Quantitative and qualitative assessment of rainwater harvesting as an alternative water source in semi-industrial areas

Mohammad Hossein Rashidi Mehrabadi[a],*, Bahram Saghafian[a], Hossein Ghalkhani[b]

[a]*Department of Technical and Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran,*
emails: hossein_hakim@yahoo.com (M.H. Rashidi Mehrabadi), b.saghafian@gmail.com (B. Saghafian)
[b]*Department of Water Resources Research, Water Research Institute, Tehran, Iran, email: h_ghalkhany@yahoo.com*

ABSTRACT

Rainwater harvesting (RWH) from the roofs of buildings can be an alternative source to meet urban water demands. Harvested rainwater could be significant in industrial buildings and factories due to their large roof areas. In this study, the quality and quantity of harvested rainwater that was stored in tanks of different storage volumes in a semi-industrial area were investigated. Mathematical modeling and an analysis showed that for roof areas between 500 and 3,000 m^2, the volume of rainwater stored in small storage tanks (less than 25,000 L) ranged from 134 to 743 m^3 and the volume of rainwater collected in large storage tanks (more than 25,000 L) was within the range of 172–956 m^3. The reliability of meeting daily water demands of storage tanks of at least 1,000 L to a maximum of 5,000 L for small roof areas (from 500 to 1,500 m^2) ranged between 25%–70% and 3%–22%, respectively. Similarly, reliability for large roof areas (2,000–3,000 m^2) varied from 38% to 78% and from 10% to 36%, respectively. For qualitative analysis of RWH systems, two pilots were made of galvanized steel and isogum. The values of chemical, physical and microbial parameters of the collected rainwater samples from isogum and galvanized steel roof covers, including Cl^-, So_4^{2-}, No_3^-, Mg^{2+}, Cd^{2+}, TDS, Cr, Ni, and total hardness, were found to be less than those of drinking water standards. Statistical analysis indicated that the galvanized steel pilot is more suitable than the isogum pilot in terms of meeting the criteria specified by the drinking water Standard No. 1053 of Iran. The microbial content of the harvested rainwater in the galvanized steel pilot was in the acceptable range and lower than those of the isogum pilot. In the galvanized steel pilot, no content of fecal coliform and fecal streptococci was observed, and the total coliform levels were negligible. The findings suggest that RWH could meet a part of industrial water demands.

Keywords: Rainwater harvesting; Reliability; Quantitative and qualitative; Water supply; Semi-industrial areas

* Corresponding author.