prepared from bamboo charcoal and core-shell biomass was used as catalyst raw materials.

3.2.2 Author Network

Import the text document format file into VOSviewer 1.6.16, select co authorship for type of analysis, select authors for unit of analysis, and select the default full counting for counting method. After debugging, the threshold of keyword frequency in VOSviewer 1.6.16 is finally set as 1, that is, the name of the author whose total frequency is not less than 1 will enter the visualization analysis, The software shows that 12 of the 12 authors have reached the threshold, and the generated visual network of author co-occurrence analysis is shown in Figure 5. The collinearity between Wu, Fangjun and other authors is the most intensive.

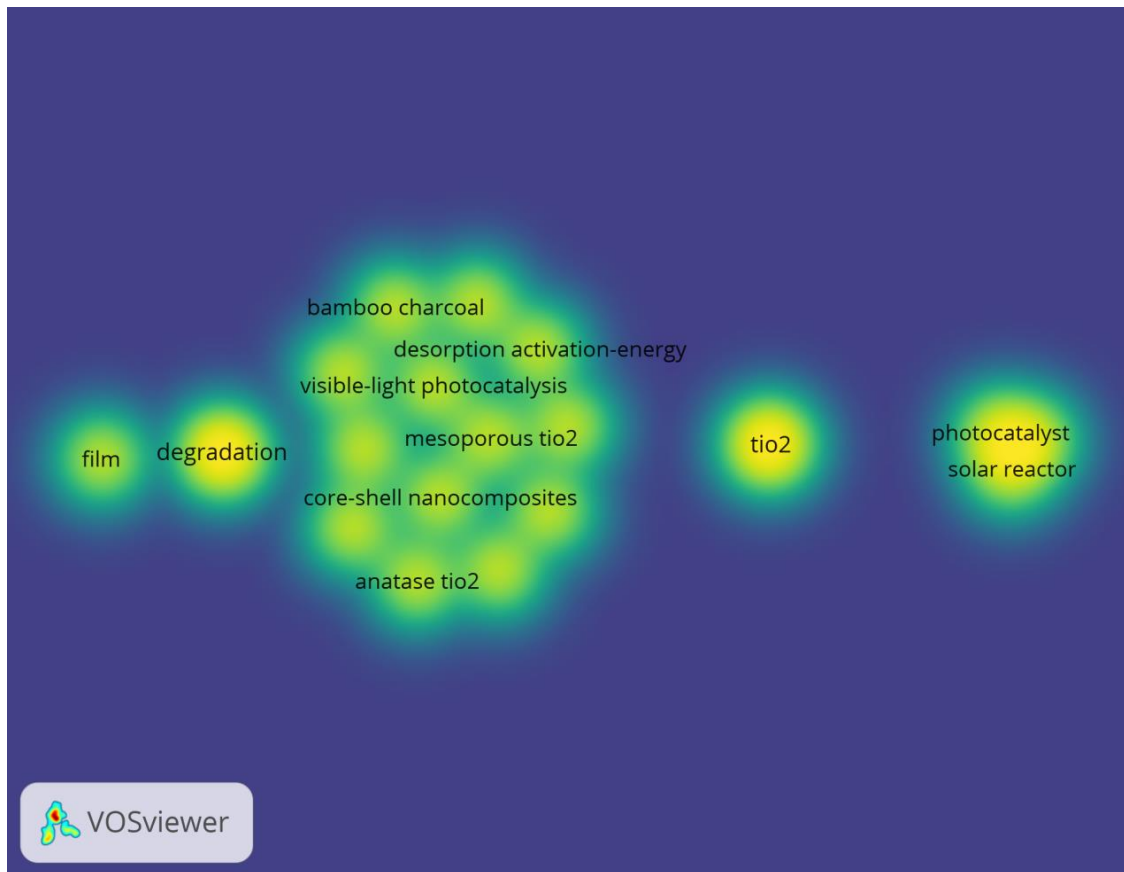


Fig. 4 Keyword co-occurrence analysis visualization density

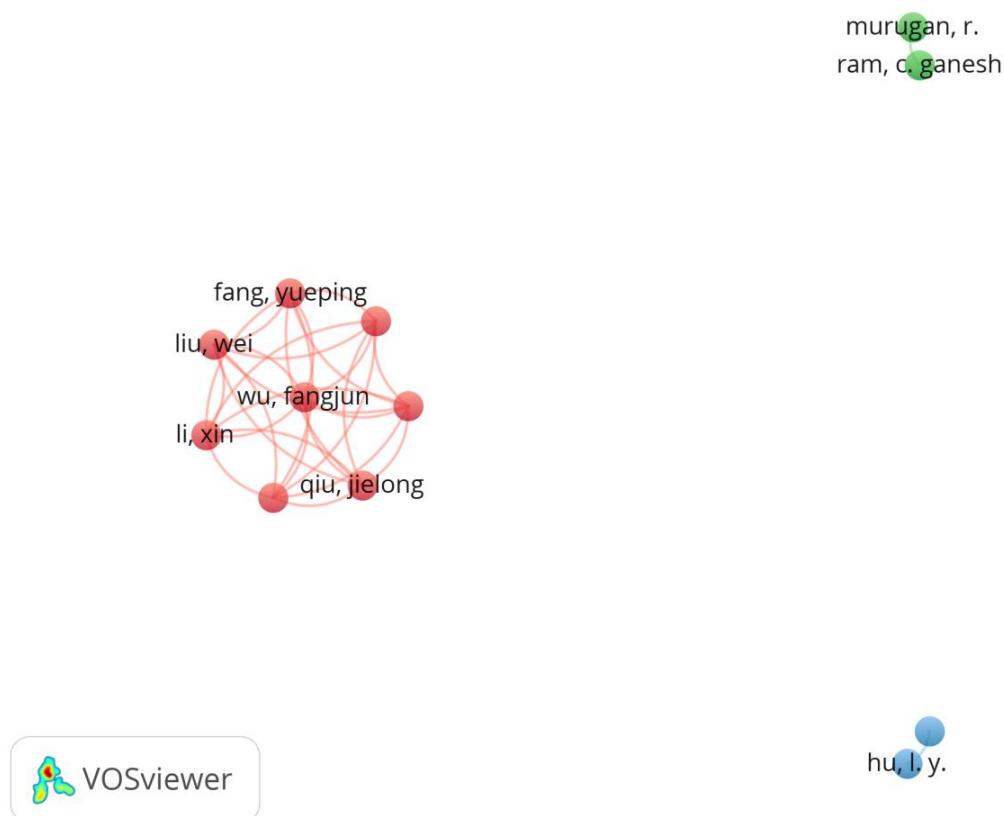


Fig. 5 Author co-occurrence analysis visualization network

Based on VOSviewer's analysis of the research hotspots of photocatalyst and preparation of photocatalyst with biochar as raw material, it is found that photocatalyst and preparation of photocatalyst with biochar as raw material have the following characteristics: ① the sustainable development concept of "green water and green mountains are golden mountains and silver mountains" was put forward in 2005 and formally implemented in 2017, And has been strong voice to the world the importance and necessity of sustainable development, which is consistent with the above time series analysis results; ② It can be seen from the keyword salience map from 2000 to 2021 that there are four overlapping salience words. Degradation, titanium dioxide [8], photocatalyst, nano particles [9] are the focus of researchers in this field; ③ Through the analysis, we know that the biomass raw materials for the preparation of photocatalyst [10] are mainly bamboo charcoal and core-shell [11-13].

4. Conclusion

Based on the above research, the source of raw materials for the preparation of photocatalyst can be more extensive. Today's rapid development of livestock and poultry industry will inevitably bring a lot of feces, and if these feces are not handled properly, it is very easy to cause water pollution. Relevant studies have shown that the biochar prepared from insect dung has a good pore structure, which is conducive to the rapid transmission of photogenerated electrons. It is necessary to develop and study insect dung reasonably and broaden the source of raw materials for the preparation of photocatalyst.

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