

EFFECT OF CADMIUM, COPPER, ZINC AND LEAD ON
Escherichia coli AND *Staphylococcus aureus*

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FAKULTÄT FÜR BIOLOGIE
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EFFECT OF CADMIUM, COPPER, ZINC AND LEAD ON *Escherichia coli* AND
Staphylococcus aureus

By

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LIST OF ABBREVIATIONS

abs	-	absorbance
gm	-	gram
M	-	molar
mmol	-	milimol
nm	-	nanometer
U	-	unit
Ppm	-	parts per million
μ	-	micro
cfu	-	colony-forming unit
cfu/ml	-	colony-forming unit per milliliter
m	-	meter(s)
ml	-	milliliter(s)
nm	-	nanometer
OD	-	optical density
%	-	percentage
UMT	-	Universiti Malaysia Terengganu

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ABSTRACT

The aim of this study is to determine the effect of the heavy metals on bacteria of *Staphylococcus aureus* (Gram-positive) and *Escherichia coli* (Gram-negative). In this study cadmium, copper, zinc and lead were used as heavy metals to study minimal inhibitory concentration (MIC) produced for each bacteria strain. The introduction of heavy metals, in various forms, in the environment, can produce considerable modifications of the microbial communities and their activities. In order to determine their activities, heavy metals were used to study the effect on bacteria growth. The minimal inhibitory concentration (MIC) produced by heavy metal for each bacteria strain was determined. In this study two methods were used which are Optical Density Test and Disk Diffusion Test. In addition, the mobility of the metallic cations (Cu, Zn, Cd, Pb) was evaluated by comparing results obtained by two tests of toxicity in solid and liquid media. The two way ANOVA and Correlation were used for statistical analysis. Cadmium showed the high reaction to the bacteria followed by copper with second high toxicity reaction. Zinc as the third toxicity metal shows less reaction and lastly lead showed less reaction than zinc. The toxicity level decreased from cadmium > copper > zinc > lead. Increasing metals concentrations decreased the rate of bacteria growth and also stopped the growth of these bacteria.

KESAN KADMIUM, KUPRUM, ZINK DAN PLUMBUM TERHADAP PERTUMBUHAN BAKTERIA *Staphylococcus aureus* DAN *Escherichia coli*

ABSTRAK

Objektif kajian ini adalah untuk mengenalpasti kesan logam berat terhadap pertumbuhan *Staphylococcus aureus* (Gram-positif) dan *Escherichia coli* (Gram-negatif). Dalam kajian ini kadmium, kuprum, zink dan plumbum telah digunakan sebagai logam berat untuk mengkaji kepekatan halangan minimum (MIC) yang dihasilkan terhadap setiap strain bakteria. Pengenalpastian logam berat, dalam pelbagai bentuk, di dalam persekitaran, boleh menghasilkan modifikasi komuniti mikroorganisma dan aktiviti mereka yang tidak seimbang. Untuk mengenalpasti aktiviti mikroorganisma, logam berat telah digunakan untuk mengkaji kesan terhadap pertumbuhan bakteria. Kepekatan halangan minimum (MIC) yang dihasilkan oleh logam berat bagi setiap bakteria Gram-positif dan Gram-negatif dikenalpasti. Dua kaedah telah digunakan dalam kajian ini iaitu Ujian Optical Density dan Ujian Disk Diffusion. Kemobilitan kation logam berat (Cu, Zn, Cd, Pb) telah dinilai daripada keputusan oleh dua ujian toksik di dalam media cecair dan media pepejal. ANOVA dua hala dan korrelasi telah digunakan untuk data analisis. Kadmium menunjukkan tindakbalas toksik yang sangat tinggi terhadap bakteria dan diikuti oleh kuprum yang merupakan logam yang menunjukkan ketoksikan kedua tinggi. Zink di tempat ketoksikan yang tiga menunjukkan tindakbalas yang sedikit terhadap bakteria dan terakhir sekali plumbum yang menunjukkan reaksi yang rendah daripada zink. Kadar toksisiti berkurang dengan aliran kadmium > kuprum > zink > plumbum. Peningkatan kepekatan logam berat tersebut akan mengurangkan kadar pertumbuhan bakteria malah akan menghentikan pertumbuhan bakteria.