

การกำจัดทองแดงที่ละลายอยู่ในน้ำโดยเอคโซโพลีแซคคาไรด์จากแบคทีเรียสายพันธุ์ตัดที่ทนต่อทองแดง

นาย ต่อเผ่า ชาญณรงค์



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REMOVAL OF SOLUBLE COPPER BY  
EXOPOLYSACCHARIDE ISOLATED FROM  
COPPER-RESISTANT BACTERIAL ISOLATES

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Thesis Advisor        Assistant Professor Dr. Pin-Chawee Vejjanukroh, Ph.D.

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ต่อเผ่า ชาญณรงค์ : การกำจัดทองแดงที่ละลายอยู่ในน้ำโดยเอคโซโพลีแซคคาไรด์จากแบคทีเรียสายพันธุ์คัดที่ทน  
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แบคทีเรียที่สามารถทนต่อโลหะทองแดงและสามารถสร้างสารเอคโซโพลีแซคคาไรด์จำนวน 2 สายพันธุ์ ซึ่งคัดเลือก  
มาจาก 350 สายพันธุ์ได้นำมาใช้ในการทดลอง โดยให้ชื่อสายพันธุ์ว่า CuR-38 และ CuR-40 จากการทดลองพบว่าน่าจะเป็นแบคทีเรีย  
ที่จัดอยู่ในกลุ่ม *Zoogloea sp.* และ *Bacillus sp.* ตามลำดับ ช่วงค่าความเป็นกรด-ด่างที่ 7 และอุณหภูมิที่ 37 องศาเซลเซียสเป็น  
สภาวะที่เหมาะสมต่อการเจริญเติบโตและการสร้างสารเอคโซโพลีแซคคาไรด์ การผลิตสารเอคโซโพลีแซคคาไรด์จะผลิตได้ปริมาณ  
มากที่สุดที่เวลา 48 ชั่วโมง แต่การเติมโลหะทองแดงในอาหารเลี้ยงเชื้อพบว่าไม่มีผลทำให้การสร้างสารเอคโซโพลีแซคคาไรด์เพิ่มขึ้น  
ในแบคทีเรียสายพันธุ์คัดทั้ง 2 สายพันธุ์ การดูดซับโลหะทองแดงโดยสารสกัดเอคโซโพลีแซคคาไรด์กับเซลล์ทั้งหมดมีประสิทธิภาพสูง  
และไม่แตกต่างกันมากนัก การดูดซับโลหะทองแดงโดยเอคโซโพลีแซคคาไรด์ที่อบแห้งให้ประสิทธิภาพมากกว่า 80 เปอร์เซ็นต์ และสามารถ  
ใช้ในการดูดซับโลหะชนิดอื่น (สังกะสี, แมงกานีสและแคดเมียม) ในแบคทีเรียสายพันธุ์คัดทั้ง 2 สายพันธุ์ การชะเอาโลหะออก  
จากสารสกัดเอคโซโพลีแซคคาไรด์สามารถทำได้โดยใช้กรดไฮโดรคลอริกและสามารถนำสารสกัดเอคโซโพลีแซคคาไรด์ไปใช้ใหม่ได้

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ลายมือชื่อนิติ ..... ต่อเผ่า, ชาญณรงค์  
ลายมือชื่ออาจารย์ที่ปรึกษา ..... ปิ่น-ฉวี เวชชานุเคราะห์  
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KEY WORD: REMOVAL / COPPER / EXOPOLYSACCHARIDE (EPS) / RESISTANCE / BACTERIA

TORPOW CHANNARONG : REMOVAL OF SOLUBLE COPPER BY EXOPOLYSACCHARIDE ISOLATED FROM COPPER-RESISTANT BACTERIAL ISOLATES.

THESIS ADVISOR : ASSIST. PROF. PIN-CHAWEE VEJJANUKROH, Ph.D. 160 pp. ISBN 974-332-524-7.

Two strains of 350 strains of copper-resistant bacterial isolates were selected and named CuR-38 and CuR-40. Both of them resisted to 700  $\mu\text{g/ml}$  Cu and EPS-producing. By some identification test, they might be classified as *Zoogloea sp.* and *Bacillus sp.*, respectively. Optimum pH and temperature for growth and EPS production were 7 and 37°C. EPS production appeared maximally during the stationary phase (48 hr.). Addition of Cu induction was not induced EPS production in both bacterial isolates. The copper accumulation capacities between wet EPS and wet whole cell is highest, but not much different. The percentage of Cu accumulation by dried EPS was greater than 80% of both strains. The dried EPS has been used to remove other metal (zinc, manganese and cadmium). The release of metal from EPS achieved by HCl and can regenerated to reuse in the future.

ภาควิชา..... Environmental Science

ลายมือชื่อนิสิต..... TORPOW CHANNARONG

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## ABBREVIATION AND SYMBOL

Ag	=	Silver
AgNO <sub>3</sub>	=	Silver Nitrate
Ag <sub>2</sub> S	=	Silver sulfide
A.N.	=	Atomic Number
BOD	=	Biochemical oxygen demand
B.P.	=	Boiling Point
Cd	=	Cadmium
CdCl <sub>2</sub> .H <sub>2</sub> O	=	Cadmium Chloride
cm	=	Centimeter
Cr	=	Chromium
Cu	=	Copper, Chalcite
Cu <sup>2+</sup>	=	Cupric ion
Cu(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>2</sub> .H <sub>2</sub> O	=	Copper acetate
CuCl <sub>2</sub>	=	Copper chloride
Cu(CN) <sub>2</sub>	=	Copper cyanide
CuCO <sub>3</sub> .Cu(OH) <sub>2</sub>	=	Copper carbonate
2CuCO <sub>3</sub> .Cu(OH) <sub>2</sub>	=	Azurite
CuO	=	Copper oxide
Cu <sub>2</sub> O	=	Cuprite
CuR-	=	Copper-Resistant Bacterial Isolates
CuS	=	Covellite
Cu <sub>2</sub> S	=	Cuprous sulfide, Chalcocite
CuSO <sub>4</sub> .5H <sub>2</sub> O	=	Copper Sulfate, Chalcanthite
°C	=	Degree Celsius

EPS	=	Exopolysaccharide or Extracellular polysaccharide or Exopolymer
g	=	Gram
g/L	=	Gram/liter
Hg	=	Mercury
HNO <sub>3</sub>	=	Nitric acid
H <sub>2</sub> S	=	Hydrogen sulfide
H <sub>2</sub> SO <sub>4</sub>	=	Sulfuric acid
KCN	=	Potassium cyanide
K <sub>2</sub> CrO <sub>4</sub>	=	Potassium Chromate
Kg	=	Kilogram
Kb	=	Kilobase
L	=	Liter
LPS	=	Lipopolysaccharide
m	=	Meter
mg	=	Milligram
mg/kg	=	Milligram/kilogram
mg/l	=	Milligram/liter
min	=	Minute
ml	=	Milliliter
MLVSS	=	Mixed liquor volatile suspended solids
mmol	=	Millimole
Mn	=	Manganese
MnSO <sub>4</sub> .H <sub>2</sub> O	=	Manganese Sulfate
mol	=	Mole



M.P.	=	Melting Point
M.W.	=	Molecular Weight
$\mu\text{g}$	=	Microgram
$\mu\text{g/g}$	=	Microgram/gram
$\mu\text{g/L}$	=	Microgram/liter
$\mu\text{g/ml}$	=	Microgram/milliliter
$\mu\text{mol}$	=	Micromole
$\mu\text{mol/L}$	=	Micromole/liter
$\mu\text{mol/mg}$	=	Micromole/milligram
$\text{NH}_4\text{Cl}$	=	Ammonium chloride
Ni	=	Nickel
$\text{NiSO}_4 \cdot \text{H}_2\text{O}$	=	Nickel Sulfate
nm	=	Nanometer
ppb	=	Parts per Billion
ppm	=	Parts per Million
Temp	=	Temperature
TSA	=	Tryptic Soy Agar
TSB	=	Tryptic Soy Broth
t/yr	=	Ton/year
U	=	Uranium
V	=	Volume
W	=	Weight
Zn	=	Zinc
ZnS	=	Sphalerite
$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$	=	Zinc Sulfate