Abstract

Ghaziabad (Uttar Pradesh-India) is being the part of the national capital region—“Delhi” having the water aquifer types of deep-shallow, lies in the Ganga plain, using the sources of ground-water since a long time. The study area involves in a number of industrial and agricultural activities having disposal sites surrounding it. In this study ground-water quality for drinking, domestic, irrigation and industrial application was assessed. Post-pre season samples analyzed for a number of physic-chemical parameters as pH, conductivity, Salinity, TDS, Resistivity, K, Na, Cl-, T. Hardness.Ca. Hardness, Mg Hardness, Ca, Mg, T. Alkalinity, CO$_3^{2-}$, HCO$_3^-$, Silica, Amm- N$_2$, NO$_2^-$, SO$_4^{2-}$, PO$_4^{3-}$, Br$^-$, F, Cr$^{6+}$, NO$_3^-$ and Be, B, Zn, Ni, Pb, Mo, Cu, Al, Fe, Sn, Mn and V. In the study area pH showed mildly acidic to mildly alkaline in both the season. The alkalinity, TDS shows the violation with respect to their respective desirable level at all the selected sites. From hardness view point 60% in pre and about 57% samples in post monsoon season exceeded the desirable limit 300 ppm. The fluoride were found exceed the desirable limit 1.0 ppm in 31% ,about 21% in both season. Nitrate shows no violation in the area. Anthropogenic activities may be responsible for the higher levels of these ions in the study area.Iron concentration were significantly high in both the season. It was found beyond the desirable limit(0.3ppm)in 41 and 70% samples in both the season, moreover 15% sample and 46% samples exceeds the permissible limit 1.0ppm in pre and post-monsoon season respectively clearly showing its anthropogenic origin. The concentration of the Cr-VI has also been found in 6-7% samples beyond the desirable limit 0.05 ppm during both the season. Lead was analyzed in about 9 and 16% samples exceeding desirable level (0.1ppm) during both the season. Aluminum was found significantly beyond the desirable limit 0.03 ppm in most of the samples during both the season. Boron was also showing violation in respect of desirable level 0.3ppm in 17 and 22% samples during both the season. Manganese was found in 3.2 and 16% samples beyond the permissible limit of 0.3ppm in the two seasons respectively. Furthermore, post-monsoon season showing the Mo, Cu and Ni beyond their desirable limit in 18.4,4 and 16% samples respectively. Ionic dominance order in the study region was Cl$^->$Na$^->$HCO$_3^->$Mg$^{2+}$>Ca$^{2+}$>SO$_4^-$>K$^->$NO$_3^-$ .According to classification of Soltan, maximum number of samples classified as Normal-sulfate, Normal-chloride and Normal-bicarbonate during pre-post monsoon season.
Base exchanges indices ($r_1$) were calculated for water samples. Based on $r_1$ in pre-monsoon season 78% samples were of Na$^+$-HCO$_3^-$ and rest of samples were of type Na$^+$-SO$_4^{2-}$, whereas 56% samples were Na$^+$-SO$_4^{2-}$ type and 44% were of Na$^+$-HCO$_3^-$ type in post-monsoon season. Based on meteoric genesis indices ($r_2$), 81% samples were of shallow meteoric and 19% of deep meteoric water-percolation type in pre-monsoon season which was changed in post-monsoon season as to 45% and 55% respectively. The ground water quality was evaluated based on BIS drinking water standard (for drinking) salinity, chlorinity, sodicity, RSC (for irrigation) and by Aggressivity Index (industrial uses). For drinking and domestic uses majority of the area samples are not in accordance of BIS standards, whereas for irrigation purpose (~90%, 92% in two seasons) tested on the basis of indices showing moderate to high salinity, thus may be considered as suitable for irrigation. Moreover, maximum number of samples (82%, 47% in two seasons) of study area were found mordantly corrosive in nature and can be used for industrial applications.

The study also involve the synthesis of ZFA (zeolitized fly-ash). In comparison to the commercial form, our synthesized (fly-ash based) zeolite was found more effective towards metals removal in mixed condition. Study reveals the removal dependency mainly on the metal ions initial concentration and the solution pH values. Removal order was found as Cu-II > Cr-III > Zn-II > Co-II > Ni-II by using the FAZ and commercial form. Pseudo second order model was found best fitted with the experimental data for Ni$^{2+}$, Cu$^{2+}$, Cr$^{3+}$, Zn$^{2+}$, and Co$^{2+}$ metal ion. Langmuir equation explained the metal adsorption isotherm more accurately. Synthesized zeolite can replace the commercial zeolite which is in accordance to its economic viability. Results also suggest the involvement of both the processes as the ion-exchange along with adsorption. So the prepared zeolite may be an alternative to the activated carbon and the purchased zeolite towards waste-water treatment having a number of metals pollutants.