SPECIATION OF HEAVY METALS IN SEDIMENTS FROM THE COAST OF MID-BLACK SEA BY ICP-OES WITH SEQUENTIAL EXTRACTION

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Many negative effects have been done on human health by the environmental pollution of heavy metals. The remediation of heavy metal pollution is often problematic due to their persistence and not degradability in the environment. As a sink and source, sediments constitute a reservoir of bioavailability trace elements and play an important role in geochemical cycles. Much concern has been focused on the investigation of the total metal contents in sediments. However, it cannot provide sufficient information about mobility, bioavailability and toxicity of metals. Their properties depend not only on their total concentration but also on the physicochemical form they occur, which has been described as “speciation” (1). Metals are distributed throughout sediment components and associated with them in various ways including ion exchange, adsorption precipitation, and complexation. They are not permanently fixed by sediments. Changes in environment conditions, such as acidification, redox potential or organic ligand concentrations, can cause mobilization of element from solid to liquid phase and cause contamination (2).

The objective of this study was to determine average concentrations of ten heavy metals (Cu, Pb, Cd, Fe, Al, Cr, Cu, Zn, Mn, Sr) in sediments of the mid-Black Sea coast of Turkey. The effects of anthropogenic activities on the accumulation of heavy metals at sediments of the mid-Black Sea coast of Turkey were examined in this study. Sediment samples were collected seasonally from the Yeşilırmak, Kızılırmak, Mert, Abdal Rivers and Kurupelit sea regions in 2007-2008. The sampling stations were chosen in way to include hotspots of polluted rivers of Samsun city. The digestion of total sediment (fraction <63 µm) were performed with a mixture of HNO₃-HCl-HF at hot-plate and cooling system. In this study, 20 sediment samples from the coast of mid-Black Sea were analyzed by sequential extraction method to obtain the information planar distributions and mobility of heavy metals in this region. Heavy metals concentrations of the solutions were measured by ICP-OES (Perkin Elmer Optima, 4300DV). In exchangeable phase (F₁), carbonate phase (F₂), Fe-Mn oxidation phase (F₃), organic phase (F₄) and residue phase (F₅) which were determined via sequential extraction method, depending on the metals mobility, the removal of heavy metals from sediments was found as; residue>Fe-Mn oxidation>organic>carbonate>exchangeable phase. According to the total concentrations of each Al, Cd, Cr, Cu, Fe, Ni, Pb, Zn, Mn ve Sr metals, a recovery rate of 84-106%, 91-105%, 92-123%, 83-127%, 83-112% were obtained from Yeşilırmak, Abdal, Kızılırmak, Mert Rivers and Kurupelit sea region sediments, respectively. For the analytical quality control, reagent blanks, standard reference materials (BCR-701), and sample replicates were randomly inserted in the analysis. There was no sign of contamination in the analysis, and all of the relative standard deviations of the replicate samples were <10% (1σ).

References