



Geochemistry, spatial distribution and environmental risk assessment of the surface sediments: Anchar Lake, Kashmir Valley, India

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Abstract

Anchar Lake, a mono-basined freshwater lake in Kashmir Valley, has experienced major sediment deterioration due to changes in the local catchment and anthropogenic inputs during the recent past. The present study was conducted to evaluate the major, trace element concentrations and environment risk assessment in the surface sediments of Anchar Lake. Spatial distribution of organic matter (OM), CaCO_3 , TOC, sand–silt–clay and C/N ratio was studied to understand their source and accumulation in recent surface sediments. Textural studies indicate that most of the sediment samples are clayey silt to silty clay except one sample being of sandy–clay–silt nature. OM, CaCO_3 content and C/N ratio results reveal that the sediments are organically rich and the source of OM is controlled by both; autochthonous and terrestrial sources. The major oxide geochemistry reflects higher concentrations of CaO, MgO and TiO_2 compared to the UCC values and the possible dilution effect of CaO on other major oxides. Environmental risk assessment indices (Igeo and EF) reveal that the lake surface sediments are low to moderately enriched with Cu, Ni, Zn and Pb and thus are a direct threat to aquatic life. Pollution load index indicates higher contamination of the sediment samples collected along the agricultural and urban land-cover sites. In the absence of industries and metal mines in the catchment area, the agricultural inputs, domestic effluents and untreated sewage discharges are the probable source for the moderate increase in trace metals in the lake sediments. Based on geochemical and environmental parameters, an assessment of sediment contamination results revealed potential risks ranging from moderate to strong for the lake environment, particularly towards areas proximal to agricultural and land-use sites. The above results from this study thus add to the fundamental knowledge of the present lake processes occurring within the lake and its interactions with the surrounding catchment areas.

Keywords Anchar Lake · Geochemistry · Environmental risk assessment · Organic matter · C/N ratio

Introduction

The valley of Kashmir is home to innumerable and pristine freshwater lakes situated at different altitudes with varied depths, sizes and shapes (Kaul et al. 1980; Zutshi et al. 1980). The water from these lakes is widely used for

various purposes including drinking, agriculture and horticulture, and tourism purposes by the local settlers (Sarah et al. 2011; Yousuf et al. 2015). As a result of these direct influences, most of the Himalayan lakes exhibit eutrophication and thus are under greater threat due to high sedimentation rates, sediment and water pollution, especially due to human interferences (Sheikh et al. 2014; Rashid et al. 2013, 2014; Sarkar et al. 2016; Lone et al. 2017). The human impact on the lakes has not only declined the water quality, but have also made a significant impact on the sediment chemistry and lake flora and fauna. In addition, during the recent years, sewage and domestic effluent inputs and proliferation of local population, runoff from agricultural land and the residual insecticides and pesticides from the paddy fields and orchard plantations have also accelerated the process of eutrophication in these lakes. This has led to excessive growth of unwanted vegetation within the lake waters,

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