ABSTRACT

Rainwater harvesting is an effective technology for urban water conservation and sustainable water management. The present study focuses on design of novel horizontal filtration system integrated within a rainwater harvesting system. The analysis of existing groundwater quality, sampled from three wells DWS-1, -2, and-3 indicated that conductivity (1075 µS/cm in DWS-3), arsenic concentration (39.45 mg/l), taste (objectionable in DWS-1 and DWS-2), and turbidity (6.7ntu in DWS-2) fluctuate from the WHO specified standards. Geological investigation data, obtained from the engineering cell, indicated the presence of permeable sand layer at a depth of 28.5 ft. The horizontal slow sand filtration system consists of a tiered arrangement of porous bricks with coarse sand, gravel stones, and flora to facilitate stormwater filtration. The treated water is directly injected to the aquifer for recharge. The rainwater harvesting potential of the site is 15,078 m3 for 300 mm rainfall, and 100% of it is recharged to the aquifer. The % removal efficiency of 100% salinity; 99.7% turbidity; 72% EC; 88.2% TDS; 99.3% COD; 74.3% Chloride, 100% Coliform, 87.4% Nitrate and 51.5% Sulfate, was obtained through the slow-sand filtration process. The pH, turbidity, TDS, Chloride, Sulfate, and conductivity of initial groundwater quality are lowered from 8.2, 6.7 ntu, 688 mg/l, 67 mg/l, 104 mg/l, and 1075 µS/cm to SSF system treated quality of 6.53, 2.5 ntu, 12.8 mg/l, 24.67 mg/l, 2.75 mg/l, and 65.3 µS/cm. The quality of direct rain and SSF treated water was within the WHO permissible limits. The findings of this study will facilitate in mitigating the urban stormwater flooding during monsoon, depleting aquifer problems, and groundwater quality deterioration.

Keywords: Rainwater Harvesting; Slow-Sand Filter; Water Treatment; Treatment Efficiency; Water Harvesting Potential; Sustainability.