

DETERMINATION OF HEAVY METALS IN
GROUNDWATER IN TERENGGANU

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DETERMINATION OF HEAVY METALS IN GROUNDWATER IN TERENGGANU

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Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: **Determination of heavy metals in groundwater in Terengganu** oleh **Adiana binti Ghazali**, No. Matrik **UK 6822** telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Kimia sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah Sarjana Muda Sains – Kimia Analisis dan Persekitaran, Fakulti Sains dan Teknologi, Kolej Universiti Sains dan Teknologi Malaysia.

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LIST OF ABBREVIATIONS

APDC	Ammonia pyrrolidine dithiocarbamate
APHA	American Public Health Association
Ca	Calcium
Cd	Cadmium
Cu	Copper
Cr	Chromium
°C	Degree of Celcius
DO	Dissolved oxygen
DOE	Department of Environmental
EC	Electrical Conductivity
EPA	Environmental Protection Agency
Fe	Iron
GEMS	Global Environment Monitoring System
gcm ⁻³	gram per centimeter cube
Hg	Mercury
HNO ₃	Nitric acid
ICP – MS	Inductively Coupled Plasma – Mass Spectrometer
ICP – OES	Inductively Coupled Plasma – Optical Emission Spectrometer
INWQS	Malaysia Interim National Water Quality Standard
K	Pottasium
KSB	Kemaman Supply Base

Mg	Magnesium
MIBK	Methyl isobutyl ketone
M	Molar
m	meter
mgL ⁻¹	milligram per liter
mgkg ⁻¹	milligram per kilogram
ml	milliliter
µgL ⁻¹	microgram per liter
µm	micrometer
µScm ⁻¹	reciprocal of the electrical resistance, S relative to 1cm ³ water at 25°C
NaOH	Sodium hydroxide
Pb	Lead
PE	Polyethylene
PP	Polypropylene
ppb	parts per billion
ppm	parts per million
PVC	Poly vinyl chloride
S	Sulfur
USEPA	United States Environmental Protection Agency
WHO	World Health Organisation
Zn	Zinc
%	Percentage

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ABSTRACT

A study to determine the concentration of dissolved heavy metals (Cd, Cu, Fe, Pb and Zn) will be carried out in Terengganu from April 2004 to July 2004. Samplings will be done two times at ten sampling stations for shallow wells and deep wells. Sampling sites with shallow and deep wells are at Kg. Raja, Besut (urban area); Kg. Kubang Badak, Kuala Terengganu (landfill area); and also Telok Kalong, Kemaman and Kerteh (industrial area), while sites with shallow wells only are located at Kg. Padang Pak Wan, Marang (rural area) and Kg. Merang, Setiu (agriculture area). Dissolved heavy metals will be extracted by using solvent extraction technique and then analysed using ICP-OES. The results showed that the metals concentration ranges are as follow: Cd ($0.08 - 0.32 \mu\text{gL}^{-1}$), Cu ($0.56 - 3.90 \mu\text{gL}^{-1}$), Fe ($3.5 - 614.9 \mu\text{gL}^{-1}$), Pb ($0.16 - 1.32 \mu\text{gL}^{-1}$) and Zn ($0.73 - 5.46 \mu\text{gL}^{-1}$). Comparison with World Health Organisation (WHO) for drinking water quality and standard for water and packaged drinking water for Malaysia (Food Act 1983, 2000) showed that all metals were below the maximum level except for Fe level in Kemaman exceeded the maximum level of standard for water and packaged drinking water for Malaysia (Food Act 1983, 2000). According to Interim National Water Quality Standards (INWQS) for Malaysia, metals in groundwater in Terengganu are classified in Class I indicating a clean status.

PENENTUAN KANDUNGAN LOGAM BERAT DI DALAM AIR TANAH DI TERENGGANU

ABSTRAK

Kajian untuk menentukan kandungan logam berat terlarut di dalam air tanah dijalankan di sekitar negeri Terengganu dari bulan April 2004 sehingga Julai 2004. Pensampelan telah dijalankan sebanyak dua kali di sepuluh stesen pensampelan bagi telaga yang cetek dan telaga yang dalam. Stesen pensampelan yang mempunyai telaga cetek dan telaga dalam adalah di Kg. Raja, Besut (kawasan perbandaran); Kg. Kubang Badak, Kuala Terengganu (kawasan tapak pelupusan sampah); dan juga Telok Kalong, Kemaman dan Kerteh (kawasan perindustrian), sementara itu stesen pensampelan yang mempunyai telaga cetek sahaja adalah di Kg. Padang Pak Wan, Marang (kawasan perkampungan); Kg. Merang. Setiu (kawasan pertanian). Logam-logam berat terlarut diekstrak dengan menggunakan teknik pengekstrakan pelarut dan dianalisa menggunakan ICP-OES. Keputusan kajian menunjukkan julat kepekatan logam adalah seperti berikut: : Cd ($0.08 - 0.32 \mu\text{gL}^{-1}$), Cu ($0.56 - 3.90 \mu\text{gL}^{-1}$), Fe ($3.5 - 614.9 \mu\text{gL}^{-1}$), Pb ($0.16 - 1.32 \mu\text{gL}^{-1}$) dan Zn ($0.73 - 5.46 \mu\text{gL}^{-1}$). Perbandingan kepekatan logam dalam air tanah dengan nilai piawaian air Malaysia (Food Act 1983, 2000) dan "World Health Organisation (WHO) International" menunjukkan semua logam berada di bawah nilai maksimum kecuali Fe di Kemaman untuk kedua-dua persampelan, melebihi nilai maksimum untuk Malaysia (Food Act 1983, 2000). Berdasarkan Piawaian Interim Kualiti Air Kebangsaan (INQWS) kandungan logam di dalam air tanah di Terengganu dikelaskan kepada kelas I iaitu status bersih.