A COMPARISON OF DIFFERENT EXCITATION MODES IN TRACE ELEMENT ANALYSIS BY THE X-RAY EMISSION SPECTROSCOPY

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Three means of excitation modes widely used in the trace element analysis by the x-ray emission spectroscopy[1] employ the x- or γ-rays from radioactive source, x-rays from a x-ray tube or a beam of charged particles. To compare the excitation modes the trace element analysis of the same sample have been made at three different laboratories; at Institute R. Bošković in Zagreb using the x-ray tube with Mo anode and Y as the fluorescer, at the Institute for Natural Sciences and Mathematics of University of Rijeka using the ^{109}Cd source and at the T.W. Bonner Nuclear Laboratories, Rice University, Houston, Texas using the 3-MeV proton beam.[2] The sample was of biological origin, the oyster tissue homogenate obtained from the IAEA International Laboratory of Marine Radioactivity, Monaco.

Table I shows the average results obtained by each system, as well as the results reported by the IAEA. The results are presented as the relative concentration ratios to Zn because, in the case of the proton beam, the absolute concentrations were not measured. Within the errors quoted a good agreement between the results obtained with different systems can be found. Although it can be concluded that all three excitation modes produce very similar results, there is a remarkable difference in the sensitivity and detection limit for particular elements. The proton beam excitation mode shows the highest sensitivies, although it has a remarkable amount of the background induced by the secondary electron bremsstrahlung. Using the x-ray tube as the source for excitation the sensitivities for particular elements can be increased by the proper choice of the fluorescers. Finally in the systems which use radioactive sources the lower sensitivities can be partly compensated with the use of bigger samples due to the larger solid angles of these systems.

The proton beam excitation mode shows the best over all

performance in the trace element analysis, but it is the most expensive one because it requires a proton accelerator.

Table I

	IRB	RIJEKA	RICE	IAEA
Mn	.0197±.0008	.029±.012	.021±.002	.026 ±.002
Fe	.095 ±.003	.076±.011	.087±.007	.115 ±.009
Ni	.0013±.0003	-	-	.0014±.0002
Cu	.120 ±.003	.085±.013	.109±.002	.120 ±.006
Zn	1	1	1	1
As	.0045±.0004		-	.0035±.0004
Br	.183 ±.003	.250±.035	.193±.011	-
Sr	.024 ±.001	.020±.003	.022±.002	-

References

1. V. Valković, Contemp. Phys. 14 (1973) 415, 439
2. V. Valković, R.B. Liebert, T. Zabel, H.T. Larson, Đ. Miljanić, R.M. Wheeler and G.C. Phillips, Nucl. Instr. & Meth. 114 (1974) 573