การกำจัดสังกะสีโดยใช้ทรายที่ถูกทิ้งจากการทำแบบหล่อ ที่บรรจุอยู่ในคอลัมน์

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REMOVAL OF ZINC USING FOUNDRY SAND WASTE IN PACKED COLUMNS.

Miss Tarinee Leepulsap

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ทรายแบบหล่อที่เป็นขยะที่เกิดขึ้นจากโรงงานหล่อโลหะ ได้ถูกนำมาทดลองและพบว่าสามารถดูดซับสังกะสีจากน้ำเสียได้ ในงานวิจัยนี้ได้ใช้ทรายแบบหล่อจากโรงงานหล่อโลหะในจังหวัด สระบุรี ประเทศไทย เพื่อนำมาใช้เป็นตัวดูดซับโลหะหนักในการทดลองแบบคอลัมน์ ซึ่งมีขนาดเส้นผ่านศูนย์กลาง 22 มิลลิเมตร และยาว 30 เซนติเมตร ที่ความหนาแน่นทรายในคอลัมน์เท่ากับ 1.04-1.05 กรัมต่อลูกบาศก์เซนติเมตร น้ำเสียถูกสังเคราะห์ขึ้นจาก $ZnCl_2$ ผสมน้ำดีไอออไนซ์ โดยค่าพีเอชของน้ำเสียสังเคราะห์ถูกปรับโดยใช้กรดไนตริก 1.0 M และ 1.0 M โซเดียมไฮดรอกไซด์ ผลการทดลองพบว่า ความยาวของคอลัมน์, อัตราการไหล และ ค่า พีเอช ของน้ำเสียส่งผลต่อประสิทธิภาพการดูดซับ ที่ความยาวคอลัมน์ 25 ซม. และอัตราการไหล 6 มิลลิลิตรต่อนาที มีประสิทธิภาพการดูดซับสูงสุด ค่าความจุในการดูดซับของทรายที่ความยาวคอลัมน์ 25, 21.5, 18, 14.5 ซม. ที่อัตราการไหล 6 มิลลิลิตรต่อนาทีมีค่า 0.61, 0.66, 0.5 และ 0.48 มิลลิกรัมต่อกรัมตามลำดับ ในขณะที่ค่าความจุในการดูดซับของทรายที่อัตราการไหล 6, 11 และ 15 มิลลิลิตรต่อนาที ที่ 25 ซม.มีค่า 0.61, 0.45 และ 0.48 มิลลิกรัมต่อกรัมตามลำดับ นอกจากนี้ยังพบว่าที่ค่าความเข้มข้นของสังกะสีที่ 60 มิลลิกรัมต่อลิตร จะใช้เวลาในการเบรกทรูสั้นกว่าที่ 30 มิลลิกรัมต่อลิตร (102 และ 157 นาทีตามลำดับ) แต่อย่างไรก็ตาม ค่าความจุของการดูดซับของทรายที่ทั้งสองความเข้มข้นมีค่าเท่ากัน ส่วนค่า พีเอชเริ่มต้นของน้ำเสีย ที่เท่ากับ 5 จะให้ประสิทธิภาพในการกำจัดมากกว่า ที่พีเอช 3 (0.66 และ 0.29 มิลลิกรัมต่อลิตรตามลำดับ) และสุดท้ายพบว่าการทดลองแบบไหลขึ้นและไหลลงนั้นไม่ส่งผลต่อค่าความจุ แต่ส่งผลต่อระยะเวลาในการเบรกทรู โดยคอลัมน์แบบไหลลงใช้เวลาในการเบรกทรูสั้นกว่าแบบไหลขึ้น

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TARINEE LEEPULSAP: REMOVAL OF ZINC USING FOUNDRY SAND WASTE IN PACKED COLUMNS, THESIS ADVISOR: PICHAYA RACHDAWONG, Ph.D., 117 pp. ISBN 974-17-6024-8.

The released of heavy metals such as zinc in wastewater is of significant effect due to its potential to cause environmental and human health problems. The USEPA has classified zinc as one of the most common metal of concern at superfund site. This metal is also present in streams from industrial processes at concentration of 7.2-1500 mg/l which is well above the USEPA standard of 5 mg/l. The objectives of this study were to investigate the column performance of foundry sand as medium for zinc removal in a continuous flow system and to generate a set of data that can be used for column design. Foundry sand was investigated as a new sorbent for zinc removal in aqueous solutions. It was collected from local foundry factories in Saraburi province, Thailand, and was packed at density between 1.04-1.05 g/cm^3 in a column with the depth and diameter of 300 and 25 mm, respectively. The results of the column study indicated that the removal capacities of various bed heights 25, 21.5, 18, and 14.5 cm at flow rate of 6 ml/min were 0.61, 0.66, 0.5 and 0.48 mg/g, respectively. A bed height of 25 cm and flow rate of 6 ml/min resulted in maximum zinc removal. Studies carried out to investigate the effect of flow rates (6, 11, and 15 ml/min) at the optimum bed height of 25 cm indicated removal capacities to be 0.61, 0.45, and 0.48 mg/g respectively. It was found that the change in concentration affected breakthrough time and exhaustion time but posed no effect of column capacities of foundry sand. An initial concentration of 60 mg/l caused shorter breakthrough and exhaustion times than 30 mg/l. The study on the effect of pH to the removal capacity of foundry sand indicated that at pH 5 removal was higher than a pH 3 (0.66, and 0.29 mg/g of initial pH 5 and 3, respectively). Finally, the study showed that mode of column operation, up-flow and down-flow, resulted in almost the same removal capacity; however, down-flow mode had shorter breakthrough time.

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

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ABBREVIATIONS

Ce.	=	effluent Concentration (mg/l)
Co.	=	initial Concentration (mg/l)
Conc.	=	concentration
g.	=	gram
ICP	=	Inductively Coupled Plasma
mg/g	=	milligram per gram
mg/l	=	milligram per litre
ml/min	=	millitre per minute
mmol/g	=	millimole per gram
PCD	=	Pollution Control Department
r^2	=	the square value of correlation coefficient
SEM	=	Scanning Electron Microscope
U.S.EPA	=	United States Environmental Protection Agency
Zn	=	Zinc
ATSDR	=	Agency for Toxic Substances and Disease Registry
RPI	=	Rensselaer Polytechnic Institute