การดูดซับฟีนอลของถ่านไม้ไผ่ป่า ไผ่มันหมู และไผ่ตง จากจังหวัดกาญจนบุรี

ADSORPTION OF PHENOL BY BAMBOO CHACOAL; *BAMBUSA ARUNDINACE WILD; DENDROCALAMUS COPELANDII* AND *DENDRO-CAMUSASPER BACK* FROM KANCHANABUREE PROVINCE)

สายใจ ชาญเศรษฐิกุล, อภิสิฏฐ์ ศงสะเสน, พัชรินทร์ กมลกิจการ, พิษณุ ขอบุตร

Saijai Charnsethikul, Apisit Songsasen, Patcharin Kamolkijakarn, Pitsanu Khorboot
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand

บทคัดย่อ: งานวิจัยนี้เป็นการนำถ่านที่เตรียมจากไม้ไผ่ จังหวัดกาญจนบุรี มาเพิ่มคุณภาพโดยผ่านกระบวนการกระตุ้นทางเคมีด้วยสารละลายโซเดียม ไฮดรอกไซด์ เข้มข้น 20% เป็นเวลา 4 และ 8 ชั่วโมง สำหรับไผ่ป่าและไผ่มันหมู ตามลำดับ ส่วนไผ่ตง จะกระตุ้นด้วยกรดฟอสฟอริกเข้มข้น เป็นเวลา 4 ชั่วโมง ประสิทธิภาพของถ่านไม้ไผ่ทั้งสามชนิดก่อนและหลังการกระตุ้นด้วยสารเคมี ได้ถูกนำมาเปรียบเทียบจากการดูดซับฟีนอลบนถ่าน โดยวัดเป็นค่าฟีนอลในเทอมของอัตราส่วนระหว่างปริมาณฟีนอลที่ถูกดูดซับ ต่อน้ำหนักถ่าน จากการศึกษาพบว่า ค่าฟีนอลของถ่านไม้ไผ่ป่า ไผ่มันหมู และไผ่ตง ที่ยังไม่ผ่านการกระตุ้น มีค่าเท่ากับ 4.90, 23.40 และ 4.40 กรัม / ลิตร ตามลำดับ และค่าฟีนอลของถ่านไม้ไผ่ป่า ไผ่มันหมู และไผ่ตงที่ผ่านการกระตุ้นแล้วจะมีค่าเท่ากับ 13.30, 18.27 และ 5.50 กรัม / ลิตร ตามลำดับ

Abstract: Activated bamboo charcoals from Kanchanaburee province were prepared through chemical process by using 20% potassium hydroxide for *Bambusa arundinacea wild (BAW);* and *Dendrocalamus copelandii* (DC) for 4 and 8 hours, respectively and concentrated phosphoric acid for *Dendrocamus asper back* (DAB) for 4 hours. The efficiencies of bamboo charcoals before and after activated with chemical process were compared from the adsorption of phenol on charcoals by measuring the phenol value in term of the ratio of the adsorption phenol to the amounts of charcoals at 10% residual phenol. The phenol values of non-activated BAW, DC and DAB were 4.90, 23.40 and 4.40 g /L , respectively. And the activated BAW, DC and DAB were 13.30, 18.27 and 5.50 g /L , respectively

Introduction : Phenol is an organic compound which hardly to degradate. It is a carcinogenic agent when react with other substances. It can be often found in the wastewater from the industry. Thus, the water must be treated before flush out to the river. Activated carbon adsorption is an effective mean for reducing organic compounds, chloride, heavy metal, unpleasant tastes and odors in effluent or colored substances from gas or liquid stream. Activated carbon is extremely porous powder with a large surface area (range 500-1400 m^2/g). The propose of this research are; studying the phenol adsorption for waste management on both activated and non-activated bamboo charcoal; *Bambusa arundinace wild; Dendrocalamus copelandii* and *Dendrocamus asper back* from Kanchanaburee province, and finding the new activated charcoal for replacing the commercial activated carbon in order to reduce the cost.

Methodology: After the bamboo charcoals were prepared**,** they were crushed, sieved to a size of 150 μm and washed until the filtrates were colorless. The charcoals, then, were filtered and dried in oven. Activated carbon charcoals were prepared as follow: *Bambusa arundinacea wild* (BAW) and

Dendrocalamus copelandii (DC) charcoal were refluxed and activated with 20% potassium hydroxide with ratio of coal weight to reagent volume 1 : 4 for 4 and 8 hours, respectively. Using the same procedure, *Dendrocamus asper back* (DAB) charcoal was refluxed with phosphoric acid for 4 hours. The activated charcoals were washed with distilled water until the pH of filtrates were approximately 6.5 or colorless. The charcoals were filtered and dried in an oven at 110°C.

The adsorption of phenol were measured by phenol value. Weighing the activated charcoals about 1 gram and put into the flask and adding 25 ml of the standard solution of phenol 10 ppm. The solutions were adjusted to the volume of 250 ml. with 0.073 M phosphoric buffer. The flasks were covered with foil. Then, the solutions were shook for 30 min. The residual phenol after adsorption on the charcoals were filtered. Finally, the absorbance of phenol were measured by UV-vis spectrophotometer at 270.1 nm. The isotherm between % residual phenol and the ratio of the adsorption phenol (X) to the amounts of charcoals (M) were plotted in logarithm. The phenol value were determined by the term of X/M at 10% residual phenol of the isotherm as equation (1). The results were compared to the commercial activated charcoal and the non-activated charcoals.

$$\text{Phenol value} = \frac{90}{\text{X/M at 10\% residual phenol}} \times \frac{100 - \%\,\text{moisture}}{100}$$

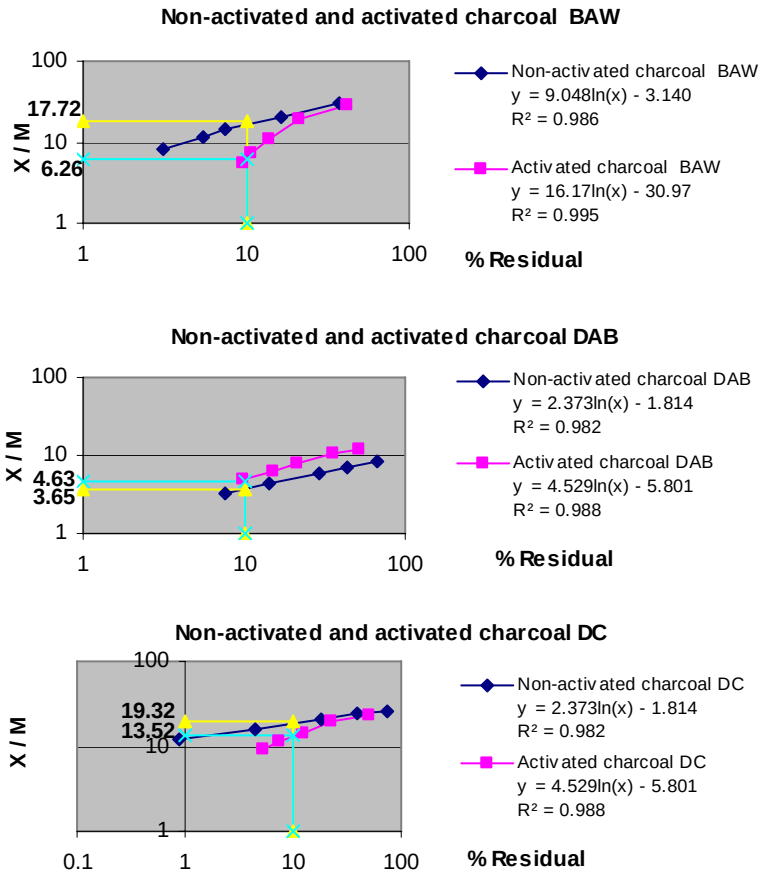

Figure 1 The Freundlich adsorption isotherms of the non-activated bamboo charcoals of BAW, DC and DAB were compared to the activated ones.

Result, Discussion and conclusion :

Figure 1(a) to 1(f) showed the Freundlich adsorption isotherms of the commercial activated charcoal that compared to the activated and non-activated bamboo charcoals of BAW, DC and DAB.

From the Freundlich adsorption isotherms, the phenol values were calculated by using equation(1) and summarized in Table 2. The non-activated and activated bamboo charcoals from BAW, DC and DAB have similar phenol values. However, the DAB charcoal has the highest adsorption efficiency for phenol comparing to other charcoals. The phenol value of DAB charcoals is not significantly different to the commercial activated charcoal. Therefore, DAB bamboo charcoal can be replaced the commercial activated charcoal for phenol treatment of wastewater.

Table 2 Phenol values of activated carbon and bamboo charcoals

Types of charcoal	10% Residual phenol	% Moisture	Phenol value (g/L)
Commercial activated carbon	33.16	14.49	**2.32**
Activated BAW charcoal	6.26	7.48	13.30
Non-activated BAW charcoal	17.72	3.64	4.90
Activated BAW charcoal	4.65	5.62	18.27
Non-activated DC charcoal	3.65	5.11	**23.40**
Activated DAB charcoal	13.52	5.13	5.50
Non-activated DAB charcoal	19.32	5.72	4.40

References :

1. Abdel-Nasser A., El-Hendawy, Samra S.E. and Girgis. (2001) "Absorption characteristics of activated carbons obtained from corncobs", *Colloids and Surface.* 180, p.209-221.
2. Ajay D.K. and Aminul C.I. (1996) "Activation of Canadian coals in a fixed-bed reactor and an internally stirred horizontal kiln", Fuel, 75, p.384-392.
3. Sopajaree K., Kleepklang A. and Bamrungsri P. (2004) " Effects of temperature and volumetric loading phenol adsorption capacity by granular activated carbon" *J. Sci. Technol*. 26, p.97-108.

Keywords: Activated carbon, Activated charcoal, Chemical activation.

Acknowledgement:

We would like to thank Kasetsart University Research and Development Institute (KURDI), Center of Innovation in Chemistry: Postgraduate Education and Research Program in Chemistry (PERCH-CIC) and Department Chemistry, Kasetsart University.