DETERMINATION OF MASS ATTENUATION COEFFICIENTS FOR SEVERAL NATURAL MINERALS IN MALAYSIA

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Special dedicated

For my beloved father and mother

Yusof Bin Sulaiman & Noraini Binti Deris

Thank for all the sacrifice and love that you give to me.

For all my friend, I want to thank for your cooperation and our friendship is meaningful experience for me.
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ABSTRACT

Mass attenuation coefficient ($\mu_m$) is an important parameter in both fundamental and applied mineral studies. The purpose of this study is to determine the values of mass attenuation coefficients of several natural minerals from various mining areas in Malaysia. Four types of minerals were chosen which are hematite, tin ore, xenotime and monazite. The samples were prepared in pallet form by mixing 7g of each sample with 3g of wax. The dimension of the pallet was 3mm in thickness and 40 mm in diameter. The element compositions of the samples were determined by using X-ray fluorescence (XRF) spectroscopy. The gamma attenuation spectra were obtained by irradiating the sample in the energy range of 50-1500 keV with hyper pure germanium (HPGe) detector. The data were analyzed using Lambert-Beer’s law to obtain experimental mass attenuation coefficient values. The theoretical mass attenuation coefficients were calculated using WinXcom software based on the concentration of elements and oxides from XRF data. The result showed that for tin ore, the experimental mass attenuation coefficients fitted well to the theoretical value with the average values of 2.382, 1.840 and 0.095 g cm$^{-3}$ for the energy range of 50-300, 300-1000 and 1000-1500 keV respectively. On the other hand, the results from other three types of samples showed a slight less consistency between experimental and theoretical values.
ABSTRAK

Pekali pengecilan jisim ($\mu_m$) merupakan parameter penting dalam bidang kajian asas dan gunaan mineral. Tujuan kajian ini adalah untuk menentukan nilai pekali pengecilan jisim bagi beberapa jenis mineral semula jadi yang diambil dari lombong yang berbeza di Malaysia. Empat jenis mineral telah dipilih iaitu bijih besi, bijih timah, xenotim dan monazit. Setiap sampel disediakan dalam bentuk pellet dengan mencampurkan 7g setiap sampel denagn 3g lilin. Dimensi setiap pellet adalah 3mm tebal dan 40mm diameter. Komposisi unsur bagi setiap sampel telah dianalisis dengan menggunakan spektroskopi pendarfluor sinar-X (XRF). Dengan menggunakan pengesan Hyper Germanium tulen (HPGe), spektrum pengecilan gamma telah diperolehi dengan menyinarkan sampel pada julat tenaga dari 50 keV sehingga 1500 keV. Kemudian, data di analisis dengan menggunakan hukum Lambert-Beer bagi mendapatkan nilai eksperimen pekali pengecilan jisim. Nilai teori pekali pengecilan jisim telah dikira menggunakan perisian winXcom dengan memasukkan nilai kepekatan unsur dan oksida yang diperolehi daripada analisis XRF. Hasil kajian menunjukkan nilai eksperimen pekali pengecilan jisim bagi bijih timah bersesuaian dengan nilai teori dengan nilai purata pekali pengecilan jisim masing-masing adalah 2.382, 1.840 dan 0.095 g cm$^{-3}$ untuk julat tenaga 50-300, 300-1000 dan 1000-1500 keV. Manakala, bagi tiga jenis sampel yang lain, terdapat sedikit pengurangan konsisten antara nilai teori dan eksperimen.