ABSTRACT

Water is a basic and essential source required for every human being to carry out their daily activities. Worldwide, water plays a key role in the development of any country. The availability of fresh water supply is limited while its demand increases day by day. Rapid population growth, urbanization, industrialization and modern living standards in peri-urban and urban areas, have led to increase of wastewater generation.

The impact of population growth results in migration of vast number of people from villages to cities in search of job opportunities, better facilities for health care etc. On the other hand, the cost of living in cities is very high. Due to saturation of urban areas, settlement occurs in peri-urban areas. Thus such expansion results in urbanisation. The majority of urban growth is associated with the rapid expansion of smaller urban centers and peri-urban developments which are situated about 10 Km to 25 Km from the metropolitan cities. The impact of urbanisation results in inadequate sanitation in urban and peri-urban areas. Peri-urban areas are generally in a state of rapid transition. The unplanned expansion of the peri-urban and rural areas lacks in provision of infrastructure. However the majority of settlements in peri-urban areas, particularly those inhabited by poor communities, do not have access to adequate water supply and sanitation facilities.

Shollinganallur Taluk of Kancheepuram District has been chosen as study area for the present research work which falls in the extension part of the peri-urban area of South Chennai city. The study area was facing problems of water scarcity and wastewater management. The wastewater generated in the study area is mainly disposed into nearby surface water
bodies like ponds, lakes and low lying vacant lands, which create environmental pollution. The quality of surface water and groundwater were assessed during pre monsoon and post monsoon periods and compared with BIS water quality standards. The laboratory study revealed that Shollinganallur Taluk was facing environmental pollution problem. Thus in order to reduce the problems associated with the disposal of untreated wastewater, there is a need to identify the suitable sites for collection, treatment and reuse the treated wastewater using advanced technologies.

A GIS based Multicriteria Analysis was carried out using AHP tool in selection of suitable Decentralised Wastewater Treatment Plants (DTP) sites for the study area. The criteria considered for DTP site selection are technical parameters such as population, landuse, wastewater quantity, slope, soil type and geology, etc., environmental factors like distance from tourist spot, water bodies and quality of wastewater and economic factors, which includes conveyance cost and land cost. Analytical Hierarchy Process (AHP) method is used to assign the relative weights and ranks for each sub-criteria. Twenty four potential sites suitable for DTP are found out by overlay analysis. The resulting suitability maps were evaluated in the field investigation. The resulted 24 DTP sites were analysed for suitable treatment technology by overlaying on landuse map which comprises two landuse classes namely the village and urban areas. Based on the type of landuse class, availability of land area and population density two types of treatment technology were opted. The Up Flow Anaerobic Sludge Blanket (UASB) treatment technology was recommended for 15 DTP sites, which fall in the urban area and Constructed Wetlands (CW) technology was recommended for 9 DTP sites, which fall in the rural area.

Each DTP site was analysed for possibilities of reuse options by simple overlay analysis using detailed landuse map. A buffer zone of 1000 m
created around each DTP site was analysed for urban, industrial, recreational and ground water recharge purpose. An attempt was made to carry out the detailed study for efficacy of wastewater reuse for recharging the aquifers through Soil Aquifer Treatment (SAT) method. The recommendations of suitable sites for SAT application within the selected DTP sites were based on the field analysis parameters such as groundwater quality, soil depth, soil salinity, soil texture and geology. Soil samples were collected from the DTP sites which satisfy all the field analysis parameters suitable for SAT application. Soil samples were packed in four soil columns. A preliminary laboratory analysis was carried out to study the effectiveness of SAT system with respect to the improvement of treated wastewater quality and soil infiltration rate before and after SAT process. Significant improvement in the water quality was observed in all the four soil columns. The infiltration rate varied in all soil columns due to different soil layers and also development of clogging layer is found at the top of the soils.

Overall, the study reveals the importance of multicriteria decision making in solving the environmental pollution problems of wastewater management. AHP as a powerful tool, was used in this research for selection of suitable DTP sites in the study area. The analysis on DTP sites for reuse options illustrates the effective management of treated waste water, replenishment of ground water table and minimal usage of fresh water. Experimental study on SAT strongly recommends the best suitable sites for SAT application for ground water recharge in the study area.