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Removal of copper (Cu^{2+}) by preparation modified carbon from macadamia shells by chemical agent with H_2O_2 in wastewater

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ABSTRACT

Macadamia shells were used to prepare modified carbon by chemical agent H_2O_2 (25%) in 48 hours with coke ratio: H_2O_2 = 1:10. Modified carbon from Macadamia shells with chemical agent H_2O_2 has capable of adsorption heavy metal copper (Cu^{2+}) at an assumption concentration is 30ppm in the optimum conditions such as pH = 4, dose is 1.8 g/l, and the processing time is 30 minutes. The result showed that the adsorption ability of the material reached the highest efficiency is 78.33%. This result showed that modified carbon from shells Macadamia by chemical agent H_2O_2 capable of removing applications on heavy metal copper (Cu^{2+}) in wastewater.

Keywords: *adsorption, copper, H_2O_2, Macadamia, modified carbon*

1. Introduction

Macadamia is a genus of four species of trees indigenous to Australia, and constituting part of the plant family Proteaceae (Mast et al., 2008). Macadamia for dried fruits, the Macadamia kernels have oil content above 87% and the unsaturated fatty acids, protein in the nucleus to 9.2% with 20 kinds of amino acids. In addition, Macadamia kernels

have more carbohydrates, quality minerals and vitamins (Nguyen Cong Tan, 2009). In Vietnam, Macadamia trees are widely grown in many places, both the North and the South, especially in the Central Highlands (Nguyen Cong Tan, 2009).

In Macadamia shells have more features to make modified carbon such as cellulose content about 41.2% in the shell (Rakesh Kumar et al, 2013), concentration of oxygen is 46.52%, concentration of hydrogen is 6.10%, concentration of nitrogen is 0.36% and concentration of ash is relatively low, about 0.22% (Toles et al., 1998).

The modified carbon is the material which was widely used for wastewater treatment, removing the dangerous metals such as: Hg, Cd, As, Cu, Zn,... Material was modified to has porous structure and high surface area (500-2500m^2/g) (Okman, Karagoz et al., 2014; Le Huy Du et al., 1981; Kwaghger & Ibrahim, 2013), the modified carbon have a good adsorption ability. Factors affect the adsorption ability of the modified carbon are often structural characteristics, surface cofunctions (Yan-Juan et al., 2014), surface area, concentration of ash,... (Kwaghger & Ibrahim, 2013).

Copper is a necessary trace element higher animals, higher plants and is often found in the composition of enzymes (Mahiya. et al., 2014). Copper is used in many industries such as power cord manufacturing, alloy production and color dye (Ahmad et al., 2012). Copper has highly toxic because it is carcinogenic and mutants in nature (Moore & Ramamoorthy, 1984).

Therefore, preparation modified carbon from Macadamia shells by chemical agent H_2O_2 study adsorption ability of heavy metal copper (Cu^{2+}) in assumption wastewater.

2. Research methods

2.1. Materials

Research subjects: Assumption wastewater have heavy metal copper.

Research chemicals: H_2O_2 (China, 25%), HCl (China, 1N), NAOH (China, 1N).

Research materials: Modified Macadamia carbon by chemical agent H_2O_2

2.2. Experimental methods

Experiment 1: Survey pH: 2.5, 3, 3.5, 4, 4.5, 5, 5.5. Concentration is 30ppm, volume is 25ml, fixed dosage is 0,3g/l, fixed time is 60 minutes (Imamoglu& Tekir, 2008; Badruddoza et al., 2011; Ben-Ali et al., 2017).

Experiment 2: Survey dosage: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0 g/L. Concentration is 30 ppm, volume is 25 ml, optimal pH, fixed time is 60 minutes (Imamoglu & Tekir, 2008; Badruddoza et al., 2011; Ben-Ali et al., 2017).

Experiment 3: Survey time: 0, 10, 20, 30, 40, 50, 60 minutes. Concentration is 30ppm, volume is 25 ml, optimal pH, optimal dosage (Imamoglu & Tekir, 2008; Badruddoza et al., 2011; Ben-Ali et al., 2017).

2.3. Evaluation methods

- Determination of pH by Mettler Toledo equidment (2017). TCVN 6492:2011 (ISO 10526:2008) of water quality.
- Determination of metal Cu by AAS (Atomic Absorptio Spectrometer) with method atomic absorption spectrum..

3. Results and discussion

3.1. Survey pH in processing heavy metals Cu (II):

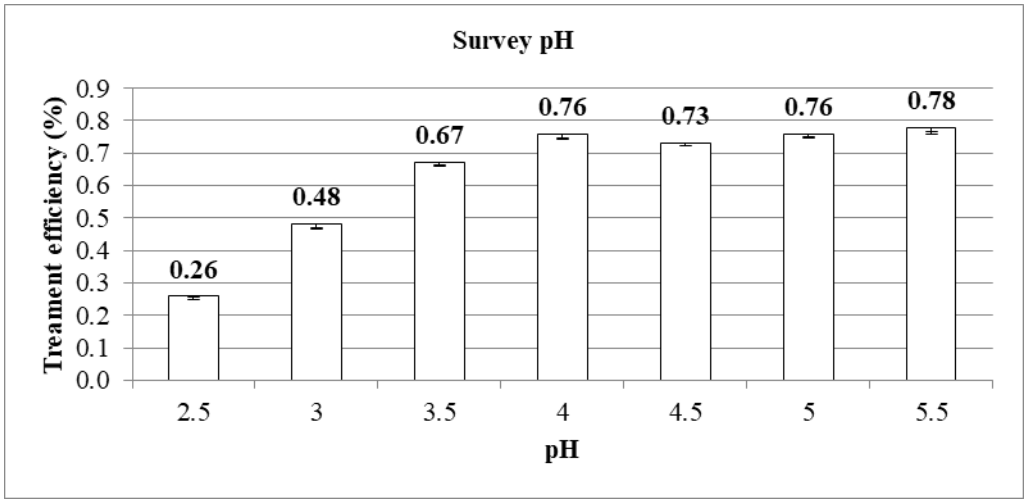

Figure 1. *Results determine the influence of pH on the removal efficiency of metal Cu(II) in the effluent of modified Macadamia carbon H_2O_2*

Results of the study by Imamoglu and Tekir (2008) on the adsorption ability of the research material and in comparison with the results of the study in Figure 1 showed a pH range ranging from 3.5; to 5, processing efficiency respectively reached: 0.67%, 0.76%, 0.73% and 0.76%. From the results showed that the pH = 5.5 to achieve the highest processing efficiency (0.78%) but in the survey process copper, Cu (II) begin to precipitate in the pH range from 5.5 to 6, so it will not select pH = 5.5. Results showed that at pH = 4 and pH = 5 were values of pH reached the same high processing efficiency is 0.76%, choosing pH = 4. The results of the study in Figure 1 have lower processing ability than the results of the study by Gupta and Ali (2000), adsorption capacity of the bagasse fly ash for the metal copper at pH = 4, the processing efficiency of bagasse fly ash reached 92%.

The results of the study showed that H_2O_2 modified carbon prepared from the Macadamia shells which had the best removal ability of copper at pH = 4 with processing efficiency is 0.76%. However, it was required to study additional dosage factors and time to increase the ability to remove copper in wastewater of materials.

3.2. Survey dosage in processing heavy metals Cu (II)

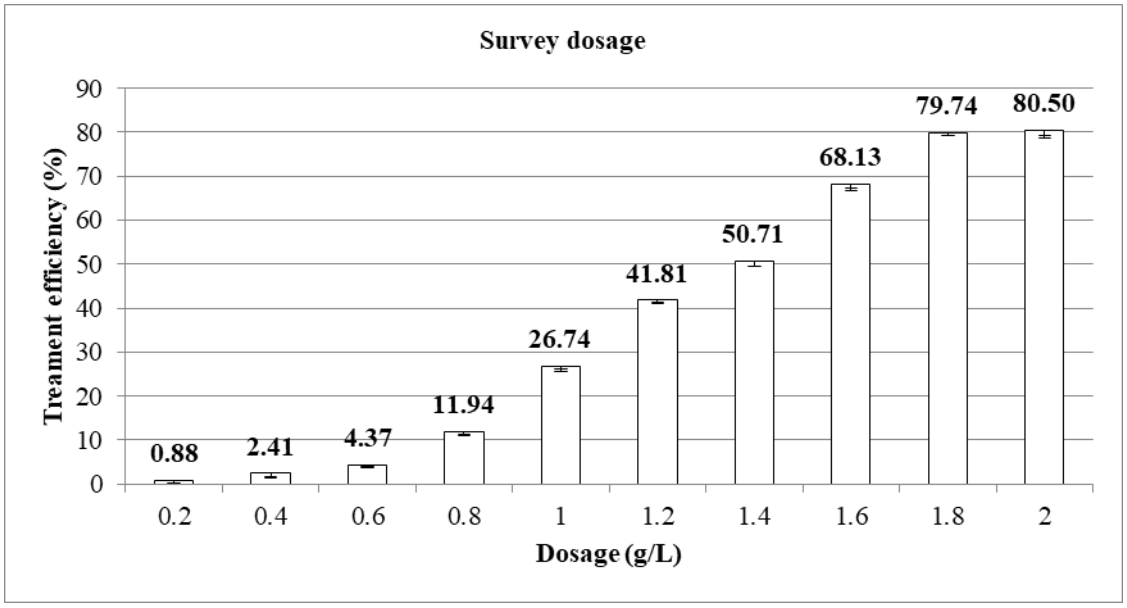

Figure 2. *Results determine the influence of dosage on the removal efficiency of metal Cu(II) in the effluent of modified Macadamia carbon H_2O_2*

Figure 2 showed that at dosages of coal in the treatment process of Cu (II) at pH = 4, dose of coal were arranged from 0.2, 0.4, 0.6, 0.8, 1, 1.2, 1.4, 1.6, 1.8, 2 had the following processing efficiency: 0.88%, 2.41%, 4.37%, 11.94%, 26.74%, 41.81%, 50.71%, 68.13%, 79.74%, 80.50%. At dosage was 1.8g/l (79.74%), coal was best suited for removal of metals Cu (II). At a dosage was 2g/l, the processing efficiency was negligible (0.76%), choosing dosage was 1.8g/l.

The results of the study of the modified Macadamia carbon by H_2O_2 showed higher this results than some previous research like as result of research of Gupta and Ali (2000), the adsorption metal copper ability of bagasse fly ash at dosages was 2g/l, the processing efficiency of bagasse fly ash only reached 35%.

The results of the study showed that the modified Macadamia carbon by H_2O_2 had the highest removal of metal copper at pH = 4 and dosage is 1.8g/l. However, a processing time is surveyed in order to increase the processing efficiency of modified carbon.

3.3. Survey time in processing heavy metals Cu (II):

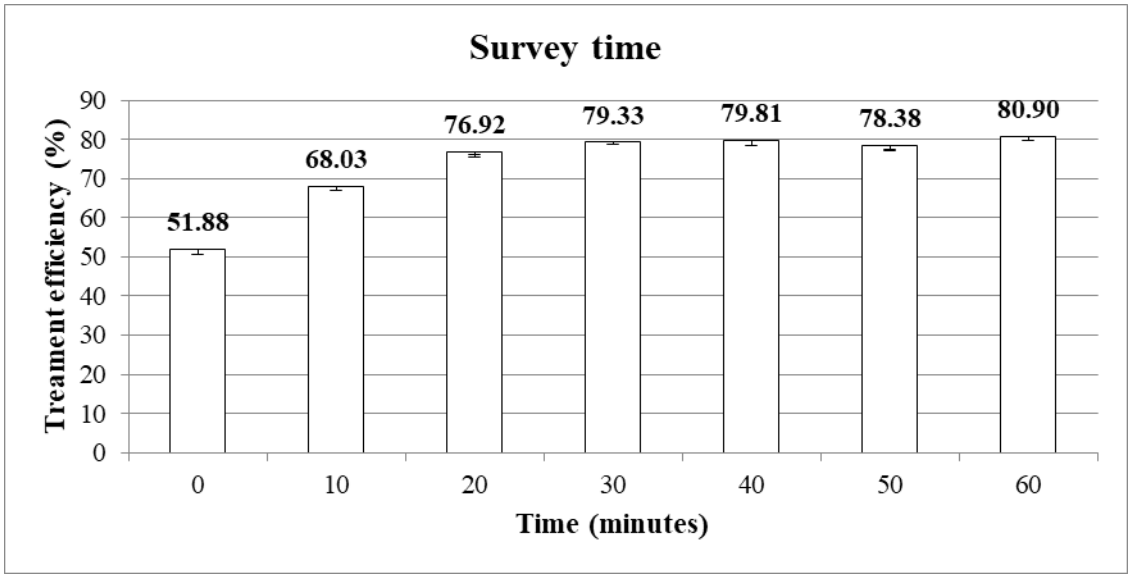

Figure 3. *Results determine the influence of time on the removal efficiency of metal Cu(II) in the effluent of modified Macadamia carbon H_2O_2*

The results of the study in Figure 3 showed the processing time of 30 minutes is a optimal time for processing copper, results has processing efficiency which reaches 79.33%, higher than the processing time of 0, 10, 20 and 50 minutes (51.58%, 68.03%, 76.92%, and 78.38%), the processing time of 40 minutes and 60 minutes have performing high processing respectively are 79.81% and 80.90%, but increased 10 minutes and 30 minutes to process an additional 0.48% and 1.57%, the processing efficiency is negligible.

Compared to study of Nasernejsf et al, (2004), carrot has capable of adsorbing copper reached 75% efficiency in 10 minutes and after 10 minutes adsorption capacity is saturated, Figure 3 showed this results higher. In addition, results are lower than the results of the study by Imamoglu and Tekir (2008) was used the hazelnuts husks to remove ion Cu (II) showed that efficiency reaches 87%

The results of the study determined at pH = 4, dosage is 1.8g/l and processing time is 30 minutes are optimal conditions to process Cu (II). Results showed that the modified carbon from Macadamia by chemical agent H_2O_2 which capable of processing copper in wastewater.

4. Conclusion

The results of the research preparation biological modified carbon from Macadamia shells by chemical agent with H_2O_2 with optimal modified conditions such as concentration is 25%, modified time is 48 hour. The results showed that at pH = 4, the optimum coal

dosage of 1.8g/l in 30 minutes with processing efficiency reaches 79.33% for the wastewater containing metal Cu (II) with a assumed concentration is 30ppm.

Through the results of study, biological modified carbon from Macadamia shells by the chemical agent H_2O_2 which capable of processing metal copper with relatively high efficiency.

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