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Removal of Cu^{2+} In sewage with macadamia coal activated by K_2CO_3

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ABSTRACT

Investigation of the possibility of treating wastewater containing Cu^{2+} heavy metal with activated carbon material prepared from macadamia husk with activating K_2CO_3 in Optimal conditions such as temperature 650^0C and burning time is 60 minutes. Survey results show that coal with the ability to handle heavy metals is best at 84.02% in optimal conditions such as pH=5 and time. Baking is 30 minutes. The results show similarities with other research results and are applicable to wastewater treatment Cu^{2+}.

Keywords*: activated carbon, adsorption, Cu heavy metals, macadamia*

1. Introduction

Research results from Ministry of Agriculture and Rural Development (MARD), (2015) in Vietnam, macadamia trees are planted stretching from the south to the north. It is estimated that by 2020, the area used to grow macadamia will be up to 10,000 ha, for every ton of macadamia seeds producing 70-77% of the bark.

Research results from the Daud and Ali, (2004) in macadamia bark there are many active ingredients to make activated carbon such as: Carbon content (47-49%) is higher

than the amount of Carbon contained in bamboo (45.53%) and is equivalent to the amount of Carbon in coconut shells 48 , 63% according to Kobya, (2004). Research results from Toles, Marshall and Johns, (1998), the shell contains oxygen content 46.52%, Hidro 6.10%, nitrogen 0.36% and relatively low ash content only 0.22%, this shows that macadamia nuts have Potential of producing activated carbon thanks to the above characteristics.

According to Okman, Karagoz, Tay and Erdem, (2014) and Le Huy Du et al., (1981) activated carbon is a carbon-shaped material that has been treated to yield a porous structure, thus having a very large surface area. Research results from Okman, Karagoz, Tay and Erdem, (2014) and Hameed and Ahmad, (2009) and Minamisawa, Minamisawa, Yoshida and Takai,(2004) and Kamib, Kabbani, Holail and Olama,(2014) the main component of activated carbon is carbon element in amorphous form, content of about 85% - 95%. As a material used in many fields such as wastewater treatment, removal of toxic gases in the atmosphere of solvent recovery, removal of colors and heavy metal ions (Cr3+, Ni2+, Cd2+, Zn2+, Pb2+ and Cu2+).

Research results from Yan-Juan, Zhen-Jiao, Zheng-Kang, Meng, and Yin, (2014) and Kwaghger and Ibrahim, (2013), the adsorption properties of activated carbon are often affected by many factors such as structural characteristics, surface functional groups, surface area, ash content,.. Research results from Kavitha and Namasivayam, (2007) and Trinh Van Dung et al., (2011) materials used to produce activated carbon often use two main sources: coal and agricultural residues with high hardness and porosity like coir, rice husks.

Therefore, bioactive carbon is made from macadamia bark using chemical methods using agents K_2CO_3 to activate. In addition, bioactive activated carbon was investigated to adsorb the capacity of heavy metal ions Cu^{2+}in textile dyeing wastewater.

2. Research methods

2.1 Research facilities

Subjects of research: fixed waste textile wastewater containing heavy metals Cu^{2+}.

Research Chemicals: CuSO4.5H2O(China), K2CO3(China, 99%), HCl 1N (China) , NAOH1N (China).

Research materials: Macadamia husk is harvested in Lam Dong province

2.2. Experimental arrangement

Experiment 1**:** *Investigate a suitable pH for activation*

Investigation of the effect of pH on heavy metal performance Cu^{2+} of activated carbon K_2CO_3.PH Survey: (concentration of 30ppm, volume of 25ml, fixed dosage of 0.3g/L, fixation time of 60 minutes).

According to Imamoglu and associates (2008) Investigate the influence of pH on heavy metal handling performance Cu^{2+} of activated carbon K_2CO_3. about 2,5 - 5,5

***Experiment 2**: Investigate the appropriate dosage for activation*

According to Malik, Ramteke and Wate (2007), investigate the word dosage (0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0g/l) (30ppm concentration, 25ml volume, optimal pH, fixation time 60 minutes). The pH was adjusted to the optimum pH investigated.

Samples filtered with filter paper and analyzed by AAS machine

***Experiment 3:** Surveying the appropriate time for activation*

According to the Supaporn Douglas, uwassa Pongampha Suwassa Pongamphai, SupaneeLerdtrailuck, SiriratPonin, SujitraPolchai, AcharapornKaewchana, Budsarin Osataworanun, (2006).Survey time 0-60 Minutes. The pH is adjusted to the optimum pH surveyed, and the optimal dosage is determined.

2.3. Evaluation methods

Determination of pH is directly measured by Mettler Toledo pH meter (2017).

Measure samples directly by AAS atomic adsorption spectrometer

Data processing methods use Microsoft Excell 2013 software to calculate and statistic data.

3. Results and discussion

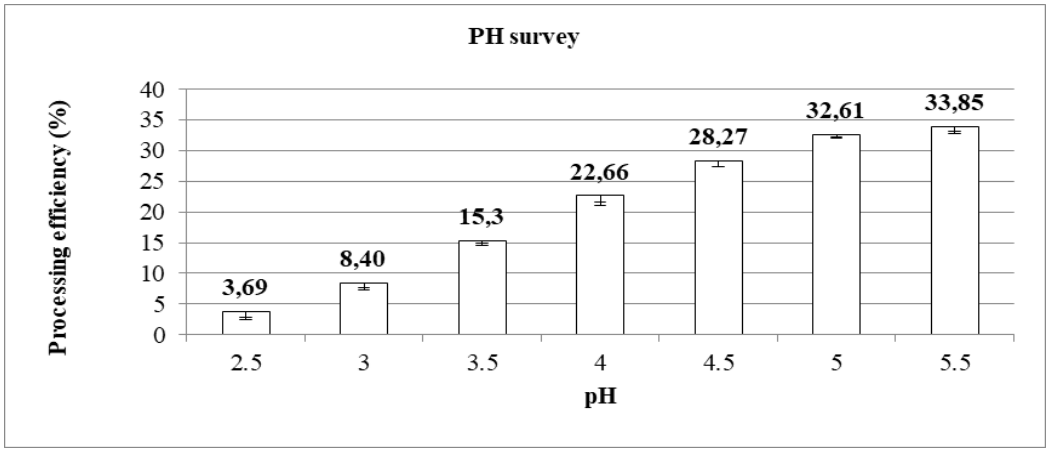

***Figure 1.** Survey results on the effect of pH on heavy metal processing performance Cu^{2+} of activated carbon K_2CO_3*

According to Imamoglu and associates (2008). Research results on the adsorption capacity of heavy metals Cu^{2+}. from the research materials and compared with the above research results show that with the pH range ranging from 4, 4.5, 5 and 5.5, the processing efficiency reaches ***Figure 1*** quite high, respectively 22.66%; 28.27%; 32.61% and 33.85%. Thereby, we see at the pH value range = 5, this is the pH range of optimal performance I decided to choose pH =5 to conduct the next experiment.

In 2011, Nguyen Thi Quynh Trang, Hanoi National University, studied the adsorption capacity of cadmium and lead in contaminated soil using materials of natural origin. It is said that "Gleam and McBride (1986) find that steaming adsorption and precipitation of Cu and Mn are related to pH. At pH <6, adsorptioṇ is the dominant spectrum, while at pH> 6, precipitation is dominant. Similar results were reported for Pb, with adsorptioṇ occurring at pH below 6 and precipitation of lead carbonate occurring at pH> 6 (Harter, 1979).

According to Imamoglu and associates (2008). The research results of activated carbon made from vegetable fibers (Imamoglu ,2008) showed that at pH = 4.5 the removal efficiency of Cu2 + heavy metal of granulated activated carbon (GAC) reached 46.8%.

Research results show that activated carbon prepared from Macadamia shell is capable of handling heavy metals Cu^{2+} preferably at approximately pH = 5

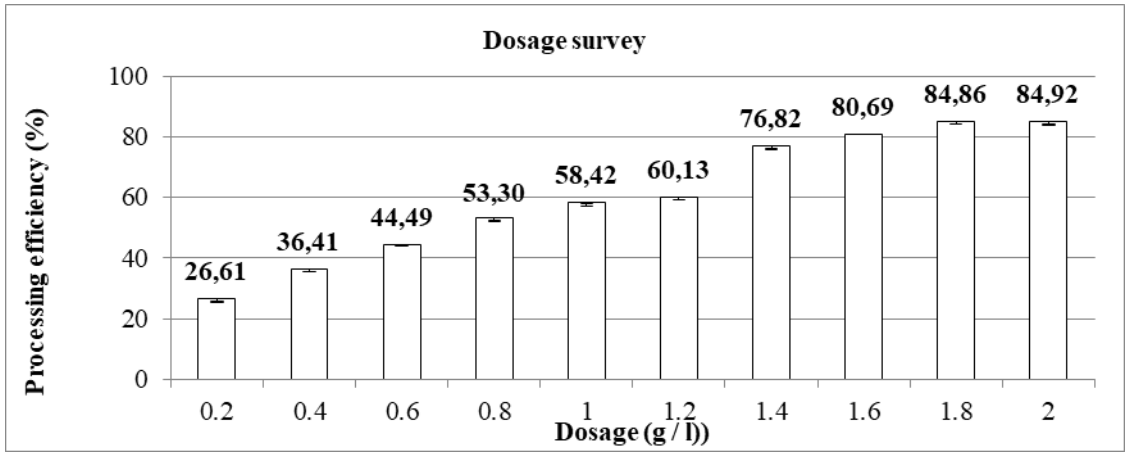

Figure 2. *Survey results on the influence of dosage on the performance of heavy metal handling Cu^{2+} of activated carbon K_2CO_3*

Research results on Cu^{2+} adsorption capacity from activated carbon with K_2CO_3 activating agent showed that Cu^{2+} metal processing performance changed with increasing dose of processed coal especially when the dosage is 0.2 g/l; with a processing efficiency of 26.61%. The highest processing efficiency is 84.92% with a dosage of 2g/l.

According to research results (Uddin; Islam; Mahmud; and Rukanuzzaman,2009), pore size and amount of activated carbon are two factors that significantly affect the absorption of heavy metals. Cu^{2+}. By increasing the surface area of absorbing material, the absorption capacity is significantly increased.

According to research results of activated carbon from Ceiba's pentiba hull of MadhavaRao, Chandra Rao, Seshaiah, Choudary, Wang, (2008) with an efficiency of 99.1%.

Research results show that activated carbon prepared from Macadamia shell is capable of handling heavy metals Cu2 + at the optimal pH range 5 and the dosage of 2g/l.

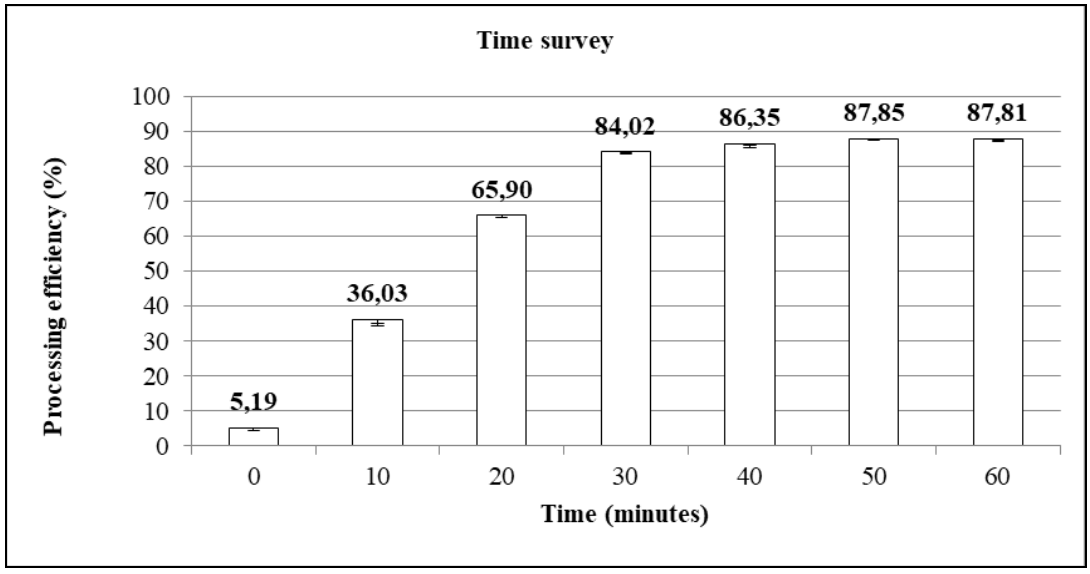

Figure 3. *Results of the survey on the influence of time on the performance of heavy metal processing Cu^{2+} of activated carbon K2CO3*

The Research results in ***Figure 3*** show performance time efficiency increased steadily from 0 minutes to 30 minutes, showing the best time to handle heavy metals. Cu^{2+} was 30 minutes, the processing result achieved an efficiency of 84.02% saturation at a 40-minute processing time (86.35%), after which the processing efficiency increased insignificantly at a time of 50 minutes (87.85%), then The efficacy decreased at 60 minutes (87.81%).

Compared with some previous studies such as research results SujitraPolchai, AcharapornKaewchana and BudsarinOsataworanun,(2006) showed that after 30 minutes of processing, heavy metal processing performance Cu^{2+} of conjugated magnetic nanoparticles carboxymethyl—cyclodextrin have equivalent processing efficiency of 90%.

Research results Uddin, Islam, Mahmud; and Rukanuzzaman (2009) showed that after 90 minutes of treatment, Cu2 + heavy metal processing efficiency of activated carbon from soybean shells reached 90%.

Research results determined at pH = 5, dosage of 2g/l and treatment time of 30 minutes are the optimal conditions for handling heavy metals. Cu^{2+}. Thereby, the activated carbon is studied and prepared from Macadamia husk by chemical agents K_2CO_3 capable of handling heavy metals Cu^{2+} in textile dyeing wastewater.

4. Conclusion

The results of the study showed that the bioactive coal material successfully prepared from agricultural residues was macadamia bark by chemical method using activating agent. K_2CO_3 with optimal activation conditions such as 1: 1: 10ml, temperature 650^0C for 60 minutes. The results of determining the three factors affecting the performance showed that at pH = 5 with the appropriate dose of coal of 2g/l in 30 minutes, the treatment can reach an efficiency of 84.02% for metal-containing wastewater heavy Cu^{2+}.

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