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UTILIZATION OF BAGASSE AND BAGASSE FLY ASH AS ADSORBENTS
FOR REMOVAL OF LEAD AND CHROMIUM AND SUBSEQUENT UTILIZATION
AS CONSTRUCTION MATERIALS

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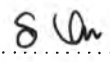
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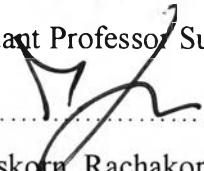
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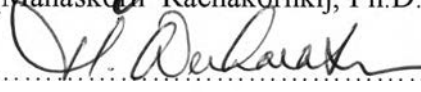
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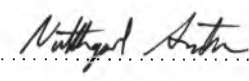

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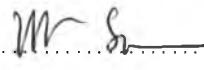
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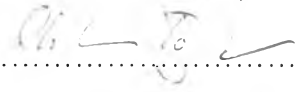

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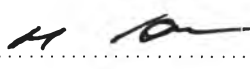

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สิริวัลย์ เรื่องช่วย : การใช้ประโยชน์จากขี้เถ้าและเถ้าลอยขี้เถ้า เพื่อเป็นตัวดูดซับในการกำจัดตะกั่ว และโครเมียม และใช้เป็นวัสดุก่อสร้าง (UTILIZATION OF BAGASSE AND BAGASSE FLY ASH AS ADSORBENTS FOR REMOVAL OF LEAD AND CHROMIUM AND SUBSEQUENT UTILIZATION AS CONSTRUCTION MATERIALS). อ. ที่ปรึกษา : ดร. มนัสกร ราชอาณาจักร, อ. ที่ปรึกษาร่วม : ศ. ดร. เมธี เวชารัตนา 268 หน้า. ISBN 974-17-4389-8.

โรงงานผลิตน้ำตาลจากขี้เถ้าจะใช้ขี้เถ้าเป็นเชื้อเพลิงในการผลิตไอน้ำ และกระแสไฟฟ้า ซึ่งหลังจากเผาไหม้แล้วขี้เถ้าบางส่วนจะกลายเป็นเถ้าลอยขี้เถ้า ดังนั้นวัตถุประสงค์ของงานวิจัยนี้คือการศึกษาศักยภาพในการนำขี้เถ้า (B) และเถ้าลอยขี้เถ้า (BFA) มาใช้ประโยชน์ ผลการศึกษาพบว่า ประสิทธิภาพสูงสุดในการกำจัดตะกั่วและโครเมียม เกิดขึ้นที่ค่า pH ของสารละลายเท่ากับ 6 และ 1 ตามลำดับ BFA มีประสิทธิภาพในการดูดซับตะกั่วมากกว่า B การกำจัดเฮกซะวาเลนต์โครเมียม (Cr(VI)) เกิดทั้งการรีดักชันและการดูดซับ พบว่า การรีดักชันเป็นกลไกหลักในการกำจัด Cr(VI) สำหรับการกำจัดด้วย B และให้ผลตรงกันข้ามเมื่อกำจัดด้วย BFA หมู่ไฮดรอกซิลในเซลล์ลูลอสของ B น่าจะเป็นแหล่งให้อิเล็กตรอนในปฏิกิริยารีดักชัน และพบว่า B และ BFA ทั้งที่ผ่านและไม่ผ่านการกำจัดโลหะหนักมาแล้ว เป็นตัวขัดขวางการเกิดปฏิกิริยาไฮเดรชันของปูนซีเมนต์ โดยทำให้มีค่ากำลังรับแรงอัดลดลง เวลาบ่มเพียง 3 วัน เพียงพอสำหรับการกำจัดทั้งแบบฝังกลบ (มากกว่า 10 กก./ลบ.ม.) ส่วนความเข้มข้นของโลหะหนักทั้งสองชนิดจากน้ำชะของก้อนหล่อแข็ง มีค่าต่ำกว่า 5 มก./ล. ซึ่งเป็นค่ามาตรฐานของประกาศกระทรวงอุตสาหกรรมฉบับที่ 6 (พ.ศ. 2540) และยังพบว่า BFA มีศักยภาพที่จะใช้แทนที่ปูนซีเมนต์ในการผลิตคอนกรีตบล็อกประสานปูพื้น และ คอนกรีตบล็อกก่อผนังได้สูงสุดถึงร้อยละ 30 การใช้ประโยชน์จากของเหลือทิ้งในลักษณะนี้ เป็นทางเลือกหนึ่งในการกำจัดตะกั่ว และโครเมียม ซึ่งเป็นการใช้ของเหลือทิ้งจากโรงงานหนึ่งมาบำบัดของเสียจากอีกโรงงานหนึ่ง จัดเป็นตัวอย่างในการจัดการของเหลือทิ้งเพื่อการพัฒนาที่ยั่งยืน

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KEY WORD: BAGASSE / BAGASSE FLY ASH / ADSORPTION / REDUCTION / LEAD / CHROMIUM / SOLIDIFICATION/STABILIZATION (S/S) / CONSTRUCTION MATERIAL.

SIRAWAN RUANGCHUAY: UTILIZATION OF BAGASSE AND BAGASSE FLY ASH AS ADSORBENTS FOR REMOVAL OF LEAD AND CHROMIUM AND SUBSEQUENT UTILIZATION AS CONSTRUCTION MATERIALS. THESIS ADVISOR: MANASKORN RACHAKORNKIJ, Ph.D., THESIS CO-ADVISOR: PROF. METHI WECHARATANA, Ph.D., 268 pp. ISBN 974-17-4398-8.

Cogeneration of steam and electricity is a standard practice in the sugarcane industry worldwide. For Thailand, 22% of the small power producers (SPPs) use bagasse as a fuel, thus generating a large quantity of fly ash and residues. The purpose of this research is to convert bagasse (B) and bagasse fly ash (BFA) into inexpensive and effective removal materials for lead (Pb) and chromium (Cr) and to assess the efficiencies of cementitious solidification of spent materials for disposal in landfill and to develop construction materials namely; interlocking concrete paving blocks and hollow non-load-bearing concrete blocks.

The batch study results indicated that removal efficiency of Pb, total Cr, and Cr (VI) increased with increasing contact time, and amount of material applied. The maximum removals of Pb and Cr were obtained at pH 6 and pH 1, respectively. BFA was a better adsorbent for Pb than B. The removal of Cr(VI) may involve two processes, namely, reduction of Cr(VI) to Cr(III) and adsorption of Cr(VI) and Cr(III). Reduction was likely the major Cr(VI) removal mechanism than adsorption in B while the reverse was true for BFA. The hydroxyl groups in cellulose structure of B were found to be the potential major reduction sites. Portland cement hydration was inhibited by the increase in the amounts of B and BFA, resulting in poor strength performance. The compressive strengths increased with curing time and a 3-day curing period was enough to meet the strength requirement of landfill standards (3.5 ksc) for 5 and 10% replacement with B and BFA, respectively. Concentrations of lead and chromium in leachate from all solidified products were below the limits (5 mg/L) established by the Ministry of Industries No.6, B.E. 2540 (1997). BFA has high efficiency for partial cement replacement up to 30% in interlocking paving concrete block and hollow non-load-bearing concrete block construction. This alternative treatment process may very well be the choice for Pb or Cr removal. It utilizes wastes from other factory to treat waste. This is an example of comprehensive waste management suitable for sustainable development.

Field of study Environmental Management (Inter-Department)..Student's signature.....

Academic year..2005.....Advisor's signature.....

Co-advisor's signature.....

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NOMENCLATURE

AAS	= Atomic Absorption Spectrophotometer
ASTM	= American Society for Testing and Materials
B	= bagasse
B-Cr	= chromium adsorbed bagasse
B-Pb	= lead adsorbed bagasse
BFA	= bagasse fly ash
BFA-Cr	= chromium adsorbed bagasse fly ash
BFA-Pb	= lead adsorbed bagasse fly ash
C ₂ S	= dicalcium silicate
C ₃ S	= tricalcium silicate
C ₃ A	= tricalcium aluminite
C ₃ AF	= tetracalcium aluminoferrite
Cr	= chromium
Cr(III)	= trivalent chromium
Cr(VI)	= hexavalent chromium
C-S-H	= calcium silicate hydrate
DI	= deionized water
ICP	= inductively coupled plasma optical emission spectroscopy
ksc	= kilogram per square centimeter
LOI	= loss on ignition(%) defined by ASTM C311 as the weight fraction of materials that is lost by heating the oven dried sample at 750 °C
Pb	= lead
SEM	= scanning electron microscope
S/S	= Solidification/Stabilization
Total Cr	= total chromium, include of hexavalent chromium and trivalent chromium
w/c ratio	= water-to-cement ratio, the weight ratio of water to cement
XRD	= X-ray diffraction spectrometer
XRF	= X-ray fluorescence spectroscopy