
Deterioration of Vital Water Resource: Risk Assessment

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Abstract

The Qarraoun Reservoir (impoundment of Litani River) is a vital artificial water resource for Lebanon. The intensive increase in industrial and agricultural activities and mismanagement of sewage and urbanization has negatively impacted the water quality. The objective of this study is to appraise the deterioration in water quality through sediment metal pollution and metal speciation, and water quality index determination over a period of 8 years (2005, 2008, and 2013). Water samples and sediments were collected and quality analysis was conducted following standard protocols. Pollution metal indicators were used for sediments (PLI, Igeo, RAC), for water (WQI). Results indicated deterioration in water quality, WQI from medium (50-70) to bad (25-50). Metal content has increased with time for Cr, Ni, Zn and Cu, while Cd was nearly same and high (1.5 mg/Kg), Pb fluctuated. In parallel, Igeo has increased: (Zn and Ni: > 0-1 moderate contamination; Cr: > 2-3 moderate to strong; Cd: > 4-5 strong to very strong). The PLI > 1 indicated pollution for all years, highest for 2013. The speciation of metals differed in the year 2013, Pb, Cd, and Cr highest in organic fraction (in 2008 Pb and Cd highest in carbonate and Cr highest in reducible); while Cu, Ni and Zn showed high levels in exchangeable. The risk assessment code (RAC) in 2013 became of very high risk for Cu (51%), high for Ni (38%) and Cu (33%); While in 2008 high risk was for Pb (38%) and Cd very high (60%); this is mainly due to predominance of carbonate minerals as indicted by XRD and lower organic content. The deterioration of the water quality and speciation result is due to increase in BOD and organic carbon due to the excessive sewage dumping and use of fertilizers, and untreated waste water effluents in the absence of integrated river basin management.

Keywords: water reservoir, sediment, metals, WQI, RAC, Lebanon

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