Reactive iron dynamics in the Yamuna River basin, India

SWATI SINGH[1], CHINMAYA MAHARANA, DEEPIKA SRIVASTAVA, JAYANT K. TRIPATHI[2]

School of Environmental Sciences, JNU, India
[1]swati.bhu23@gmail.com, [2]jktrip@yahoo.com

Iron is known to have significant effect on environment as it controls biogeochemical cycles of many elements such as phosphorus, sulphur, and many other contaminants owing to redox controlled chemical activities. In the sediments, iron is mainly present in three operationally defined fractions Fe_{HR} (highly reactive iron in carbonate, easily reducible oxides, reducible oxides, and magnetite), Fe_{PR} (poorly reactive iron in sheet silicates) and Fe_U (unreactive iron in silicates) where the total iron is represented as Fe_T. Sediments (channel, overbank, and suspended) of the Yamuna river along with its southern tributaries (Chambal, Ken, Betwa and Sindh) have been studied for their contributions of different fractions of Fe to the Ganga river. The sequential extraction procedure of Poulton and Canfield (2005) was applied and the concentrations of Fe in each of the fractions were analyzed using ICP-AES.

The floodplain sediments and channel sediments of the tributaries were found to have large proportion of iron in the reactive fraction where Fe_{HR}/Fe_T values range between 0.43 and 0.59 as compared to that of the Yamuna mainstream where it ranges between 0.21 and 0.31. It has been found through this study that before the confluence with the southern bank tributaries the suspended sediments of the Yamuna river have lower values of Fe_{HR}/Fe_T (0.30-0.40) as compared to that after the confluence, i.e., 0.5, at Allahabad. The tributaries were also observed to have more reactive fraction of iron in the suspended sediments (Chambal: 0.41, Betwa: 0.38, Ken 0.35) than from the locations in the upper reaches of the Yamuna river. Fe_{HR} flux at Agra was found to be 161 million tons/year while it was calculated to be 461.99, 304.50 and 161.42 million tons/year for Chambal, Betwa and Ken rivers, respectively. At Allahabad, Fe_{HR} flux was estimated to be 2312.64 million tons/year. Therefore, it is suggested that although the tributaries from the southern craton play an important role in supplying reactive iron to the Yamuna river, high runoff and sediment load at Allahabad indicate recycling of the Fe_{HR} from the alluvial floodplain.