Hindawi
Mobile Information Systems
Volume 2022, Article ID 3389112, 10 pages
https://doi.org/10.1155/2022/3389112

Research Article

Characterization Techniques Application on Pesticide Adsorption Mechanism Research of Corn Straw Biochar Based on KOH Thermal Activation

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Received 22 June 2022; Revised 20 July 2022; Accepted 22 July 2022; Published 3 August 2022

Academic Editor: Chi Lin

In this paper, research on pesticide adsorption mechanism of corn straw biochar based on KOH thermal activation is carried out. In this paper, corn stalks and pine needles are used as raw materials for preparing biomass charcoal, and biochar is prepared at temperatures of 200°C, 400°C, and 600°C. This paper uses thermogravimetric analysis, elemental analysis, electron microscopy scanning, aperture measurement, infrared spectroscopy, and other characterization techniques to analyze the structure and properties of biochar in detail. Moreover, this paper uses batch method to select different organic pesticides diuron and carbaryl to test their adsorption performance. This article discusses the relationship between the adsorption mechanism and structural characteristics of biochar for organic pollutants. In addition, this paper studies the adsorption mechanism of diuron and carbaryl in the loess by adding exogenous biochar to the loess. Finally, this article analyzes the impact of the addition of biochar on the environmental behavior of diesel-contaminated loess adsorption of organic pollutants. This paper studies the role of KOH thermally activated corn stover biochar in agricultural adsorption, and verifies the reliability of the method proposed in this paper through experimental studies.

1. Introduction

With the development of modern agriculture, a large number of pesticides are used for the prevention and treatment of diseases, pests, and weeds. It is of great significance in ensuring a bumper harvest in agriculture, promoting the development of high-yield, high-quality, and efficient modern agriculture, meeting people's demand for agricultural and sideline products, and reducing the intensity of agricultural production. According to incomplete statistics, if pesticides are not used in world food production, the average loss of the three major food crops of wheat, rice, and corn will be more than 30%. If pesticides are not used, the output of agricultural products may be reduced by about 40% in the first year, and the output may be reduced by 60% or even no production in the second year [1]. The use of pesticides in my country can recover 15–30% of the loss of agricultural products every year, and the income from the use of pesticides is about 4 times the cost of pesticides. Therefore, pesticides have become an indispensable means of production in the modern agricultural production [2]. However, while the use of pesticides brings huge benefits to mankind, pesticides and the metabolites and degradation products of some pesticides not only pollute the crops themselves, but also pollute the growth environment of crops such as soil and natural water bodies, posing serious threats to the ecological environment and human health. With the progress of society and the enhancement of human environmental protection awareness and the increasing exposure of the harm caused by the pesticides, people have begun to realize the seriousness of the harm caused by pesticides to human health and environmental pollution. Moreover, all countries in the world have formulated relevant rules and regulations to strictly manage pesticides, and environmental pollution and governance of pesticides have become a global problem. The United States, Japan, Malaysia, South Korea, Canada, the United Kingdom, Germany, Russia, France, Russia, Taiwan, and other countries and regions have successively established standards for maximum pesticide residue limits, and formulated and promulgated relevant standards. At the same time, the United Nations, European Community, and other world organizations have established a special pesticide residue work system, which is fully responsible for the formulation of pesticide residue standards [3].

The use of pesticides has increased the output of agricultural products. Driven by market demand and economic benefits, people have used more and more pesticides. Although my country has issued relevant industry standards for the safe use of pesticides many times, as well as a list of prohibited pesticides [4], under the temptation of economic interests, the use of pesticides continues to increase; The human body is exposed to organic pesticides remaining in the environment through various channels, and trace amounts of toxic pesticides slowly enter the human body. Accumulation, although it will not cause obvious acute poisoning hazard to the human body in a short time, it will cause chronic potential hazards. For example: organophosphorus and carbamate pesticides can inhibit cholinesterase activity, and prolonged exposure to such pesticides affect the normal function of the human nervous system. Biochar is a carbon-rich substance formed by the pyrolysis of wastes such as wood, straw, manure, or leaves under oxygen-limited or anaerobic conditions. My country produces a large amount of agricultural straw waste every year, but the utilization rate is very low and less than 50%. More than 30% of the straw is directly burned or discarded in the field, which not only causes serious waste of resources, but also causes environmental pollution and other problems. Especially in remote rural areas, the random burning of agricultural straws releases a large amount of CO2 gas, which aggravates the greenhouse effect; on the other hand, the random stacking of agricultural waste makes the toxic and harmful pollutants enter the soil and groundwater with the erosion of rainwater., which can also become the source of agricultural pollution. However, the preparation of biochar can be a new way to deal with agricultural waste straw, because the unique properties of biochar itself determine its utilization value. Applying biochar into the soil can improve the soil environment, and the carbon sequestration effect of biochar can alleviate the greenhouse effect to a certain extent. In addition, because of its special surface structure, biochar has the ability to adsorb pollutants, which is also of great significance for improving the quality and safety of agricultural products.

2. Related Work

Through the research on the environmental behavior of pesticides in soil, literature [5] found that the mobility of pesticides in soil is closely related to the physical and chemical properties of pesticides themselves, which is mainly affected by chemical properties, shape, structure, pH, water solubility, molecular size, and polarity. Ionic pesticides mainly react with soil particles through ion exchange and hydrogen bonding, while organic pesticides that are easily dissociated into cations can be adsorbed in soil or sediments through cation exchange (ionic bonding). The literature [6] found that the content of organic matter in the soil plays a decisive role in the adsorption of nonionic herbicides to a certain extent. However, mineral components have little effect on its adsorption, while ionic herbicides have the opposite effect.

Since the structure of biomass charcoal is relatively loose, it can be mixed with the soil to increase the porosity of the soil, thereby increasing the air and moisture content in the soil. Unlike other organic matter in the soil, biomass charcoal contains more trace elements and the biomass charcoal applied to the soil also has good chemical stability, will not be weathered and decomposed for a long time, and can continuously improve the soil fertility [7]. Literature [8] applied biomass charcoal as fertilizer to corn fields, and found that the yield of corn has been significantly improved. In addition, mixing biomass charcoal and traditional inorganic or organic fertilizers into the soil in a certain proportion can delay the release of nutrients in the fertilizer, which will reduce the loss of nutrients and significantly increase the utilization rate of fertilizers. Biomass charcoal has also played a positive role in improving the absorption of nutrients by crops. The literature [9] found through a series of studies that the nitrogen content in the soil to which biomass charcoal is applied has increased to a certain extent. However, the research on the application of biomass charcoal as a soil amendment to agricultural production is still mainly in a short period of time, and the mechanism of action and long-term effects are still unclear. In addition, since it cannot be ruled out whether it has major side effects, it is currently difficult to promote it on a large scale. Scientists still need to further explore and study the biochar soil amendment.

In modern industry, almost all products that are produced have to go through the process of printing and packaging. In the process of packaging and printing, a large amount of dyes are consumed. This aspect has promoted the continuous development of the printing and dyeing industry. On the other hand, the excessive use of dyes has also caused a considerable degree of environmental problems [10]. If the surplus and unused dyes in the factory cannot be processed in time, they are easily discharged into the environment. Because dye molecules contain more aromatic functional groups, the complex molecular structure often makes them difficult to degrade, which will cause serious pollution to soil and rivers [11]. According to reports, some dyes can irritate human skin and cause allergic symptoms. In severe cases, it can also cause cancer or deformity [12]. For example: Methylene blue is the most common dye for cotton, wood, silk, and other products. It contains certain toxicity. Acute exposure to methylene blue solution can cause increased heart rate, vomiting, shock, cyanosis, jaundice, quadriplegia, and tissue necrosis. Reference [13]. Before being discharged to public water sources, how to effectively remove dyes from industrial wastewater is the focus of attention nowadays. Adsorption is generally considered to be a reliable technology for the treatment of dye-containing wastewater.

Out of economic considerations, scientists have been studying the process of preparing biomass-activated carbon from agricultural by-products and waste materials as raw materials for a long time. Various agricultural and forestry wastes, such as walnut shells, wood chips, rubber trees, jute fibers, snail shells, castor beans, coconut shells, and oil palm fibers, have been tried to prepare high specific surface area biomass-activated carbon adsorbents, especially for the research on the specific adsorption function of biomass charcoal that has always been valued by the scientific researchers [14].

3. Preparation of Corn Stover Biochar Based on KOH Thermal Activation

Soil is an important place for human activities to survive, and it is also the main destination for environmental behaviors of various external pollutants. The pollutants that enter the environment will eventually accumulate in the soil sediments. It often leads to secondary pollution of the groundwater environment. The organic pesticides remaining in the soil will be enriched and migrated in the food chain, which will cause harm to human health. After pesticides enter the soil environment, processes such as adsorption runoff, biodegradation, and plant absorption will occur. Moreover, it can be degraded into intermediate products or even completely mineralized under the combined action of physics, biology, and chemistry. Or, it migrates through leaching, evaporation, diffusion, absorption and enrichment of animals and plants, and causes pollution to the groundwater environment, atmosphere, and agricultural products (Figure 1). In this process, soil adsorption becomes a key step to lock pesticide pollutants and control their migration. The distribution capacity of pesticides in these media determines its ultimate fate in the environment [15].

The adsorption process of organic pesticide molecules in the soil is the process of their distribution in soil media such as solution, organic matter, and surface minerals (Figure 2). Hydrophobic distribution, covalent bonds, hydrogen bonds, ligand exchange, and chelation are important factors for the adsorption of organic pesticides on soil particles. Studies have pointed out that when atrazine and other herbicides are adsorbed on solids such as activated carbon or clay minerals, compared with soil organic matter, the role of mineral components in sediments to adsorb organic pollutants is not the primary factor. On the one hand, the soluble organic matter in the soil can solubilize pesticides. On the other hand, there are special adsorption sites in the humic acid structure of organic matter, which can still adsorb herbicides on the surface. However, the amount and structural composition of the organic matter in the soil in different regions are different, which makes the environmental behavior of organic pollutants such as pesticides different. Therefore, studying the environmental behavior of pesticide pollutants in soil has far-reaching practical significance for soil pollution control [16].

Broadly speaking, biochar is a type of black carbon. Because of its special structure, it has a wide range of applications in the fields of agriculture, ecological restoration, and environmental protection. It was found that biochar prepared from different sources and different pyrolysis conditions showed differences in the adsorption performance of organic pollutants and heavy metals [17]. Therefore, it is necessary to effectively characterize the prepared biochar to understand the changes in its structure and properties and reveal its influence on the adsorption of organic pollutants by loess. We selected corn stalks and pine needles as the biomass raw materials in this study, and the preparation of biochar was carried out at 200, 400, and 600 temperature conditions by oxygen-limited and temperature-controlled pyrolysis. We use thermogravimetric analysis, elemental analysis, FTIR spectroscopy, specific surface area analysis, and other methods to characterize the structural characteristics of each substance, and analyze the effects of different preparation methods on its elemental composition, surface structure, and surface properties. The problem of soil pollution caused by the abuse of various pesticide pollutants has become more and more serious. This has attracted the attention of my country's environmental protection departments, and relevant laws and regulations have also made further improvements and clear regulations, which have made soil pollution problems in my country. It has become a research hotspot for environmental workers, and the environmental behavior of various toxic and hazardous pollutants in soil has also become an important research topic in the environmental field. Therefore, it is necessary to seek a new way that is cost-effective and can improve soil environmental pollution, while also improving the soil environmental quality. This has also become an objective requirement for ensuring the safety, yield, and quality of agricultural products. There are great differences in soil structure and organic matter content in different regions, and there are also great differences in their ability to adsorb organic pollutants. Up to the present stage, there is a lack of relevant theoretical studies on the adsorption behavior of organic pesticide pollutants in loess in Northwestern cold and early regions by exogenous biochar, especially for some new persistent organic pollutants. At present, the research on the influence mechanism of biochar on the migration and transformation behavior of organic pollutants in the soil environment is not diminishing. The heterogeneity of carbon itself makes the adsorption effect, process, and mechanism of different biochar to have certain differences, so it has great research potential.

Pesticides are widely used in agricultural production to improve the yield and appearance quality of agricultural products. They are a very common environmental pollutant. A large number of residual pollutants entering the soil environment will produce a series of side effects, which will reduce the quality of the soil, affect the activity of microorganisms, and then cause soil compaction, which is not conducive to the long-term growth of crops. Therefore,

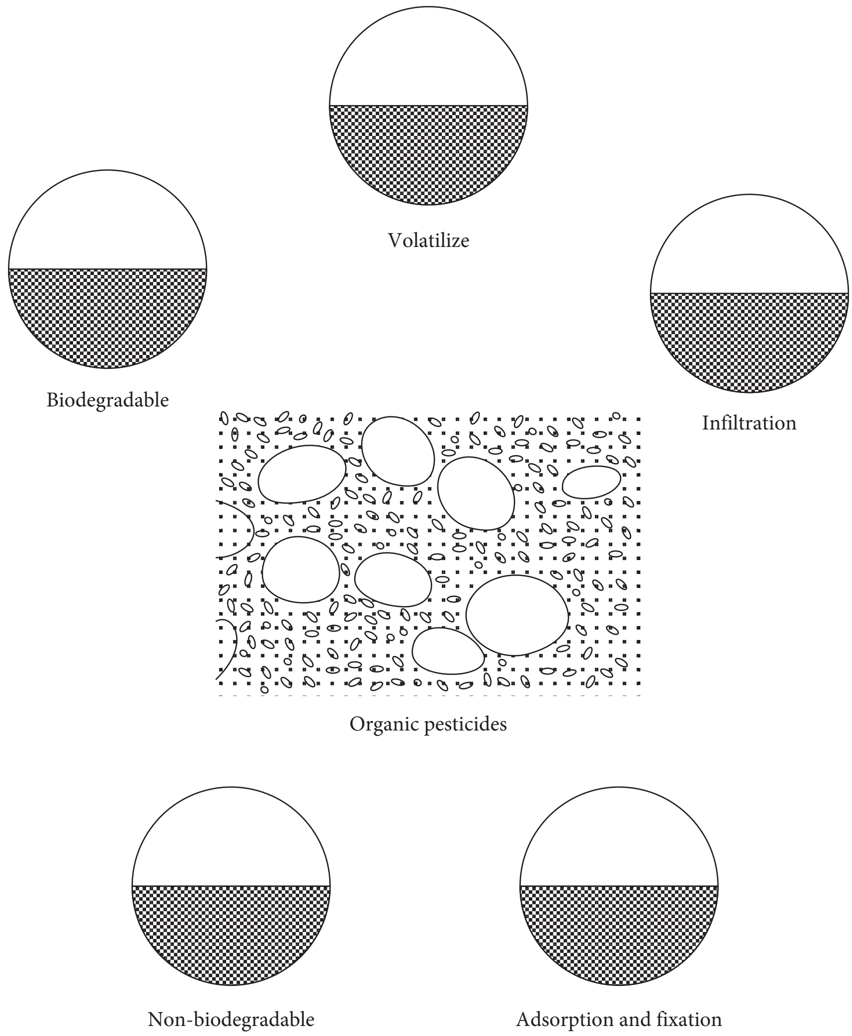

Figure 1: The fate of pesticides in the soil environment.

exploring the adsorption mechanism of pesticide pollutants in soil helps to provide a certain theoretical reference for the treatment and improvement of soil in polluted areas [18].

Based on the above analysis, this paper studies the adsorption mechanism of corn stover biochar pesticides based on KOH thermal activation, and the following research will be carried out in conjunction with the experimental research.

The raw material of biochar is derived from corn stalks in the north. We first wash away the adhering debris on the surface of the straw, then ventilate and dry it under natural conditions, then crush it and sieve it, soak it in a certain amount of deionized water for 24 hours, and then filter it. Finally, it is dried in a drying box and stored for later use. The main instruments include thermogravimetric analyzer, temperature-controlled muffle furnace, Fourier transform infrared spectrometer, element analyzer, scanning electron microscope (SEM), and specific surface area analyzer.

We use limited oxygen temperature control carbonization method, weigh a small amount of straw powder in a crucible, carbonize it at 200, 400, and 600°C, respectively, for 6 h, take it out after cooling to room temperature, sieving, and storing. The sample numbers of corn stover and pine needle biochar are MBC-200, MBC-400, MBC-600, PBC-200, PBC-400, and PBC-600, respectively.

1 mol/l KOH solution and 5 g biochar are mixed. The mixture was magnetically stirred at 80°C in a water bath for 1 h, and then immersed for 11H at room temperature.

We use a cloth funnel to filter and separate the biochar mixture fully impregnated with KOH activator, and place the filtered biochar in a crucible for later use [19].

The biochar precursor obtained in the previous step was placed in a horizontal vacuum tube electric furnace in a nitrogen atmosphere (160 ml/min) (Figure 3). The biochar precursors with different alkali-to-carbon ratios were activated at 600°C, 700°C, and 800°C for 30 minutes, and the heating rate of the reactor was set to 3°C/min.

After taking out the cooled biochar, it was soaked in an excess HCI solution with a concentration of 0.1 mol/L and boiled slightly for 10 minutes. After cooling, it is washed repeatedly with the same concentration of HCl solution, and finally washed with distilled water until the

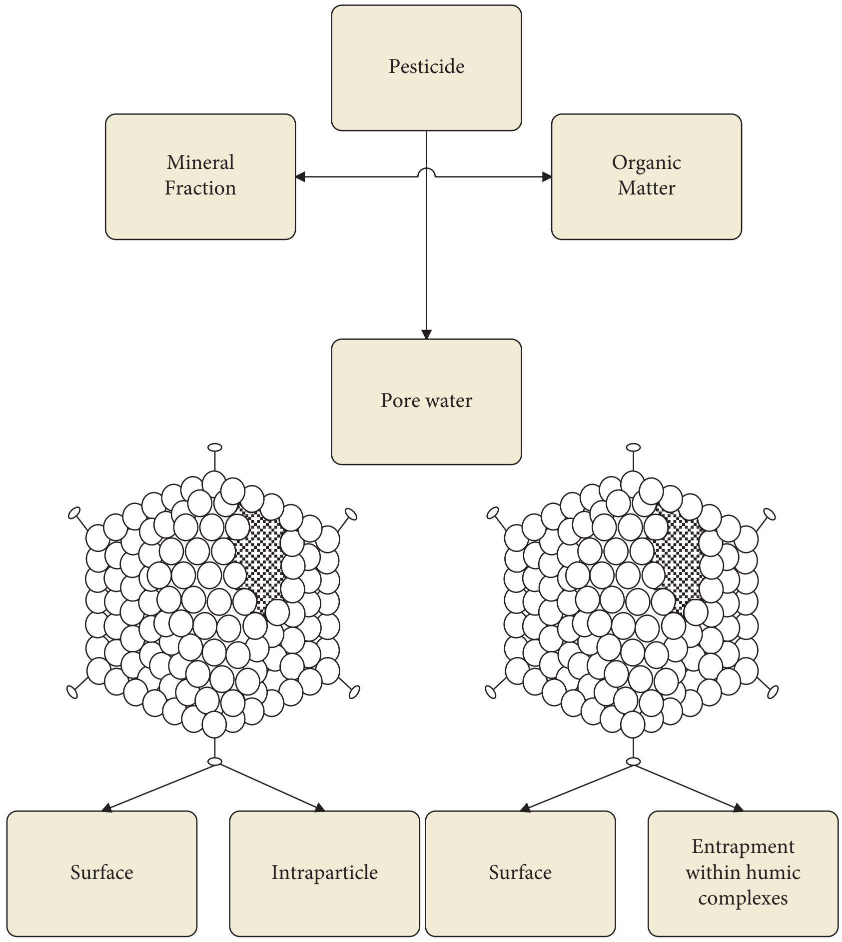

Figure 2: The adsorption of organic pollutants such as pesticides by soil.

pH of the filtrate is 6-7. After filtration and separation, the activated biochar is dried at 105°C for 12 h and cooled to room temperature for later use, which is called activated biochar [20].

When biomass is pyrolyzed, part of the organic matter is destroyed, while relatively stable carbonaceous substances are retained. The ash content and yield of biochar are shown in Tables 1 and 2. From the calculation results in the table, it is concluded that the yield of biochar is related to the pyrolysis temperature in the preparation process. As the pyrolysis temperature increases, the yield shows a certain downward trend. When the pyrolysis temperature is 200°C, the yield of MBC-200 is 67.1%, and the yield of PBC-200 is as high as 75%. At 400°C, the carbonization yield of MBC-400 was reduced to 28.2%, and the carbonization yield of PBC-400 was reduced to 37%. However, when the temperature rises to 600°C, corn stalks and pine needles are carbonized in a large amount, the carbonization yield of MBC-600 drops to 24%, and the carbonization yield of PBC-600 drops to 2.27%. The comparison shows that the carbonization yield of pine needles is higher than that of corn stalks at the three different preparation temperatures. It is mainly due to the differences in the structure and elemental composition of the protoplasm. With the continuous increase of pyrolysis temperature, a large amount of cellulose breaks and loses.

Due to its special physical and chemical properties, biochar has been widely used in sewage treatment and air purification fields. Its application in soil is considered to be a win-win measure to alleviate climate change and increase soil fertility, and it has become a research hotspot in the field of agricultural production and ecological environment. Moreover, there are a wide range of sources of materials for the preparation of biochar. In this paper, corn stalk biochar and pine needle biochar are taken as examples to study the adsorption behavior of organic pollutants (carivin and diuron) of biochar obtained from different pyrolysis conditions. Moreover, this paper determines the adsorption thermodynamics and adsorption kinetics models, and discusses the relevant factors affecting the adsorption behavior.

4. Results

The kinetic adsorption curves of the pollutants diuron and carbaryl on different biochar are shown in Figures 4 and 5. The data is shown in Tables 3–6. It can be seen from the figure that the equilibrium adsorption capacity of biochar for diuron, carbaryl, etc. is positively correlated with its thermal cracking temperature. Whether it is the adsorption of diuron or carbaryl, the adsorption capacity of MBC-00 and PBC-

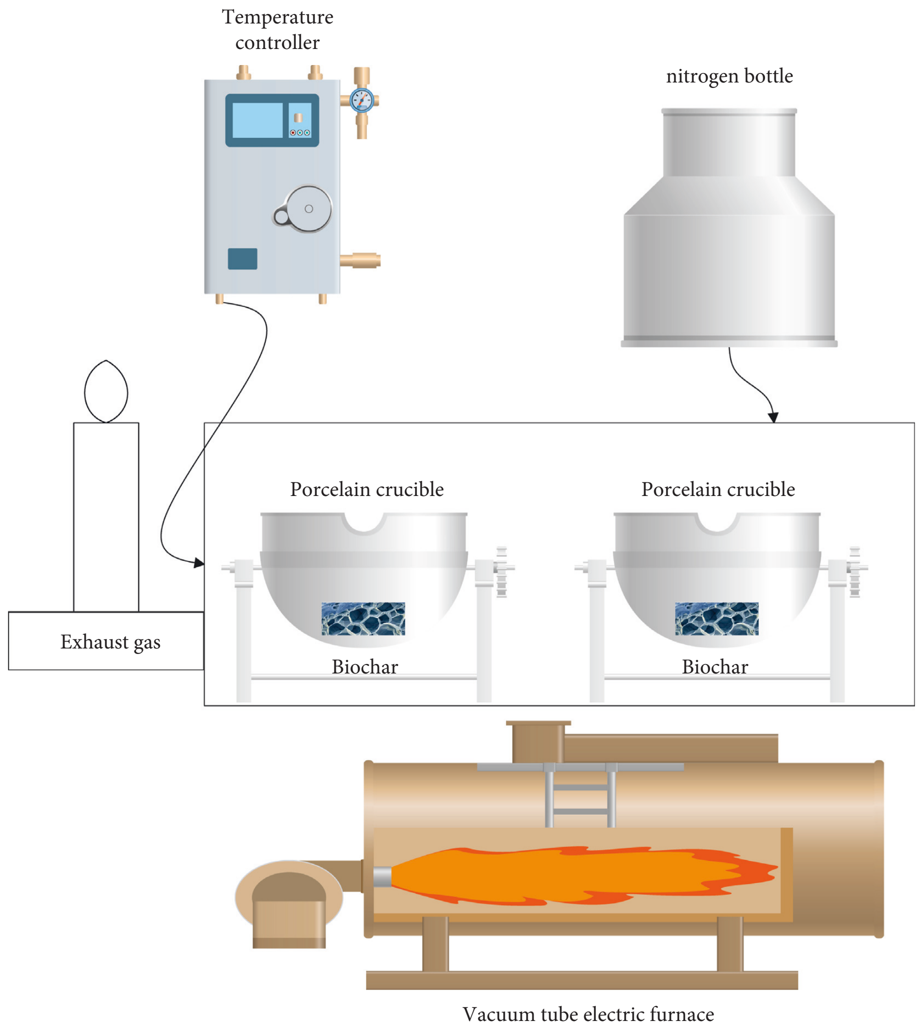

Figure 3: Schematic diagram of activation device.

Table 1: The yield, element composition, and ash content of corn stover biochar.

Sample name	Corn stover	MBC-200	MBC-400	MBC-600
Temperature/°C	—	200	400	600
Yield%	—	67.1	28.1	24.2
Ash content%	—	4.33	11.02	12.35
C%	43.6	51.36	53.22	55.32
H%	5.51	4.78	2.82	1.64
N%	0.44	0.49	0.46	0.47

Table 2: The yield, element composition, and ash content of pine needle biochar.

Sample name	Pine needles	MBC-200	MBC-400	MBC-600
Temperature/°C	—	200	400	600
Yield%	—	75.2	37.1	27.1
Ash content%	—	2.74	7.78	9.22
C%	52.5	65.65	63.94	67.34
H%	6.21	4.71	3.22	1.85
N%	0.31	0.6	54	0.57

600 is much greater than the adsorption capacity of biochar prepared at 200°C and 400°C. Moreover, all the adsorption processes are manifested as a fast reaction stage and a slow reaction stage. The fast reaction stage is mainly controlled by electrostatic gravity, and is mainly exchange adsorption. In this stage, the adsorption of carbaryl and diuron by biochar is first carried out on the surface of biochar. When the surface of biochar reaches adsorption saturation, there are pore structures inside the biochar particles, and these pores can accept more diuron and carbaryl molecules. Therefore, the carbaryl and diuron molecules adsorbed on the surface of the biochar slowly diffuse into the biochar particles, causing the surface of the biochar to become unsaturated again, and more carbaryl and diuron molecules need to be adsorbed. At this time, the concentration of the solution decreases. As the "active sites" that can be adsorbed on the surface of the biochar decrease and the concentration of carbaryl and diuron molecules that can be adsorbed in the solution decreases, the adsorption turns to a slow reaction stage. At this time, the adsorption rate decreases, and the adsorption gradually reaches a saturated state.

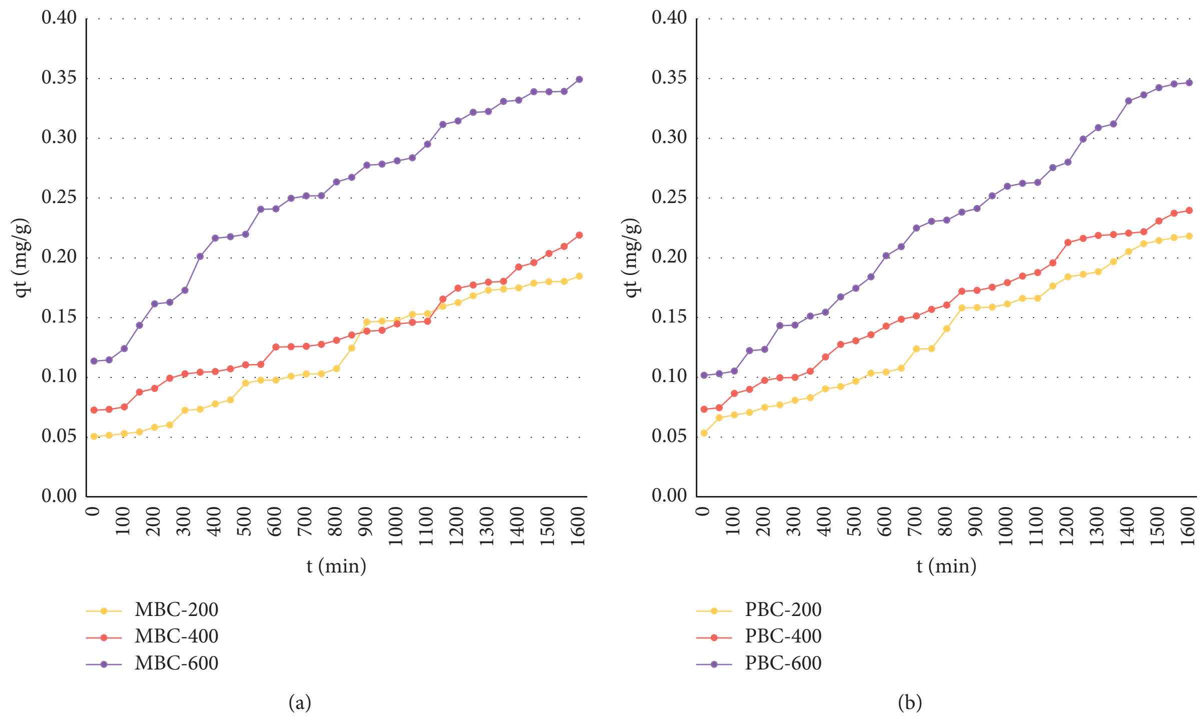

Figure 4: Kinetic adsorption curve of biochar on diuron: (a) diuron adsorption curve 1 and (b) diuron adsorption curve 2.

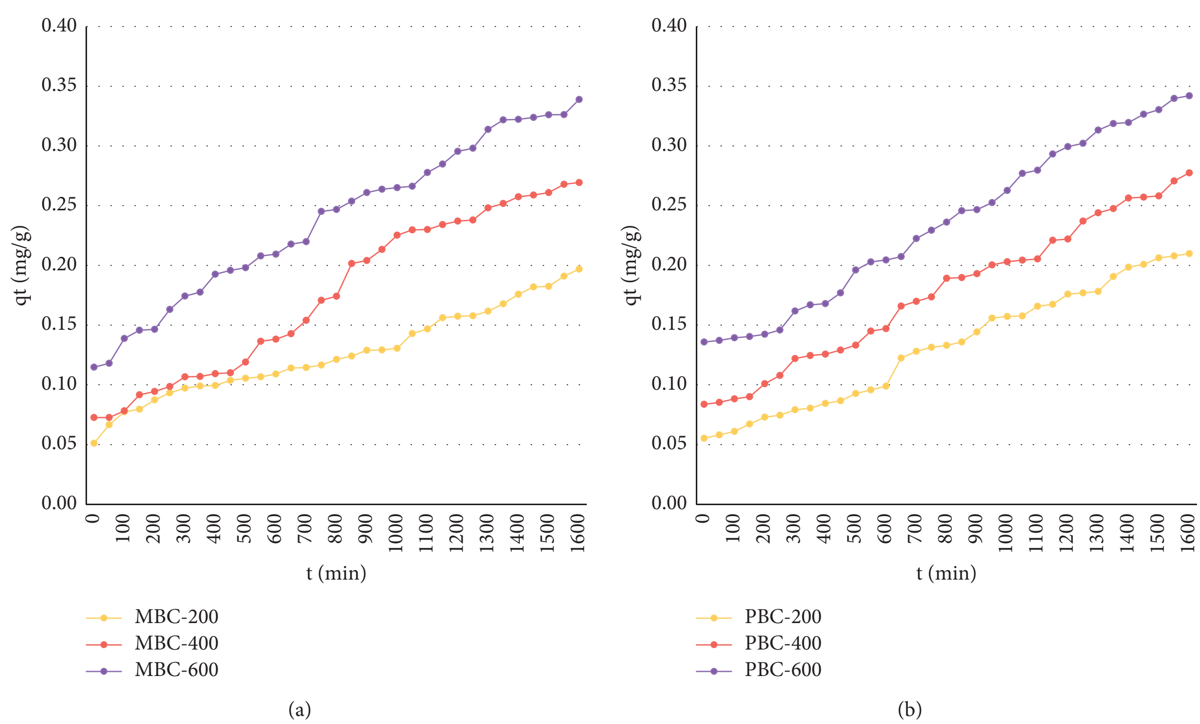

Figure 5: Kinetic adsorption curve of biochar on carbaryl: (a) Carbine adsorption curve 1 and (b) Carbine adsorption curve 2.

Table 3: Diuron adsorption curve 1.

Number	MBC-200	MBC-400	MBC-600
0	0.050	0.073	0.114
50	0.052	0.073	0.115
100	0.053	0.075	0.124
150	0.054	0.088	0.144
200	0.058	0.091	0.161
250	0.060	0.099	0.163
300	0.072	0.103	0.173
350	0.073	0.104	0.201
400	0.078	0.105	0.216
450	0.081	0.107	0.218
500	0.095	0.111	0.220
550	0.098	0.111	0.241
600	0.098	0.125	0.241
650	0.101	0.126	0.250
700	0.103	0.126	0.252
750	0.103	0.128	0.252
800	0.107	0.131	0.263
850	0.125	0.135	0.267
900	0.146	0.139	0.277
950	0.147	0.139	0.278
1000	0.148	0.145	0.281
1050	0.153	0.146	0.284
1100	0.153	0.147	0.295
1150	0.160	0.166	0.311
1200	0.163	0.175	0.315
1250	0.168	0.177	0.322
1300	0.173	0.180	0.322
1350	0.174	0.180	0.331
1400	0.175	0.192	0.332
1450	0.179	0.196	0.339
1500	0.180	0.204	0.339
1550	0.180	0.210	0.339
1600	0.185	0.219	0.349

Table 4: Diuron adsorption curve 2.

Number	PBC-200	PBC-400	PBC-600
0	0.053	0.073	0.102
50	0.066	0.075	0.103
100	0.069	0.086	0.105
150	0.071	0.090	0.122
200	0.075	0.097	0.123
250	0.077	0.100	0.143
300	0.081	0.100	0.144
350	0.083	0.105	0.151
400	0.090	0.117	0.154
450	0.092	0.128	0.167
500	0.097	0.131	0.174
550	0.103	0.135	0.184
600	0.104	0.143	0.202
650	0.108	0.148	0.209
700	0.124	0.151	0.225
750	0.124	0.157	0.230
800	0.141	0.160	0.231
850	0.158	0.172	0.238
900	0.158	0.173	0.241
950	0.159	0.175	0.252
1000	0.161	0.179	0.260
1050	0.166	0.185	0.262
1100	0.166	0.188	0.263
1150	0.176	0.196	0.275
1200	0.184	0.213	0.280
1250	0.186	0.216	0.299
1300	0.188	0.219	0.309
1350	0.197	0.219	0.312
1400	0.205	0.221	0.331
1450	0.212	0.222	0.336
1500	0.214	0.231	0.342
1550	0.217	0.237	0.345
1600	0.218	0.240	0.346

5. Analysis and Discussion

The paper has reached the following conclusions:

(1) The characterization results of biochar show that the surface of biochar contains hydroxyl, carboxyl, and carbonyl groups. With the increase of biochar preparation temperature, O. H, C, a large number of chemical bonds such as H, *C=O,* and phenol-OH are broken and disappeared. It shows that the high pyrolysis temperature during the preparation of biochar will lead to a large loss of polar functional groups on the surface of the biochar, which will increase the hydrophobicity of the biochar surface. The ash content and carbonization degree of biochar increased with the increase of the preparation temperature and the extension of the pyrolysis time, but the yield and organic matter content decreased. At 200°C, biochar exhibits higher polarity and fatness. But with the increase of carbonization temperature, the aromaticity of biochar increases and the polarity decreases. It shows that the heating process is the process of biochar from "soft carbon" to "hard carbon". The preparation temperature of biochar has a great influence on the surface microstructure. As the pyrolysis temperature increases, the number of micropores on the surface of biochar increases, the pore size is irregular, the distribution is uneven, and the pore volume increases. This causes the surface roughness to increase, the specific surface area increases, and the average pore diameter decreases.

(2) The kinetic adsorption of pesticides carbaryl and diuron on loess is divided into fast reaction stage and slow reaction stage, and the time to reach adsorption equilibrium is 14 h and 16 h, respectively. The test results of the biochar adsorption performance show that the adsorption capacity of MBC-600 and PBC-600 is much greater than that of the biochar prepared under the conditions of 200°C and 400°C, regardless of whether it is the adsorption of diuron or carbaryl. Moreover, all the adsorption processes are manifested as a fast reaction stage and a slow reaction stage, and the equilibrium time for the adsorption of diuron and carbaryl by biochar is 12 h and 10 h, respectively. At the same temperature and the same initial concentration, the adsorption capacity of biochar made from pine needles is higher than that of biochar made from

Table 5: Carbine adsorption curve 1.

Number	MBC-200	MBC-400	MBC-600
0	0.051	0.073	0.115
50	0.067	0.073	0.118
100	0.077	0.078	0.139
150	0.080	0.092	0.146
200	0.087	0.094	0.146
250	0.093	0.099	0.163
300	0.097	0.107	0.174
350	0.099	0.107	0.178
400	0.099	0.109	0.193
450	0.104	0.110	0.196
500	0.106	0.119	0.198
550	0.107	0.136	0.208
600	0.109	0.138	0.209
650	0.114	0.143	0.218
700	0.115	0.154	0.220
750	0.117	0.171	0.245
800	0.121	0.174	0.247
850	0.124	0.202	0.254
900	0.129	0.204	0.261
950	0.129	0.213	0.264
1000	0.131	0.225	0.265
1050	0.143	0.230	0.266
1100	0.147	0.230	0.278
1150	0.156	0.234	0.285
1200	0.157	0.237	0.295
1250	0.158	0.238	0.298
1300	0.162	0.248	0.314
1350	0.168	0.252	0.322
1400	0.176	0.257	0.322
1450	0.182	0.259	0.324
1500	0.182	0.261	0.326
1550	0.191	0.268	0.326
1600	0.197	0.269	0.339

Table 6: Carbine adsorption curve 2.

Number	PBC-200	PBC-400	PBC-600
0	0.055	0.084	0.136
50	0.058	0.085	0.137
100	0.061	0.088	0.139
150	0.067	0.090	0.140
200	0.073	0.101	0.142
250	0.075	0.108	0.146
300	0.079	0.122	0.162
350	0.080	0.124	0.167
400	0.084	0.126	0.168
450	0.087	0.129	0.177
500	0.093	0.133	0.196
550	0.096	0.145	0.203
600	0.099	0.147	0.205
650	0.122	0.166	0.207
700	0.128	0.170	0.222
750	0.131	0.174	0.229
800	0.133	0.189	0.236
850	0.136	0.190	0.246
900	0.144	0.193	0.247
950	0.156	0.200	0.253
1000	0.157	0.203	0.263
1050	0.158	0.204	0.277
1100	0.166	0.205	0.280
1150	0.167	0.221	0.293
1200	0.176	0.222	0.299
1250	0.177	0.237	0.302
1300	0.178	0.244	0.313
1350	0.191	0.247	0.319
1400	0.199	0.256	0.320
1450	0.201	0.257	0.327
1500	0.206	0.258	0.330
1550	0.208	0.271	0.340
1600	0.210	0.278	0.342

corn stalks. It is mainly caused by the difference between different biomasses. The analysis and research on the contribution show that the adsorption of biochar prepared at low temperature is dominated by the partitioning effect. With the increase of the preparation pyrolysis temperature, the surface adsorption is enhanced, and the adsorption behavior of biochar prepared by high-temperature pyrolysis is realized by two kinds of adsorption together.

The saturated adsorption capacity of diuron and carbaryl on loess added with exogenous biochar increased significantly. It shows that the physical adsorption is the main reaction type. The adsorption capacity of diuron on loess with exogenous biochar is positively correlated with the temperature of the system and the initial concentration of the solution, indicating that the adsorption is a spontaneous endothermic process. The difference in the amount of biochar added and the pyrolysis temperature has a significant effect on the adsorption of diuron by the loess, and most of the organic pollutants are mainly absorbed by the added biochar in the loess. The pH has a great influence on the adsorption of carbaryl, and the change in the adsorption amount of diuron is negligible.

6. Conclusion

The problem of soil pollution caused by the abuse of various pesticide pollutants has become more and more serious, which has attracted the attention of my country's environmental protection departments. Moreover, relevant laws and regulations have also made further improvements and clear regulations, which makes soil pollution in my country a hotspot for environmental workers to study. At the same time, the environmental behavior of various toxic and harmful pollutants in the soil has also become an important subject in the environmental field. Therefore, it is necessary to seek a new way that is cost-effective and can improve soil environmental pollution, while also improving the soil environmental quality. This has also become an objective requirement for ensuring the safety, yield, and quality of agricultural products. There are great differences in soil structure and organic matter content in different regions, and there are also great differences in their ability to adsorb organic pollutants. Therefore, the research on the influence mechanism of biochar on the migration and transformation behavior of organic pollutants in the soil environment is not diminished. The heterogeneity of carbon itself makes the adsorption effect, process, and mechanism of different biochar have certain differences, so it has great research potential. This paper studies the role of KOH thermally activated corn stover biochar in agricultural adsorption, and verifies the reliability of the method proposed in this paper through the experimental studies.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declared that there are no conflicts of interest regarding this work.

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