



King Saud University

Saudi Journal of Biological Sciences

www.ksu.edu.sa
www.sciencedirect.com



ORIGINAL ARTICLE

Adsorption characteristics of sulfur powder by bamboo charcoal to restrain sulfur allergies



Wanxi Peng^{a,c,*}, Shengbo Ge^a, Zhenling Liu^b, Yuzo Furuta^c

^a School of Materials Science and Engineering, Central South University of Forestry and Technology, Changsha 410004, China

^b School of Management, Henan University of Technology, Zhengzhou, Henan 450001, China

^c Laboratory of Biomaterials Science, Kyoto Prefectural University, Kyoto, Japan

Received 19 May 2016; revised 31 August 2016; accepted 31 August 2016

Available online 20 September 2016

KEYWORDS

Bamboo charcoal;
Desulfuration;
Na₂SO₃;
Na₂S₂O₈;
Na₂SO₄;
Fe₂(SO₄)₃;
S

Abstract Exposures to particulate matter with a diameter of 2.5 μm or less (PM_{2.5}) may influence the risk of birth defects and make you allergic, which causes serious harm to human health. Bamboo charcoal can adsorb harmful substances, that was of benefit to people's health. In order to figure out the optimal adsorption condition and the intrinsic change of bamboo charcoal, five chemicals were adsorbed by bamboo charcoal and were analyzed by FT-IR. The optimal blast time was 80 min of Na₂SO₃, 100 min of Na₂S₂O₈, 20 min of Na₂SO₄, 120 min of Fe₂(SO₄)₃ and 60 min or 100 min of S. FT-IR spectra showed that bamboo charcoal had five characteristic peaks of S—S stretch, H₂O stretch, O—H stretch, C=O stretch or C=C stretch, and NO₂ stretch at 3850 cm⁻¹, 3740 cm⁻¹, 3430 cm⁻¹, 1630 cm⁻¹ and 1530 cm⁻¹, respectively. For Na₂SO₃, the peaks at 3850 cm⁻¹, 3740 cm⁻¹, 3430 cm⁻¹, 1630 cm⁻¹ and 1530 cm⁻¹ achieved the maximum at 20 min. For Na₂S₂O₈, the peaks at 3850 cm⁻¹, 3740 cm⁻¹, 3430 cm⁻¹ and 1530 cm⁻¹ achieved the maximum at 40 min. For Na₂SO₄, the peaks at 3850 cm⁻¹, 3740 cm⁻¹ and 1530 cm⁻¹ achieved the maximum at 40 min. For Fe₂(SO₄)₃, the peaks at 3850 cm⁻¹, 3740 cm⁻¹, 1630 cm⁻¹ and 1530 cm⁻¹ achieved the maximum at 120 min. For S, the peaks at 3850 cm⁻¹ and 3740 cm⁻¹ achieved the maximum at 40 min, the peaks at 1630 cm⁻¹ and 1530 cm⁻¹ achieved the maximum at 40 min. It proved that bamboo charcoal could remove sulfur powder from air to restrain sulfur allergies.

© 2016 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

* Corresponding author at: School of Materials Science and Engineering, Central South University of Forestry and Technology, Changsha 410004, China.

E-mail address: pengwanxi@163.com (W. Peng).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

1. Introduction

With the rapid development of global economy, the development and utilization of coal have brought serious pollution to the environment, especially as the coal-fired power plant boiler emits large amounts of sulfur dioxide and nitrogen oxides (accounts for about 35%~40% of the total SO₂ and NO_x emissions) to further aggravate the deterioration of the environment. For example, Shanghai and Beijing are two of the largest cities in China. Both cities have populations of over

<http://dx.doi.org/10.1016/j.sjbs.2016.08.013>

1319-562X © 2016 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Table 1 Adsorption results.

Blast time [min]	20	40	60	80	100	120
Na ₂ SO ₃	1.48	0.25	0.5	1.52	1.24	1.5
Na ₂ S ₂ O ₈	1.75	0.75	0.74	2	2.02	1.73
Na ₂ SO ₄	2.25	2.02	2.02	0.74	1.49	0.5
Fe ₂ (SO ₄) ₃	1.49	0.49	1.01	1.26	1.24	1.74
S	2.76	3.25	4.47	2.24	4.47	2.98

Table 2 Groups of bamboo charcoal during adsorption of Na₂SO₃, Na₂S₂O₈, Na₂SO₄, Fe₂(SO₄)₃ and S (%).

Kind	Peak (cm ⁻¹)	Adsorption time (min)						Groups
		20	40	60	80	100	120	
Na ₂ SO ₃	1530	87.7	56.9	51.3	44.3	56.9	52.2	NO ₂
	1630	87.0	59.3	54.3	43.0	60.7	52.8	C=O or C=C
	3430	81.7	55.1	47.2	37.4	55.9	47.2	O—H stretch
	3740	88.7	57.9	48.5	43.7	57.8	52.1	H ₂ O
	3850	89.1	59.4	49.6	43.7	59.5	52.7	S—S stretch
Na ₂ S ₂ O ₈	1530	84.7	87.3	82.5	88.5	82.9	83.7	NO ₂
	1630	86.9	86.9	86.8	87.2	87.4	88.1	C=O or C=C
	3430	80.5	83.0	82.6	78.5	78.0	80.7	O—H stretch
	3740	81.3	88.7	81.8	87.1	81.5	82.0	H ₂ O
	3850	84.4	89.0	84.0	88.1	83.0	84.0	S—S stretch
Na ₂ SO ₄	1530	85.5	88.3	85.6	83.4	82.0	82.5	NO ₂
	1630	87.4	87.9	88.1	86.0	84.8	86.4	C=O or C=C
	3430	79.0	79.2	80.5	78.8	77.1	80.0	O—H stretch
	3740	83.2	86.5	82.6	82.3	81.4	81.1	H ₂ O
	3850	85.0	87.5	84.6	84.0	83.4	83.0	S—S stretch
Fe ₂ (SO ₄) ₃	1530	81.2	82.0	89.1	82.0	84.2	90.4	NO ₂
	1630	86.0	87.3	86.5	87.3	86.6	88.3	C=O or C=C
	3430	78.5	81.2	78.4	81.2	82.8	78.8	O—H stretch
	3740	79.3	81.2	88.1	81.2	84.3	88.9	H ₂ O
	3850	81.5	83.4	88.8	83.4	85.8	89.2	S—S stretch
S	1530	90.5	90.1	79.2	85.1	85.2	80.3	NO ₂
	1630	88.8	88.3	84.0	86.4	88.1	83.7	C=O or C=C
	3430	78.2	80.4	76.1	78.3	83.4	73.8	O—H stretch
	3740	88.4	89.2	78.9	84.3	83.5	79.5	H ₂ O
	3850	88.7	89.4	81.3	85.5	85.2	81.7	S—S stretch

10 million. These two urban areas have experienced a rapid increase in the use of vehicles, concurrent with large increases in energy consumption. Particulate pollution has become a major problem (Yao et al., 2002). NO_x and hydrocarbon with photochemical smog formation, cause serious harm to human health. In hazy weather during sports the human respiratory system changes direction, damaging the human respiratory system seriously (Li, 2014). Exposures to particulate matter with a diameter of 2.5μm or less (PM_{2.5}) may influence the risk of birth defects and make you allergic (Girguis et al., 2015).

Bamboo planting in China is very large, it is a kind of short growth cycle and timber fast biomass resource. Therefore, bamboo charcoal is a natural, renewable environmental protection material and functional material. Bamboo charcoal was created by heating bamboo at temperatures of 600–900 °C and then the charcoal itself was processed and mixed in with fabrics as part of the growing field of nanotechnology

(Girguis et al., 2015; Yang et al., 2005; Ignatova et al., 2003; Abe et al., 2001; Kawashita et al., 2003; Mizuta et al., 1994; Wang et al., 2006; Xue et al., 2014; Cui et al., 2014; Le et al., 2015; Peng et al., 2014a,b,c; Peng et al., 2012a). Bamboo charcoal had many positive qualities (Girguis et al., 2015; Yang et al., 2005; Ignatova et al., 2003; Abe et al., 2001). The fabric inhibited bacterial metabolism causing fewer allergic skin reactions than other fibers sterilized with antimicrobial agents. Because the trait was due to the highly porous structure of the bamboo fabric, it could absorb sulfur-based compounds, nitrogen-based compounds and so on (Ignatova et al., 2003; Abe et al., 2001; Kawashita et al., 2003; Mizuta et al., 1994; Wang et al., 2006; Xue et al., 2014; Cui et al., 2014). What's more, bamboo charcoal, which contained potassium, calcium and other minerals, could cause adsorption and filtration of extractives, oil, and other substances (Peng et al., 2013a; Xiao et al., 2013; Peng et al., 2013b; Wang et al., 2013; Peng et al., 2013c; Peng et al., 2012b; Peng and Le, 2012; Peng

Download English Version:

<https://daneshyari.com/en/article/5745505>

Download Persian Version:

<https://daneshyari.com/article/5745505>

[Daneshyari.com](https://daneshyari.com)