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PRODUCTION AND APPLICATION OF ACTIVATED CARBON FROM WASTE TIRES

Mr. Pisit Ariyadejwanich

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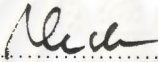
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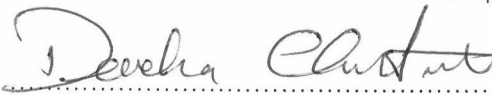
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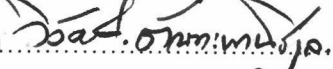


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ถ่านกัมมันต์ที่ได้รับการเตรียมจากยางล้อใช้แล้ว และยางล้อที่ผ่านการสลายพันธะแล้ว โดยวิธีการแอกติเวชันด้วยไอน้ำทั่วไป กระบวนการทั่วไปซึ่งเพิ่มการฟิสิกส์ที่เมนต์ด้วยการรดก่อนการแอกติเวชันด้วยไอน้ำ, และกระบวนการที่มีการฟิสิกส์ที่เมนต์ด้วยสารประกอบโลหะ และลักษณะรูพรุนของถ่านกัมมันต์ที่ได้นั้นได้รับการตรวจสอบ นอกจากนี้ ผลกระทบของอัตราการเพิ่มอุณหภูมิในการคาร์บอนไนเซชัน, อุณหภูมิการคาร์บอนไนเซชัน, และอุณหภูมิการแอกติเวชัน ที่มีต่อคุณสมบัติของถ่านกัมมันต์ ได้รับการตรวจสอบเช่นกัน อนึ่ง ถ่านกัมมันต์ที่เตรียมได้นั้น มีปริมาตรของเมโซพอร์ และไมโครพอร์ สูงถึง 1.62 และ 0.57 ลูกบาศก์เซนติเมตรต่อกรัม ตามลำดับ พร้อมกับค่าพื้นที่ผิวสูงถึง 1119 ตารางเมตรต่อกรัม

ในการศึกษาคุณสมบัติการดูดซับในเฟสของเหลว นั้น ฟีนอลและสีย้อมอินทรีย์ 2 ชนิด ได้แก่ แบล็ค 5 และ เร็ด 31 ได้ถูกเลือกเป็นสารดูดซับตัวอย่าง ถ่านกัมมันต์ที่เตรียมโดยมีการฟิสิกส์ที่เมนต์ด้วยกรดไฮโดรคลอริก ก่อนการแอกติเวชันถูกทดสอบเปรียบเทียบกับถ่านกัมมันต์ทางการค้า ผลการทดลองการดูดซับในเฟสของเหลวถูกระบุว่า ถ่านกัมมันต์ที่ได้นั้นมีความสามารถในการดูดซับฟีนอลเปรียบได้กับถ่านกัมมันต์ทางการค้าแต่มีความสามารถในการดูดซับสีย้อมอินทรีย์สูงกว่า ถ่านกัมมันต์ทางการค้าอย่างชัดเจน เนื่องด้วยคุณสมบัติในการดูดซับและประสิทธิภาพในการคืนสภาพด้วยเอทานอลที่ดี ถ่านกัมมันต์ที่เตรียมได้นั้นมีความเหมาะสมอย่างมากสำหรับการนำไปใช้ในระบบบำบัดน้ำเสีย โดยเฉพาะกรณีการดูดซับสารโมเลกุลใหญ่

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ลายมือชื่อนิสิต..... 
ลายมือชื่ออาจารย์ที่ปรึกษา..... 
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม..... 

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Activated carbons were prepared from vulcanized and decrosslinked waste tires by the conventional steam activation method, the conventional method plus acid treatment prior to steam activation, and the second method with the pre-treatment by metal compound, and their porous properties were characterized. Furthermore, the effects of heating rate during carbonization, carbonization temperature, and activation temperature on the resulting porous properties of the activated carbons were investigated. The obtained activated carbon has the V_{meso} and V_{micro} values up to 1.62 and 0.57 cm³/g, respectively as well as the S_{BET} value up to 1119 m²/g.

In liquid-phase adsorption study, phenol and two organic dyes, Black 5 and Red 31, were selected as the representative adsorbates. The activated carbon prepared with HCl-treatment prior to steam activation was compared with a commercial activated carbon. The results from liquid-phase adsorption were indicated that the obtained activated carbon shows comparable phenol adsorption capacity as but clearly higher dyes adsorption capacities than the commercial one. Because of good liquid-phase adsorption-desorption characteristics and ethanol regeneration efficiency, the obtained activated carbon is very suitable for use in wastewater treatment especially for adsorbing the bulky adsorbates.

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NOMENCLATURES

C_{a_b}	Char carbonized from waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$\text{HCl } C_{a_b}$	HCl-treated-Char carbonized from waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$\text{AC } c_d a_b$	Activated carbon prepared at $c^\circ\text{C}$ for d hr from char carbonized from waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$\text{AC HCl } c_d a_b$	Activated carbon prepared at $c^\circ\text{C}$ for d hr from HCl-treated char carbonized from waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$C_m a_b$	Char carbonized from the mixture of m compound and waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$\text{HCl } C_m a_b$	HCl-treated-Char carbonized from the mixture of m compound and waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$\text{AC } m c_d a_b$	Activated carbon prepared at $c^\circ\text{C}$ for d hr from char carbonized from the mixture of m compound and waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$C_{DE} a_b$	Char carbonized from decrosslinked waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$
$\text{HCl } C_{DE} a_b$	HCl-treated-Char carbonized from decrosslinked waste tires at $a^\circ\text{C}$ at the heating rate of $b^\circ\text{C}/\text{min}$

NOMENCLATURE (Continued)

$AC\ DE\ c_d\ a_b$	Activated carbon prepared at $c^{\circ}C$ for d hr from char carbonized from decrosslinked waste tires at $a^{\circ}C$ at the heating rate of $b^{\circ}C/min$
$AC\ HCl\ DE\ c_d\ a_b$	Activated carbon prepared at $c^{\circ}C$ for d hr from HCl-treated char carbonized from decrosslinked waste tires at $a^{\circ}C$ at the heating rate of $b^{\circ}C/min$
$C\ m\ DE\ a_b$	Char carbonized from the mixture of m compound and decrosslinked waste tires at $a^{\circ}C$ at the heating rate of $b^{\circ}C/min$
$HCl\ C\ m\ DE\ a_b$	HCl-treated-Char carbonized from the mixture of m compound and decrosslinked waste tires at $a^{\circ}C$ at the heating rate of $b^{\circ}C/min$
$AC\ m\ DE\ c_d\ a_b$	Activated carbon prepared at $c^{\circ}C$ for d hr from char carbonized from the mixture of m compound and decrosslinked waste tires at $a^{\circ}C$ at the heating rate of $b^{\circ}C/min$
P/P°	Relative pressure [-]
q	The amount of N_2 adsorbed [cm^3 (STP)/g]
R_p	Pore radius [nm]
$dV_p/d\log(R_p)$	Pore size distribution [cm^3/g]
V_{meso}	Mesopore volume [cm^3/g]
V_{micro}	Micropore volume [cm^3/g]
S_{BET}	BET surface area [m^2/g]

NOMENCLATURE (Continued)

Q	The amount of adsorbate adsorbed [g/g AC]
C_e	Equilibrium concentration [mg/l]



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