

POTENTIALS OF *Arthrocnemum maritimum*, *Bryghiera
cylindrica* AND *Sonneratia alba*
AS HEAVY METAL ABSORBENT

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POTENTIALS OF *Avicennia marina*, *Bruguiera cylindrica* AND *Sonneratia alba* AS
HEAVY METAL ABSORBENT

By

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LIST OF ABBREVIATIONS

μg	microgram
μm	micrometer
<i>A. marina</i>	<i>Avicennia marina</i>
<i>B. cylindrica</i>	<i>Brugueira cylindrica</i>
Cd	cadmium
Cd^{2+}	cadmium aqueous solution
CdSO_4	cadmium sulphate
Cu	copper, Cuprum
Cu^{2+}	copper aqueous solution
CuSO_4	copper sulphate
Cys	Cysteine
EDTA	ethylenediaminetetraacetate
EPA	Environmental Protection Act
g	gram
Glu	Glutamate
Gly	Glycine
GSH	Glutathione Synthetase
HCl	hydrochloric acid
HNO_3	nitric acid
ICPMS	Inductive Coupled Plasma Mass Spectroscopy
m	meter
mg	milligram
ml	milliliter
MTs	Metallothioneins
$^{\circ}\text{C}$	degree Celcius
Pb	lead, Plumbum
Pb^{2+}	lead aqueous solution
PbNO_3	lead nitrate
PC	Phytochelatin
PCs	Phytochelatin's
PCS	Phytochelatin Synthase

ppb	parts per billion
ppm	parts per million
rpm	rotation per minute
<i>S. alba</i>	<i>Sonneratia alba</i>
SRM	Standard Reference Material

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ABSTRACT

The potential of plants to absorb heavy metals can be determined by obtaining the differences between the plants' metal sorption rate and the amount of metal in the plants itself. In this study, the potentials of leaves, barks and roots of three mangrove species; *Avicennia marina*, *Bruguiera cylindrica* and *Sonneratia alba*, to absorb Cd^{2+} , Pb^{2+} and Cu^{2+} was successfully determined. Samples with the powder concentration of 0.5 mg/ml and an initial metal solution concentration of 100 ppm was analyzed using ICP-MS. Root portion appeared to be the best part of plant to absorb metal solution with the following order of root > leaf > bark. The average metal sorption value by root is 0.527 ppm, leaf; 0.449 ppm and bark; 0.322 ppm. The heavy metals absorbed was determined in order of Pb^{2+} > Cd^{2+} > Cu^{2+} with the averaged value of 1.003 ppm, 0.246 ppm and 0.049 ppm, respectively. *B. cylindrica* distinctively appeared to be the most excellent plant that is capable to absorb metal in aqueous solution among all species studied with the indicated order of *B. cylindrica* (0.455 ppm) > *A. marina* (0.436 ppm) > *S. alba* (0.406 ppm). Overall, the root of *B. cylindrica* appeared to be the best ionic metal absorber of all other sorbents studied with the value of 1.402 ppm metal uptake. Based on this study, it was found that all of the mangrove plants' constituents studied have a great potential in absorbing heavy metals in aqueous solution. The findings from this study are important to initiate further research in developing bioremediation method using mangrove plants to treat metal contaminated area.

POTENSI *Avicennia marina*, *Bruguiera cylindrica* DAN *Sonneratia alba* SEBAGAI PENYERAP LOGAM BERAT

ABSTRAK

Potensi tumbuhan untuk menyerap logam berat boleh di peroleh dengan cara menentukan perbezaan antara kadar penyerapan logam berat oleh tumbuhan itu dengan jumlah logam berat yang terdapat di dalam tumbuhan itu sendiri. Dalam kajian ini, potensi bahagian daun, kulit pokok dan akar tiga spesies tumbuhan paya, *Avicennia marina*, *Bruguiera cylindrica* dan *Sonneratia alba* untuk menyerap Cd^{2+} , Pb^{2+} dan Cu^{2+} telah berjaya diperolehi. Sampel dengan kepekatan serbuk 0.5 mg/ml dan kepekatan awal larutan logam berat 100 ppm dianalisa menggunakan ICP-MS. Bahagian akar telah dikenalpasti menjadi bahagian tumbuhan yang paling berpotensi untuk menyerap logam dari larutan dengan tertib akar > daun > kulit pokok. Purata nilai kadar penyerapan oleh bahagian akar ialah 0.527 ppm, daun; 0.449 ppm and kulit pokok; 0.322 ppm. Plumbum merupakan logam yang paling berpotensi untuk diserap berbanding logam lain dalam aturan $Pb^{2+} > Cd^{2+} > Cu^{2+}$ dengan nilai purata 1.003 ppm , 0.246 ppm dan 0.049 ppm masing-masing. Dengan mengambil kira seluruh tumbuhan, kadar penyerapan logam dari larutan akues adalah paling tinggi oleh spesies *B. cylindrica* diikuti oleh *A. marina* dan *S. alba* mengikut aturan *B. cylindrica* (0.455 ppm) > *A. marina* (0.436 ppm) > *S. alba* (0.406 ppm). Secara keseluruhannya, akar *B. cylindrica* merupakan penyerap logam dari larutan akues yang terbaik jika dibandingkan dengan sampel lain dengan nilai 1.402 ppm. Berpandukan dari kajian ini, didapati bahawa semua bahagian tumbuhan yang dikaji mempunyai potensi yang besar untuk menyerap logam berat dari larutan akues. Keputusan dari kajian ini adalah penting untuk mendalami kajian cara perawatan kawasan yang dicemari logam berat dengan kaedah biologi.