

Metals and organic pollutants in sediments of the Sava River

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The Sava River (945 km) is the biggest tributary to the Danube River. The 95551 km² large catchment is extended over Slovenia, Croatia, Bosnia and Herzegovina and Serbia and Montenegro. In the development of the river basin management plan all countries are already collaborating under the International Commission for the Protection of the Danube River (ICPDR) guidance. Although the methodological bases for data collection have been reasonably unified, data on the ecological character of the river basin, inventory of pollution sources, dangerous substances, socio-economic parameters, cost and benefit implications are still lacking due to insufficient financing and recent warfare. Within the 6th FW EU project: Sava River Basin: Sustainable Use, Management and Protection of Resources (SARIB) specific tools based on combination of chemical analysis and biological effect methods are developed and validated for the estimation of the pollution of sediments and impact on water biota. Geographical distribution of pollution is identified and historical trends defined. Integrated prediction model about the behaviour of hazardous chemical substances will be combined with the socio-economic prediction model to serve as a base for the elaboration of scenario, remediation measures and best practice techniques. For that purpose an expert data and information management system will be developed.

In order to assess the geographical distribution and historical trends in sediment contamination of the Sava River Basin, sediments were analysed in 20 selected sampling sites along the Sava River from its origin to its outfall into the Danube River. The extent of pollution was estimated by determination of the total element concentrations and by the identification of the most hazardous highly mobile element fractions and anthropogenic inputs of metals to sediments. For comparability of data to other river basins the sediment fraction < 63 µm was analysed. To assess the mobile metal fraction extraction in 0.11 mol L⁻¹ acetic acid was performed, while anthropogenic inputs of elements were estimated on the basis of normalization data to aluminium concentration. According to the Water Framework Directive the following elements were investigated: cadmium, lead, copper zinc, chromium, nickel, arsenic and mercury. In addition, organotin compounds were also determined in sediments.

Among metals, mercury was found to be present in elevated concentrations in the sediments of the Sava River (concentrations in general ranged from 0.2 to 0.6 mg kg⁻¹). The origin of high mercury levels in sediments will be further investigated. Results also indicated that the Sava River is moderately polluted with chromium and nickel from Županja (Croatia) up till Brčko (Serbia). Normalization data indicated on the anthropogenic inputs of these metals in sediments. However, the data of the extraction in 0.11 mol L⁻¹ acetic acid showed that the percentage of the easily soluble metal fraction is low. Organotin analysis showed that the Sava River sediments are not polluted with butyltins, phenyltins or octyltins.

In parallel, the investigation on the presence of organic pollutants downstream the Sava River has been estimated. Results showed low level PCB contamination (ng g⁻¹) in the tested locations between Sava Mojstrana and Jesenice na Dolenjskem in Slovenia. Obtained values will be compared with analysis of the Sava River samples from Croatia, Bosnia and Herzegovina and Serbia which analysis are currently underway in our laboratory. In the Sava River sediment samples also selected pesticides (HCB, Heptachlor, Aldrine, p,p-DDE, Lindane, p,p-DDD, p,p-DDT, Dieldrin and Endrine) were determined. Results did not show any significant differences between tested locations. The differences in pesticide content are expected in samples from southern stream of the Sava River (Croatia, Bosnia and Herzegovina and Serbia) regarding to agricultural activities. These samples are currently being processed.

Polyaromatic hydrocarbons were determined in the Sava River samples. The sum of 16 PAHs in samples literally increases downstream the Sava River (for samples analysed). In the future we will, in collaboration with other SARIB partners, identify sources of PAHs in tested samples.

In the continuation of the SARIB project the data of pollution with elements and organic substances will be compared to the ecotoxicity tests.