Identification of the deep groundwater recharge process in Kathmandu Valley, Nepal.

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Increasing population and water demand in developing countries have marked groundwater as a major water source in terms of both economic and accessibility. However, with the increase in population diversity and an unmanaged pollution trend in such countries, groundwater is supposed to be more vulnerable to anthropogenic contaminations. Kathmandu Valley, the capital of Nepal, is also not far away from such problems. Groundwater, being divided into shallow (0-50 m) and deep (50+ m), has its own characteristics and human dependency. Although shallow groundwater is more accessible to the public, the various author reported most of the shallow groundwater to be contaminated from the anthropogenic insurgency. Moreover, deep groundwater is then targeted by institutional and private sectors as an alternative water supply to cover the water demand in Kathmandu. The extraction of deep groundwater in Kathmandu valley is highly expected, however, knowledge regarding the deep groundwater recharge process and interaction on shallow and deep groundwater is still limited.

This study focuses on identifying the current state of recharge mechanism in deep groundwater of Kathmandu Valley. Twenty-five samples from deep groundwater and six samples from mountain spring were collected and analyzed during the wet season of the year 2016. The value of $\delta^{18}O$ and δD varied from -9.7 ‰to -7‰ and -71‰ to -47‰, respectively for deep groundwater samples, and from -9.3‰ to -8.2‰ and -63‰ to -56‰, respectively for the spring water samples. A linear line obtained from the spring water isotope data showed the occurrence of altitude effect in the valley. The spatially distributed water isotope data show the occurrence of various processes in the deep groundwater. The lighter water isotopes concentrated in the NW and periphery side of the valley shows the mountain groundwater recharge (localized recharge) whereas the higher valued water isotope in the deep groundwater of the central part of the valley is anticipated to be paleo-groundwater and from direct recharge. Meanwhile, the medium valued water isotope shows the mixing of groundwater recharged from the higher elevated hills and lower elevated hills along with the anticipated paleo-groundwater.
The preliminary stable water isotope analysis in Kathmandu Valley indicated the wide distribution of water sources and mixing of the water sources even in the deep groundwater. The result of heavier water isotope obtained from the central part of the valley shows either the deep groundwater is having direct recharge from the shallow surface or the paleo- groundwater is being extracted. Thus this paper also seeks the attention of the groundwater management for redesigning extraction scenario mostly from the central part of the Kathmandu Valley.

Keywords: Groundwater, Stable Isotopes, Kathmandu valley

