

Determination of trace elements in hepatic cells of Zn-deficient mice by PIXE and instrumental neutron activation analyses

Makoto Yanaga, Takanori Ogi^{*1}, Takuya Ohyama^{*1}, Nobuyuki Kinugawa^{*1}, Ryuji Minayoshi
Motoko Noguchi^{*2}, Hideo Suganuma, Shoji Futatsugawa^{*3}, Kouichiro Sera^{*4}

Radiochemistry Research Laboratory, Faculty of Science, Shizuoka University
836 Ohya, Shizuoka 422-8529, Japan

^{*1} Department of Biology and Geosciences, Faculty of Science, Shizuoka University
836 Ohya, Shizuoka 422-8529, Japan

^{*2} Graduate School of Science and Engineering, Shizuoka University
836 Ohya, Shizuoka 422-8529, Japan

^{*3} Nishina Memorial Cyclotron Center, Japan Radioisotope Association
348-58 Tomegamori, Takizawa 020-0173, Japan

^{*4} Cyclotron Research Center, Iwate Medical University
348-58 Tomegamori, Takizawa 020-0173, Japan

Abstract

The effect of zinc deficiency on concentrations of trace elements in hepatic cells of mice was investigated by means of INAA combined with cell fractionation technique. Almost all of the trace elements except for iron investigated in the present study mainly existed in cytosol which contains various proteins and enzymes. Zinc concentrations in each cell organelle (each hepatocellular fraction separated by centrifugation) of zinc deficient mice examined were not distinctly lower than those of control mice. On the other hand, cobalt concentrations in all organelles of zinc deficient mice increased significantly compared with control mice. These results suggested that metal proteins and other compounds, in which zinc was replaced by cobalt, might partially be synthesized in the liver of zinc deficient mice. It was also suggested that the other metal elements might slightly substitute for zinc in zinc binding proteins.

In the present study, PIXE analytical technique was proposed for the quantitative analysis of the metal content in proteins separated by electrophoresis. PIXE analytical data for each band on polyacrylamide gel showed that zinc concentrations in low molecular weight proteins in hepatic cells of zinc deficient mice were lower than those of control ones. On the other hand, zinc concentration in high molecular weight protein of zinc deficient mice was higher than that of control one. This result indicated the change of components of metal elements in proteins.