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Application of stable isotopes (D and 18O) to study the groundwater recharge system in Kathmandu Valley, Nepal

Saroj Kumar Chapagain[1*]

[1]International Research Center for River, [2]International Research Center for River,
[3]Department of Ecosocial System Engineeri

Overexploitation of groundwater has led to a severe decline in groundwater level and well yield over the recent years in Kathmandu Valley. Therefore, understanding of groundwater recharge system has become important for a sustainable groundwater use of this area. The previous traditional hydrogeological methods adopted to study groundwater have not been sufficient to delineate the groundwater recharge system. In this study, a first detailed investigation of stable isotopes (D and 18O) of water sources were made for the evaluation of groundwater recharge characteristics. The values of deltaD and delta18O ranged -66.2 to -43.6 permil and -9.6 to -6.3 permil respectively in deep groundwater and -59.7 to -44.9 permil and -8.2 to -6.6 permil respectively in shallow groundwater. The delta D-delta 18O plot of groundwater fell close to the constructed LMWL (deltaD=8.2delta18O+9.5); and it has suggested the dominance of rainfall and the minimum effect of evaporation during the recharge of groundwater in the basin. The stable isotopic composition was spatially varied in deep groundwater; whereas, the dominance of lighter stable isotopes towards the edge of the basin suggested the origin of deep groundwater from high altitude recharge; however, there was a minimum effects of such high altitude recharge towards the central part of groundwater in the basin. The study suggested protection of the high altitude areas from the human intervention, and need to be managed for enhancing the natural recharge of deep groundwater in the basin.

Keywords: isotope, groundwater, Kathmandu Valley, altitude effect