Ain Shams University
Women's College for Arts,
Science and Education
Physics Department

Studies and Applications on Neutron Capture (n, γ) using k_0-Method

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By

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B. Sc. in Physics, 2003

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A Thesis for M.Sc in Physics
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Tahra El Sayed.

Abstract

Studies and Applications on Neutron Capture (n, γ) using k_0-Method

The thesis aimed to throw some light on studies of Neutron Activation Analysis and its related applications.

The applications are directed to geological and biological applications.

Firstly, the second Egyptian Research Reactor ET-RR-2 (Inchass, Egypt) was used to irradiate six geological samples from Wady sitra at Eastern Desert of Egypt together with a group of standard samples of Mo, Fe, Sb and W. The irradiation time is three hours at the reactor core. A Hyper Pure Germanium (HPGe) detection system was used for the measurements of the gamma-rays emitted. Mo, Fe, Sb standard were used to measure the neutron spectrum parameters α (epithermal non-ideality factor) and *f* (the thermal to epithermal flux ratio) while W was used to test the obtained result. The parameters α and *f* were measured by using the so-called bare triple monitor method, and the obtained results was found to be $f = 17.5 \pm 0.35$ and $\alpha = -0.03 \pm 0.002$. A FORTRAN computer program is designed and used to calculate the values of $Q_0(\alpha)$ for the analyzed elements.

As a result of the complete analysis of the data obtained, k_0 neutron activation techniques (k_0-NAA) is used to estimate the elemental concentrations.

Secondly, 17 blood samples (11 Breast),(2 Prostate),(2 Colon),(1 Pancreatic), (1 Ovarian) from the National Cancer Institute of Egypt at Cairo and one sample from random person are using to estimate the concentration values of Na, Mg, Al ,

Cl, Mn, K , Br, and Ca. The pneumatic irradiation rabbit system (PIRS) built in the vertical thermal column of the ET-RR-2 reactor is used for short time irradiation at 19 MW power. The irradiation time between 60 and 180 second. For sake of comparison, the elemental concentrations of the random sample using (k_0- NAA) compared with the concentrations obtained by (ICP-MS) technique.

Elemental concentrations were estimated from measurements of the gamma ray spectra of the product short lived isotopes in the samples. The thermal to epithermal neutron flux ratio was calculated (f=196) at irradiation position. The obtained concentration was calculated using k_0-standardization method.

FORTRAN program and EXCEL sheet were constructed and used for the determination of the neutron flux ratio and for the determination of elemental concentration values.

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