Assessment of Synergy between Biomedical Waste and Shallow Groundwater Pollution

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Rapid urbanization and increasing population growth rate followed by the high rates of resource consumption patterns and increased waste generation have had an unintended negative impact on the prevailing environment. In a developing country like India where 50.34 % groundwater resources are not suitable for drinking as per WHO standards (United Nations, 2016), scrutinizing the open dumping of pathogenic biomedical waste becomes of paramount importance. Poor waste management practices pose a huge risk to the health of the public, patients, professionals and contribute to environmental degradation (land, air, and water pollution) if dumped untreated on the open ground. To assess this nexus, a prevalence study of the patients affected with waterborne diseases was conducted in a total of 35 hospitals comprising of government-, government-aided- and private hospitals of Ambala city. With a pronounced steppe climate, Ambala is located in North-Eastern (mean spatial coordinates: 30˚ 22' 41.4480" N and 76˚ 46' 36.1020" E) edge of Haryana, India. The city is drained by non-perennial streams and therefore the inhabitants depend solely on shallow groundwater resources for meeting their domestic water demand.

Data about the sources, quantity produced, treatment facilities, and awareness of biomedical waste, collected by questionnaire method based survey revealed that the mean waste generation was 8.08 kg/day with SD 5.371 kg/day. The biomedical waste consisted of approximately 1.2 % of the total municipal waste generated by the city and the patients affected with waterborne diseases were about 36 % of the total patients recorded. A latin hypercube Pareto distribution coupled with AMALGAM algorithm was employed for the initial sampling states of the proposals from the observed data (no. of patients). Thereafter, posterior estimates were generated using the Markov Chain Monte Carlo (MCMC) methods which showed a close fit with the observed and simulated data with RMSE 0.158. Furthermore, regression analysis with R^2=0.868 construed strong positive linear correlation between two variables viz. the number of patients and biomedical waste generated (and dumped). Recommendations are made for prioritizing the waste segregation and employing the indispensable management processes including waste treatment to avoid the further deterioration of the drinking water quality. The hospital authorities are advised to conduct the periodic seminars for enhancing awareness among the workforce from present 93.3 % to a maximum possible level.

Keywords: Groundwater, Biomedical waste, MCMC methods, Environmental awareness

