

Study of arsenic 76 using the neutronic activation analysis technique

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Keywords: arsenic, Argonauta research reactor, neutron activation analysis, arsenic 76

This work aims to contribute to the study of arsenic quantification in fish meat using the neutron activation analysis technique with the help of the Argonaut research reactor at the Nuclear Engineering Institute. The toxicity of arsenic depends on its chemical form or species, where the inorganic arsenic is more toxic than organic [1]. Neutron activation is an analytical technique for determining the elemental chemical composition of the most various matrices, where through neutron irradiation, artificial radioactivity is induced in the sample. Gamma spectrometry was performed for two hours to obtain a background spectrum of the flask without sample and with a sample. It was observed that there was no presence of interferences in the spectra. According to the literature, ⁷⁶As nuclide has a half-life of 26.24 hours and energy peaks at 559.10, 657.05, 1216.08 [2]. Then, an arsenic solution was activated for 30 minutes in the J9 channel of the Argonauta reactor with 10^8 n.cm⁻².s⁻¹ flow of neutrons. Figure 1 shows the obtained spectrum and the counting area of the energies that represent ⁷⁶As.

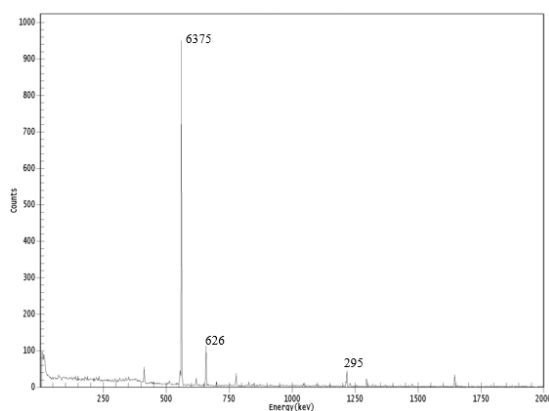


Figure 1. Gamma spectrometry of 1 mg/L arsenic solution and the counting area of each peak

Two other counts were made for the arsenic solution on different days for three weeks to confirm, by the decrease of the photopeak area in the energies of the ⁷⁶As, that it was, in fact, ⁷⁶As. All these measurements occurred under the same conditions. At the end of the third week, it was observed across the spectrum that the sample had no longer a count area for the photopeaks that represent ⁷⁶As. With that, the spectrometry was repeated, but with a 1-hour count to ensure greater confidence, as shown in Figure 2.

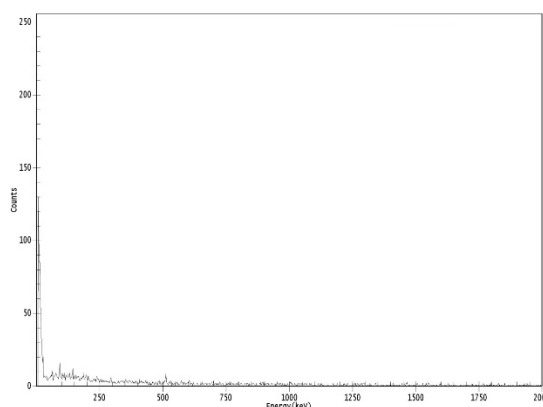


Figure 2. 1-hour gamma spectrometry of arsenic solution at the end of the third week

It can be seen that there is no more count for the photopeaks that represent the ⁷⁶As. Regarding these results, the methodology used in this work was adequate to carry out the study of arsenic neutron activation analysis. The result obtained from irradiation shows that it is possible to activate this element under the used reactor operating conditions. Therefore, with the spectra obtained over three weeks, it was possible to confirm, through peak energies, that the activated element was ⁷⁶As. Future works involve the thermochemical opening of fish meat followed by its neutron activation to determine the presence of arsenic in that sample.

References

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