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Original Research Article

Consequences of environmental characteristic from livestock and domestic wastes in wetland disposal on ground water quality in Lucknow (India)

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The objective of present research was to assess pH, chloride, alkalinity, hardness, nitrate, phosphate, sulphate and metals leaching to shallow groundwater and to quantify the impact of the sources. The complex array of potential point and nonpoint sources were divided into three major source areas representing liquid manure, dry manure and domestic waste in feed storage areas. An extensive shallow groundwater monitoring network (hand pumps and submersible pumps) was installed in three representative wetlands operations in the north Lucknow from summer, monsoon and winter season 2014. The range of observed nitrate and salinity levels was similar on all five dairies. Average concentration of phosphate, sulphate, alkalinity, chlorides, pH and hardness were higher in summer season (PO_4; 0.15, SO_4; 40.15, alkalinity; 351.80, chloride; 45.41, pH; 7.91, hardness 330.60 mg/L) whereas nitrate in monsoon season (NO_3; 17.12 mg/L). The metals concentration was higher in winter season such as Cr; 0.0050, Zn; 0.0067, Cd; 0.0024, Pb; 0.0064, Fe; 0.8283, Mg; 1.6071, Co; 0.0037, Ni; 0.0258 mg/L whereas Cu; 0.0476, Mn; 0.0470 mg/L was higher in monsoon season in shallow groundwater. Concentrations of above metals were more than the concentration was found in control sample. Results concluded that leaching from those mismanagement areas, since manure-treated fields represent the extreme contaminated land area of the dairy, proper nutrient management will be a key to protecting groundwater quality in dairy regions overlying alluvial aquifers.

Key word: Ground water, season, metals leaching, wetlands, Lucknow

INTRODUCTION

Adil Nagar is located in north east of Lucknow having geological information 26°54'36"N, 80°58'3"E. Livestock dairies are the confined as animal husbandry (dairies) in the Adil Nagar Lucknow. A major portion of these dairies (around 8x8 km^2 in area), which have an average nearly 20 animals unit, were located in study area. Large amount of liquid, solid manure and domestic wastes are generated and stored in these dairies wetland. Little is known about the impact of dairies manure and domestic waste (solid & liquid) mismanagement practices on ground water quality of the extensive alluvial aquifers underlying these wetland area. In study area, ground water has being contaminated through some anthropogenic activity such as poultry dairy and others. Groundwater is the basic need of every person in daily life.

Unfortunately due to injudicious and unplanned urbanization and industrialization for the past decades in few parts of the country, the resource is either being depleted or degraded in quality (Murhekar, 2011; Parihar et al., 2012; Haribhau, 2012; Manimaran et al., 2012; Antony et al., 2012, Krishan et al., 2014; Macdonald et al., 2014). The depth of water tables changes with monsoons going down to 4-6 m, during pre monsoon and rises to 0-3 m, during monsoon and post monsoon period (Xu et al., 2013; Macdonald et al., 2015).

Over the years, excessive amounts of nitrate are surfacing in groundwater in various parts of the state (Krishnan and Srinivas, 1995). Groundwater will normally clear and clean because the soil rock naturally filters out particulate matter. But, natural and human induced chemicals can be found in groundwater. Ramesh et al. (1995) have explained the unequal distribution of major and trace elements in the ground water due to anthropogenic activities (such as domestic sewage, industrial effluents waste dumping etc.). About 80% of the diseases of the world population and more than one third of the deaths in the developing countries are due to contamination of water (WHO, 1998; The Earth Summit, 1990). Ground water composition in a region depends on the natural (such as wet and dry deposition of atmospheric salts, evaporation and soil rock water interactions) and anthropogenic processes, which can alter or modify the natural system of hydrological cycle (Subba Rao, 2002; Singh et al., 2002; Shukla et al., 2015).

As groundwater flows through the ground, metals such as iron and nitrates are dissolved and may later be found in high concentrations in the ground water. Industrial discharges, urban activities, agriculture activities, ground water pumpage and disposal of waste, can affect ground water quality. Contaminants can be human induced, as from leaking fuel tanks or toxic chemical spills. Pesticides and fertilizers applied to lawns and crops can accumulate and migrate to the water table. Soil can eventually end up in water drawn from a well. Or, a well might have been placed in land that was once used for something like a garbage or chemical dump site (Tiwari et al., 2015a).

High concentrations of dissolved solids shorten the life of hot water heaters. Iron imparts a bitter astringent taste to water and a brownish color and nitrate (as nitrogen) occurs naturally in mineral deposits, soils, seawater, freshwater systems, the atmosphere and biota. More stable form of combined nitrogen in oxygenated water (Tiwari et al., 2015b). Found in the highest levels in groundwater under extensively developed areas, which enters the environment from fertilizer, feedlots and sewage. Toxicity results from the body's natural breakdown of nitrate to nitrite causes "blue baby disease," or methemoglobinemia, which threatens oxygen carrying capacity of the blood. Nitrite (combined nitrate/nitrite) enters environment from fertilizer, sewage and human or farm animal waste (Tiwari et al., 2015b). Chloride may be associated with the presence of sodium in drinking water when present in high concentrations. Often from saltwater intrusion, mineral dissolution, industrial and domestic waste can change the taste of water and has a laxative effect in high doses [Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources (Oxford University Press, New York)]. Under-groundwater can also be getting contaminated from industrial, dairy wastes, domestic and agricultural chemicals and also from naturally occurring contaminants are present in the rocks and sediments. In sampling areas, ground water affected in many different types. Manage and prevention of ground water quality degradability in modern life and awareness to village's peoples. Keeping in view, establishment of industries and urbanization disturbed the groundwater, which is like a nature gift, is limited. The present research focuses on physico-chemical analysis of the groundwater as well as heavy metals present in bound phases have been studied and also discussed better management practices to protect groundwater contamination.

Contaminants such as iron, manganese, lead and cadmium can dissolve from soil and waste material into groundwater in a process known as leaching. The dissolution of these metals is based on the chemistry of the water and the soil. Factors that affect metal mobility include pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), specific conductivity, temperature, and soil conditions (McLean et al., 1992). High content of chromium may be due to various anthropogenic activities, industrial effluents, tanneries, old plumbing and household sewages (Warmate and Ideriah, 2011). The source of zinc slight high value may due to agricultural inputs, domestic waste discharges and the industrial effluents (Abdul and Sirajudeen, 2006). The concentration of Mn slight rise in its level may be accounted for by the influence of domestic waste, natural geological rocks (Kumar, 2001). The low level metal may be due to absorption process by the soil, which reduces the concentration of the heavy metals in water (Aggarwal et al., 2000). High level of Cu may be due to presence of industrial and domestic waste (Sharpley and Menzel, 1987). The contamination of Pb in the ground water may be the result of entry from industrial effluents, old plumbing, household sewages containing phosphate fertilizers and human & animal excreta. Higher amount encountered particularly at few stations show that they are having high domestic sewage (Abdul and Sirajudeen, 2006). The high level of Ni may due to mixing of variety of wastes including that of automobile repair shops, electroplating units, utensil manufacturing process, sewage, agricultural runoff (Sharpley and Menzel, 1987). This study in important on the basis of human being because drinking water is a basic need of every life so government and NGO also take a solid action against this problems.

The major position of the district is occupied by soils locally known as "Bhur" or "Silty sand" on the ridges. "Matiyar" or "Clay soils" occurs along topographic lows and "Dumat or Loamy soils" in the level lands. Clay is dominant in the areas where "Reh" (Usar) prevails. Along the river valleys, a very fertile soil called "Dumat" is prevalent (Arun Kumar, 2008-09). This soil type is prone to high leaching capacity to ground water. So it is important to know the impact of contaminated wetland on ground water.

MATERIALS AND METHODS

Study area

Samples were collected and analyzed from 6 locations of Adil Nagar, Lucknow. The altitude and latitude between 26°54'36"N 80°58'3"E, wet lands catch permanent wastewater from livestock and domestic waste runoff. Lucknow district forms a part of Central Ganga Plains and city forms a part of Sai Gomti sub basin. General elevation of the city varies between 103 and 130 M above mean sea level showing southeasterly slope. Triplicate samples were collected around the wet lands in 5 L Tarson sampling bottles and carried out in laboratory in ice box at about 4°C having preserved with HNO_3. Samples were collected in summer, monsoon and winter season. Hand pumps and submersible pumps were selected for water sampling source in 50 meter periphery of wetland. In this area, people using above sources for drinking purpose.

Analysis in laboratories and used methods

Samples were analyzed in laboratory according to APHA/ AWWA-2012 (22nd Edition). Ion-selective electrode is used for pH; Argentometric titration method for the Chloride; Sulphuric acid titration method for Total alkalinity; EDTA titration for Total hardness; UV Spectrophotometric screening method for Nitrate; Turbiditimetric method for Sulfate; Gravimetric method for TDS and Atomic absorption spectrometric method for metals.

Quality assurance procedure

Special precautions were taken during sampling and analysis of physico-chemical and elemental parameters. Before collecting the samples, the polythene containers are dipped overnight in 2% HCl and washed with double distilled water.

Analytical Methodology

Trace metals were analyzed by using ICP-MS (Perkin-Elmer Sciex Elan 5000) standard reference material (Merck make). Seven different linear concentration standards were prepared, ranging from 0.001 mg/L to 0.1 mg/L. Before conducting sample analysis, different concentrations of standards were analyzed and linear curve was prepared. All metals having good linear graph with correlation coefficient of > 0.999 were observed in the preparation of standard curves.

Instrumentation: ICP- MS

The instrument used was ICP- MS equipped with quartz torch, nickel sampler and skimmer cones, a peristaltic pump (maintaining a 1.0 mL/ min sample uptake rate), a cross-flow type pneumatic nebulizer and a double pass Scott-type spray chamber.

RESULTS AND DISCUSSION

ICP-MS is the useful instrumental technique for the determination of trace metals up to parts per billion levels in single aspiration.

Chromium

During the study period, chromium has been analyzed and found average value in summer, monsoon and winter season 0.004, 0.0039 and 0.005 mg/L in all study locations. The maximum acceptable limit for chromium as per IS: 10500 are 0.05 mg/L and 0.05 mg/L as per WHO. The maximum value of chromium was found in winter season but under the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Zinc

During the study period, zinc has been analyzed and found average value in summer, monsoon and winter season 0.0045, 0.0042 and 0.0067 mg/L in all study locations. The maximum acceptable limit for zinc as per IS: 10500 are 5.0 mg/L and 0.01 mg/L as per WHO. The maximum value of zinc found in also winter season but under the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Copper

During the study period, copper has been analyzed and found average value in summer, monsoon and winter season 0.0020, 0.0476 and 0.0035 mg/L respectively. The maximum acceptable limit for copper as per IS: 10500 are 0.05 mg/L and 2.0 mg/L as per WHO. The maximum value of copper found in monsoon season but under the prescribed limit of WHO guideline. The concentration of copper in monsoon season was higher than the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Cadmium

During the study period, cadmium concentration levels in ground water has been found average value in summer, monsoon and winter season 0.0016, 0.0015 and 0.0024 mg/L respectively. The maximum concentration of cadmium has been observed in winter season. The maximum acceptable limit for cadmium as per IS: 10500 are 0.003 mg/L and same for WHO also (Table 1).

Manganese

During the study period, manganese has been analyzed and found average value in summer, monsoon and winter

Table 1. Seasonal variation of physico-chemical and metals concentrations (mg/L) in Adil Nagar: (a) Summer, (b) Mansoon and (c) Winter seasons

(a) Summer Season																
Locations	**Cr**	**Zn**	**Cu**	**Cd**	**Mn**	**Pb**	**Fe**	**Mg**	**Co**	**Ni**	**NO_3**	**PO_4**	**SO_4**	**Alkalinity**	**Chloride**	**pH**	**Hardness**
1	0.0038	0.0014	0.0053	0.0018	0.0640	0.0139	0.4852	0.8542	0.0028	0.0242	14.88	0.23	41.78	380.00	36.04	7.89	381.00
2	0.0048	0.0162	0.0021	0.0014	0.0460	0.0020	1.0254	1.0258	0.0088	0.0163	12.98	0.19	45.36	344.00	48.25	8.00	368.00
3	0.0026	0.0020	0.0011	0.0014	0.0042	0.0031	0.9464	0.9875	0.0007	0.0190	20.45	0.14	49.58	410.00	65.35	8.10	378.00
4	0.0019	0.0016	0.0009	0.0016	0.0009	0.0075	1.3015	0.5247	0.0032	0.0043	15.60	0.10	35.44	320.00	40.23	7.69	268.00
5	0.0070	0.0014	0.0008	0.0017	0.0029	0.0051	0.3699	0.9632	0.0020	0.0202	14.87	0.10	28.61	305.00	37.18	7.88	258.00
Average	0.0040	0.0045	0.0020	0.0016	0.0236	0.0063	0.8257	0.5247	0.0035	0.0168	15.76	0.15	40.15	351.80	45.41	7.91	330.60
Max.	0.0070	0.0162	0.0053	0.0018	0.0640	0.0139	1.3015	1.0258	0.0088	0.0242	20.45	0.23	49.58	410.00	65.35	8.10	381.00
Min.	0.0019	0.0014	0.0008	0.0014	0.0009	0.0020	0.3699	0.8711	0.0007	0.0043	12.98	0.10	28.61	305.00	36.04	7.69	258.00
Control	NIL	0.0012	0.0010	NIL	0.0085	NIL	0.1584	0.5471	NIL	0.0068	10.36	0.035	15.34	132.5	18.37	7.69	142.39
IS: 10500 Standard	0.05	5.00	0.05	0.003	0.10	0.01	0.30	30.00	-	0.02	45.00	-	200.00	200.00	250.00	6.5-8.5	200.00
WHO Standard	-	0.01	2.00	0.003	0.1-0.5	0.01	0.30	50.00	-	0.07	50.00	-	250.00	200.00	250.00	6.5-8.5	100.00
Detection Limit (mg/L)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001	0.0001	0.0001	0.0001	-	-	-	-	0.01	-	-

(b) Monsoon Season																
Locations	**Cr**	**Zn**	**Cu**	**Cd**	**Mn**	**Pb**	**Fe**	**Mg**	**Co**	**Ni**	**NO_3**	**PO_4**	**SO_4**	**Alkalinity**	**Chloride**	**pH**	**Hardness**
1	0.0035	0.0012	0.0680	0.0014	0.0580	0.0101	0.4200	0.4870	0.0025	0.0185	10.95	0.08	11.25	189.00	22.71	7.52	149.00
2	0.0041	0.0150	0.0250	0.0012	0.0430	0.0014	0.8640	1.4500	0.0074	0.0148	9.10	0.08	06.05	178.00	18.66	7.61	155.00
3	0.0029	0.0021	0.0370	0.0016	0.0390	0.0025	0.4870	1.0020	0.0048	0.0176	26.71	0.24	61.74	450.00	58.25	8.31	346.00
4	0.0020	0.0014	0.0740	0.0014	0.0620	0.0068	1.0250	0.2580	0.0029	0.0124	22.48	0.18	22.51	335.00	49.68	8.00	310.00
5	0.0071	0.0015	0.0340	0.0020	0.0330	0.0048	0.3210	0.6310	0.0019	0.0114	16.34	0.13	10.77	265.00	36.22	7.95	225.00
Average	0.0039	0.0042	0.0476	0.0015	0.0470	0.0051	0.6234	0.7656	0.0039	0.0149	17.12	0.14	22.46	283.40	37.10	7.88	237.00
Max.	0.0071	0.0150	0.0740	0.0020	0.0620	0.0101	1.0250	1.4500	0.0074	0.0185	26.71	0.24	61.74	450.00	58.25	8.31	346.00
Min.	0.0020	0.0012	0.0250	0.0012	0.0330	0.0014	0.3210	0.2580	0.0019	0.0114	9.10	0.08	6.05	178.00	18.66	7.52	149.00
Control	NIL	0.0012	0.0010	NIL	0.0085	NIL	0.1584	0.5471	NIL	0.0068	10.36	0.035	15.34	132.5	18.37	7.69	142.39
IS: 10500 Standard	0.05	5.00	0.05	0.003	0.10	0.01	0.30	30.00	-	0.02	45.00	-	200.00	200.00	250.00	6.5-8.5	200.00
WHO Standard	-	0.01	2.00	0.003	0.1-0.5	0.01	0.30	50.00	-	0.07	50.00	-	250.00	200.00	250.00	6.5-8.5	100.00
Detection Limit (mg/L)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001	0.0001	0.0001	0.0001	-	-	-	-	0.01	-	-

(c) Winter Season

Locations	Cr	Zn	Cu	Cd	Mn	Pb	Fe	Mg	Co	Ni	NO_3	PO_4	SO_4	Alkalinity	Chloride	pH	Hardness
1	0.0049	0.0021	0.0062	0.0025	0.0754	0.0100	0.0524	2.5829	0.0035	0.0358	10.55	0.09	9.28	200.00	22.55	7.68	179.00
2	0.0056	0.0254	0.0029	0.0019	0.0572	0.0085	1.1580	1.7315	0.0048	0.0245	13.58	0.20	42.58	326.00	46.85	8.01	354.00
3	0.0033	0.0021	0.0017	0.0021	0.0421	0.0027	1.0214	2.4509	0.0012	0.0221	18.38	0.16	45.68	357.00	59.78	8.12	345.00
4	0.0026	0.0020	0.0037	0.0023	0.0185	0.0048	1.3852	0.3929	0.0055	0.0102	14.85	0.10	33.18	312.00	48.37	7.77	275.00
5	0.0085	0.0017	0.0031	0.0030	0.0325	0.0059	0.5244	0.8776	0.0034	0.0363	12.64	0.09	30.48	287.00	32.16	7.79	248.00
Average	0.0050	0.0067	0.0035	0.0024	0.0451	0.0064	0.8283	1.6071	0.0037	0.0258	14.00	0.13	32.24	296.40	41.94	7.87	280.20
Max.	0.0085	0.0254	0.0062	0.0030	0.0754	0.0100	1.3852	2.5829	0.0055	0.0363	18.38	0.20	45.68	357.00	59.78	8.12	354.00
Min.	0.0026	0.0017	0.0017	0.0019	0.0185	0.0027	0.0524	0.3929	0.0012	0.0102	10.55	0.09	9.28	200.00	22.55	7.68	179.00
Control	NIL	0.0012	0.0010	NIL	0.0085	NIL	0.1584	0.5471	NIL	0.0068	10.36	0.035	15.34	132.5	18.37	7.69	142.39
IS: 10500 Standard	0.05	5.00	0.05	0.003	0.10	0.01	0.30	30.00	-	0.02	45.00	-	200.00	200.00	250.00	6.5-8.5	200.00
WHO Standard	-	0.01	2.00	0.003	0.1-0.5	0.01	0.30	50.00	-	0.07	50.00	-	250.00	200.00	250.00	6.5-8.5	100.00
Detection Limit (mg/L)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001	0.0001	0.0001	0.0001	-	-	-	-	0.01	-	-

season 0.0236, 0.0470 and 0.0451 mg/L respectively. The maximum acceptable limit for manganese as per IS: 10500 are 0.1 mg/L and 0.1-0.5 mg/L as per WHO. The maximum value of manganese found in monsoon season but under the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Lead

During the study period, lead concentration in ground water of study area has been found average value in summer, monsoon and winter season 0.0063, 0.0051 and 0.0064 mg/L respectively. The maximum concentration of lead has been observed in winter season. The maximum acceptable limit of lead as per IS: 10500 and 0.01 mg/L as per WHO. However the observed concentration of lead in the study area is within the permissible limits specified in the IS: 10500 and WHO guidelines (Table 1).

Iron

During the study period, iron has been analyzed and found average value in summer, monsoon and winter season 0.8257, 0.6234 and 0.8283 mg/L respectively. The maximum acceptable limit of iron as per IS: 10500 are 0.3 mg/L and 0.3 mg/L as per WHO. The maximum value of iron found in winter season and higher than the prescribed limit of IS: 10500 as well as WHO guideline in all locations (Table 1).

Magnesium

During the study period, magnesium has been analyzed and found average value in summer, monsoon and winter season 1.6017, 0.7656 and 0.8711 mg/L respectively. The maximum acceptable limit of magnesium as per IS: 10500 are 30.0 mg/L and 50.0 mg/L as per WHO. The maximum value of magnesium found in summer season but under the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Cobalt

During the study period, cobalt concentrations has been found average value in summer, monsoon and winter season 0.0035, 0.0039 and 0.0037 mg/L respectively. The maximum concentration of cobalt has been observed in monsoon season. There is no acceptable limits are given of cobalt in both IS: 10500 and WHO (Table 1).

Nickel

During the study period, nickel concentration in ground water has been analyzed and found average value in summer, monsoon and winter season 0.0168, 0.0149 and 0.0258 mg/L respectively. The maximum concentration of nickel has been observed in winter season. The maximum acceptable limit of nickel as per IS: 10500 are 0.02 mg/L and 0.07 mg/L as per WHO. The observed concentration levels of nickel in the study area are within the permissible limits of WHO except winter (Table 1).

Nitrate

During the study period, nitrate has been analyzed by using UV-Vis spectrophotometric screening method and found average value in summer, monsoon and winter season 15.76, 17.12 and 14.00 mg/L respectively in all study locations. The maximum acceptable limit of nitrate as per IS: 10500 are 45 mg/L and 50 mg/L as per WHO. The maximum value of nitrate found in monsoon season but under the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Phosphate

During the study period, phosphate has been analyzed by using turbiditimetric method and found average value in summer, monsoon and winter season 0.15, 0.14 and 0.13 mg/L respectively in all study locations. There is no prescribed acceptable limit for phosphate in IS: 10500 and WHO (Table 1).

Sulfate

During the study period, sulfate has been analyzed by using turbiditimetric method and found average value in summer, monsoon and winter season 40.15, 22.46 and 32.24 mg/L respectively in all study locations. The maximum acceptable limit of sulfate as per IS: 10500 are 200 mg/L and 250 mg/L as per WHO. The maximum value of sulfate found in summer season but under the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Total alkalinity

During the study period, total alkalinity has been analyzed by using sulphuric acid titration method and found average value in summer, monsoon and winter season 351.80, 283.40 and 296.40 mg/L respectively in all study locations. The maximum acceptable limit of total alkalinity as per IS: 10500 are 200 mg/L and 200 mg/L as per WHO. The maximum value of total alkalinity found in summer season but higher than the prescribed limit of IS: 10500 as well as WHO guideline (Table 1).

Chloride

During the study period, chloride has been analyzed by using argentometric titration method and found average value in summer, monsoon and winter season 45.41, 37.10 and 41.94 mg/L respectively in all study locations. The maximum acceptable limit of chloride as per IS: 10500 are 250 mg/L and 250 mg/L as per WHO. The maximum value of chloride found in summer season but under the prescribed limit of IS-10500 as well as WHO guideline (Table 1).

pH

During the study period, pH has been analyzed by using ion-selective electrode and found average value in summer, monsoon and winter season 7.91, 7.88 and 7.87 respectively. The maximum acceptable limit for pH as per IS: 10500 are 6.5 - 8.5 and same for WHO (Table 1).

Total Hardness

During the study period, total hardness has been analyzed by using EDTA titration method and found average value in summer, monsoon and winter season 330.60, 237.00 and 280.20 mg/L respectively in all study locations. The maximum acceptable limit of total hardness as per IS: 10500 are 200 mg/L and 100 mg/L as per WHO. The maximum value of total hardness found in summer season but higher than the prescribed limit of IS: 10500 as well as WHO guideline in all locations (Table 1).

Plot showed that the impact of physico-chemicals and metals concentration on ground water quality in seasonally changes (Figure 1 (a) and (b).

Conclusions

The groundwater samples were taken on both sides of each wetland station. The water samples were subjected to the physico-chemical and heavy metal concentrations. The result of above work shows that the most of the heavy metal ions are more than the permissible limit of IS: 10500 and WHO standard which are polluted by the intrusion of dairy wastage water, dumping of waste and percolation of domestic sewage by inhabitants. Even though, the condition is very bad at present, but if the same continues in future ground water source will be completely polluted and become unfit for drinking and other purposes. This observation indicates contamination to the environment. Hence, it is high time to preserve and protect this valuable ground source. Thus dumping of dairy waste polluted materials should be avoided and they should not be let into the surface because wastewater is percolates in ground water.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of the paper

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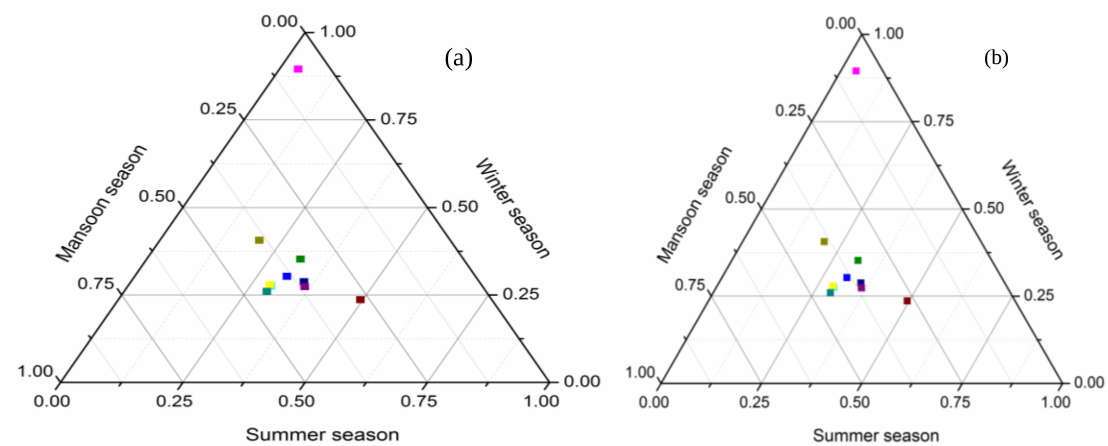

Figure 1: Behaviors of (a) physico-chemical parameters and (b) metals concentration in ground water samples

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