

**Trace element analysis and radionuclide measurements in a Mediterranean Tuna Fish sample**

Ana PANTELICA and Maria SALAGEAN

Institute of Physics and Nuclear Engineering, BUCHAREST (Romania)

**Abstract**

The results of instrumental neutron activation analysis of 16 elements and the determination of artificial and natural radionuclide levels in the Mediterranean tuna fish homogenate (IAEA-350 and IAEA-352, reference materials) are reported.

**Introduction**

Tuna fish (about 200 kg) were collected in the Western Mediterranean Sea in April 1988 in order to establish a new biological reference material. The flesh was separated from approximately half the fish and prepared as an intercomparison sample of trace metals and organochlorine compounds. A second sample, consisting of 80% fish flesh and 20% bones, was prepared for the radionuclide analyses. This paper represents our contribution to the intercomparison exercises for these two reference materials organized by the IAEA Marine Environment Laboratory in Monaco.

**Experimental**

For neutron activation analysis, the samples and standards (MA-A-2/TM and Soil-7) were irradiated in a VVR-S reactor at  $10^{11} - 2.10^{12} \text{ n.cm}^{-2} \cdot \text{s}^{-1}$  flux. The induced and natural gamma spectra were measured using a high resolution HPGe detector coupled to a multi-channel analyzer.

**Results and Discussion**

Our results for concentrations of Cr, Fe, Rb, Sb, Se, Zn and their certified values are presented in Table 1. Except for Se, our values are in very good agreement with the certified values. Concentration values for Al, As, Au, Br, Cl, Co, Cs, K, Mg and Na determined in our laboratory, but non-certified, are presented in Table 2.

**Table 1.** Certified values of elemental concentrations in tuna fish flesh (IAEA-350, reference material)

Element	Concentration	Confidence interval	Our values
Cr (ppm)	0.75	0.55 - 1.01	$0.82 \pm 0.11$
Fe (ppm)	72.1	66.7 - 77.3	$74.6 \pm 3.7$
Rb (ppm)	2.50	2.41 - 3.40	$2.9 \pm 0.3$
Sb (ppb)	20	3 - 80	$41 \pm 3$
Se (ppm)	5.51	4.40 - 5.95	$6.9 \pm 0.2$
Zn (ppm)	17.4	16.6 - 18.5	$16.9 \pm 0.7$

The  $^{40}\text{K}$  and  $^{137}\text{Cs}$  activities determined by direct gamma spectrometry are presented in Table 3. Concerning  $^{134}\text{Cs}$  activity, from the eleven results submitted, eight included "less than" and one N.D. An upper limit of 2.4 Bg/kg for  $^{134}\text{Cs}$  has been estimated in our laboratory.

**Table 2.** Non-certified values of elemental concentrations in tuna fish flesh (IAEA-350, reference material) determined in our laboratory

Element	Concentration
Al (ppm)	$35 \pm 3$
As (ppm)	$5.6 \pm 0.3$
Au (ppb)	$1.0 \pm 0.3$
Br (ppm)	$16.3 \pm 0.6$
Cl (ppm)	$2179 \pm 50$
Co (ppb)	$34 \pm 4$
Cs (ppm)	$0.21 \pm 0.03$
K (%)	$1.541 \pm 0.060$
Mg (ppm)	$2664 \pm 247$
Na (ppm)	$1506 \pm 47$

**Table 3.** Certified values of radionuclide activity in tuna fish flesh (IAEA-352, reference material) Reference date: 1 January 1989

Radionuclide	Activity (Bq/kg <sup>-1</sup> )	Confidence interval	Range of accepted lab means	Our values
$^{40}\text{K}$	391	379 - 405	300 - 470	$370 \pm 8$
$^{137}\text{Cs}$	2.7	2.5 - 2.8	1.9 - 3.5	$2.8 \pm 0.3$

Our results in Table 3 are also in good agreement with the certified activity values for  $^{40}\text{K}$  and  $^{137}\text{Cs}$