DISTRIBUTION AND SPECIATION OF ARSENIC IN GROUNDWATERS AND TAP WATERS OF EASTERN CROATIA

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Abstract  The presence of arsenic in the groundwater of Eastern Croatia was found almost 20 years ago; however, the extent of this anomaly is still unknown. There is a growing need to improve the knowledge of arsenic distribution in the region as well as of As speciation since As(III) is more toxic and less strongly retained in water treatment processes. Different methods for the determination of As speciation and species preservation have been proposed in the literature, but preservation of As species is still

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subject of scientific debate. In the present study, two analytical approaches (HPLC-ICP-MS and field speciation) have been used to study arsenic speciation in raw groundwater (at 31 different locations) and tap water (at 11 locations). Samples for laboratory speciation were preserved with EDTA, a commonly used preservative when using HPLC-ICP-MS technique. It was shown that EDTA conservation alone is not sufficient for species preservation, at least not for long (≥30 days) periods of storage. It was shown that shallow aquifers were not contaminated by arsenic, while deeper aquifers were generally more affected. Arsenic in the tested groundwater was present predominantly in dissolved form as As(III). As(V) was the predominant species in the residents’ tap water. These results contribute to a greater understanding of hydrogeochemical settings in the area. They also have important implications on the protection of public health and will be helpful for the choice of a cost-effective arsenic removal technology.

**Keywords:** Groundwater; arsenic; speciation; eastern Croatia

1. **Introduction**

During the last decade, the presence of arsenic in the groundwater was reported from many countries all over the world.\(^1\) Arsenic is a human carcinogen. Thus, drinking water contaminated by arsenic has been considered as a global problem. Arsenic exists under different chemical species in groundwater; inorganic arsenite (As(III)) and arsenate (As(V)) are predominant, but low amounts of organic species (monomethyl- and dimethylarsenic) may also be found.\(^2\) Regarding their toxicity, inorganic arsenic species arsenite As(III) and arsenate As(V) are more toxic than organic species. Moreover, As(III) is more toxic than As(V) species.\(^3\) The efficiency of arsenic removal from drinking water depends on its speciation, As(V) being more easily removed than As(III).\(^4,5\) Thus, the knowledge of individual concentrations of As(V) and As(III) is essential.

The presence of arsenic in the groundwater in Eastern Croatia (Osijek-Baranya and Vukovar-Srijem Counties) was found many years ago, and a great deal of work has been done for arsenic removal, especially in the water supply company Vodovod-Osijek plc.\(^6\) However, little was known about the extent of the arsenic contamination in the area. Santo et al.\(^7\) gave the first data regarding the state of the arsenic contamination in Osijek-Baranya County, while for the Vukovar-Srijem County data are scarce.