River dynamics and nanopaticles formation: A comprehensive study on the nanoparticle geochemistry of suspended sediments in the Magdalena River, Caribbean Industrial Area

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Abstract

The coastal zones on continental shelves are the main channels for the distribution of fluvial-sourced suspended sediments (SSs). In the current research, the monthly average amount of SS draining into the Caribbean Sea from the Magdalena River in northern Colombia was analyzed to detect nanoparticle (NPs) containing potential hazardous elements (PHEs). The ecological authorities of Colombia claimed that the climate change is the key reason behind land erosion and floods occurred in the last years; therefore, an elaborate understanding of NP dynamics between the Magdalena River body and streambed is an essential issue in SS research. In this work, the NP geochemistry of SS in the Magdalena River estuary was studied from the perspective of water quality controls on SS sorting. The morphologies and the structures of NPs (<100 nm) were examined by field emission scanning electron microscopy (FESEM), high-resolution transmission electron microscopy (HR-TEM), and selected area electron diffraction (SAED)/micro-beam diffraction (MBD)/energy dispersive X-ray spectroscopy (EDS) techniques. The average size of NPs was found to be greater than 2 nm and Al, Ti, Fe oxides, and other hazardous elements were also detected in the SS. The obtained data confirmed that these typical categories of NPs caused the occurrence-dependent intensification of a conjugative transmission rate associated with the regulators. The advanced electron beam technique provided a clear insight into SS transportation; therefore, it could be used as an essential instrument for river supervision/dynamics.

Keywords:

Human activities, Suspended sediments, River basin, Sediments geochemistry, Water pollution, Magdalena River