Effect of dissolved organic carbon and salinity on flocculation process of heavy metals during mixing of the Navrud River water with Caspian Seawater


ABSTRACT

Behavior of dissolved metals during estuarine mixing can significantly influence the chemical mass balance between fresh water and saline water. The flocculation of dissolved metals has an important role in self-purification of heavy metals during estuarine mixing. Most studies in the field of flocculation of dissolved metals have only focused on effects of salinity on flocculation of heavy metals. The aim of this study was to evaluate and validate effect of dissolved organic carbon (DOC); and salinity on flocculation of dissolved metals (Cu, Mn, Ni, Zn, and Pb) was investigated on a series of mixtures with salinities ranging from 0.6 to 2.7 ppt at various DOC values (3.2, 7.2, and 10.3 mg/L) during mixing of Navrud River water with Caspian Seawater. The results of mixing of a filtered seawater sample (0.45 μm) with a filtered water sample taken from the Navrud River at constant salinity regimes (0.6‰) and at different DOC (3.2, 7.2, and 10.3 mg/L) indicates that Ni, Zn, and Pb have non-conservative behavior and Cu and Mn have conservative behavior [Ni (79.05) > Pb(75.14) > Zn(38.45) > Cu(24.82) > Mn(17.97)]. Also, increasing DOC values (3.2–10.4 mg/L) at constant salinities, lead to increment of maximum flocculation rate of copper. The flocculation trends at constant salinity regimes (1.1 and 2.1 ppt) at various DOCs (DOC = 3.2, 7.2, and 10.3 mg/L) indicates that Mn, Ni, Zn, and Pb have non-conservative behavior and Cu has conservative behavior. It is also important to note that Ni has maximum rate of flocculation at various DOCs and at constant salinity of 2.7 ppt. According to the mean annual discharge of the Navrud River (166 × 10⁶ m³/year), the annual discharge of dissolved Cu, Mn, Ni, Zn, and Pb into the Caspian Sea would reduce from 6.20, 4.88, 12.31, 23.78, 2.69 to 4.37, 3.06, 1.45, 4.92, 0.41 tons/year, respectively.

Keywords: Flocculation; Salinity; DOC; Micro nutrients; Caspian Sea

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