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AGRICULTURE WATER POLLUTION OF GONDIA DISTRICT

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Abstract

Chemical fertilizers are used extensively in modern agriculture, in order to improve crop yield. Most of the current concern with regard to environmental quality is focused on water, because of its importance in maintaining the health of human and aquatic ecosystem. The addition of various kinds of pollutants and nutrients through the agricultural runoff in to the water bodies brings about a series of changes in the physico-chemical characteristics of water. The composition of surface and groundwater is dependent on natural factors such as Topographical, Geological, Meteorological, Hydrological, Topographical, and Biological factors which vary with, seasonal difference in run off volumes and weather conditions. Excessive fertilization can create the problem about ground water & sub surface water for farmers.

Introduction

Over the past five decades, pesticides have been extensively used in modern agriculture practices to improve the yield of crop. Gondia has been an agriculturally based city for and hence inevitably faces the threat of groundwater contamination due to excess pesticides. Irresponsible pesticides use and excess application introduce large amounts of nutrients to water bodies.

Paddy fields are susceptible to pesticide runoff, since the chemicals are applied directly into the paddy water. Pesticide loss from paddy fields can reach more than 30-50% of the applied amount, depending on the water management. A number of the active ingredients in pesticides used in rice culture, such as Urea, Diammonium phosphate, Zinc have been detected in source water and these contaminants appear to be causing adverse effects on the aquatic ecosystem as well as human being. .The present study carried out in the selected agricultural farm lands of Gondia District (M.S.) with the objective to assess the effect of chemical fertilizers, pesticides like Urea and Diammonium Phosphate to agriculture farm lands on surface and ground water quality.

Material & methodology

Study area

Gondia district is situated on north-eastern side of Maharashtra State and share the state borders with Madhya Pradesh on north and Chattisgarh in east. It covers an area of about 5859 sq.km and lies between 20°39 and 21°38 north latitudes and 79° 52' to 80°42 east longitudes. The adjoining districts to Gondia are on northern side Balaghat district of Madhya Pradesh State and on eastern side Rajnandgaon district of Chhattisgarh State. To the south and west are Chandrapur district and Bhandara district respectively of Maharashtra. During the past 15 years, the consumption of chemical fertilizers in Gondia was about 73,253 metric tones per year, out of which 50% contribution was from nitrogenous fertilizers, particularly urea. The commonly used chemical fertilizers in the study area- are urea and diammonium phosphate, in addition to this, farmyard manures is also used. The average annual application rate of nitrogenous and phosphorous fertilizers is over 150-300 kg/ha of urea and 150-250 kg/ha of diammonium phosphate per cropping season, particularly in paddy cultivations. The soil types, which are predominant in the study, were found to be Kali ,Kankar, Morand, Khardi, Sihar and Bardi.

Table 1: Chemical fertilizer residues in water samples

Ground Water			Lake Water		
SAMPLE	UREA	DAP	SAMPLE	UREA	DAP
G-1	0.3	3.54	L-1	0.3	3.54
G-2	0.6	3.77	L-2	-	4.17
G-3	2.6	5.11	L-3	3.2	4.86
G-4	3.8	3.06	L-4	2.3	4.31
G-4	1.5	4.71	L-4	0.8	5.42
G-5	1.8	4.00	L-5	0.6	3.05
G-6	1.2	5.18	L-6	-	2.92
G-7	4.2	5.89	L-7	2.1	3.61

Note: All values are expressed in ppm.

Table-2: Physico-chemical characteristics of water samples collected around selected agricultural areas of Gondia district

Table-2.1: Ground water samples

Parameters	WHO Standards							
		G-1	G-2	G-3	G-4	G-5	G-6	G-7
pH	7-8.5	7.43	7.47	7.25	7.09	7.19	8.92	8.92
EC	2500	989	1688	980	1332.8	1479	775.2	1387.2
TDS	500	620	860	520	910	750	560	880
DO	6.0	6.56	7.43	8.32	6.32	7.01	7.12	7.21
Cl^-	250-1000	1470.41	1044.76	773.9	2050.83	773.9	1431.71	309.56
COD	10	14.78	13.23	14.23	12.09	16.08	13.12	10.13
Na^+	200	440	540	660	390	240	500	680
K^+	12	12	22	12	16	17	90	22
Ca^{2+}	100	172.34	208.41	180.36	68.136	196.3	48.09	56.11
Mg^{2+}	150	90.82	161.24	94.45	41..42	103.34	30.19	59.14

Table 2.2: Lake Water samples

Parameters	WHO Standards							
		L-1	L-2	L-3	L-4	L-5	L-6	L-7
pH	7-8.5	8.51	7.92	8.01	7.34	7.98	8.33	7.94
EC	2500	540.8	285	601.4	1445	785.7	240	970
TDS	500	320	140	480	740	480	110	527
DO	6.0	7.32	8.10	7.45	7.12	8.97	6.43	5.09
Cl^-	250-1000	309.56	349.25	232.12	812.59	889.98	270.86	1044.76
COD	10	10.53	14.28	11.43	13.21	12.78	6.23	10.86
Na^+	200	200	100	470	440	360	160	580
K^+	12	60	60	80	14	14	16	90
Ca^{2+}	100	20.04	24.04	64.12	116.23	80.17	36.07	184.30
Mg^{2+}	150	28.2	14.51	26.11	31.15	21.13	43.64	75.39

Collection of water samples

Fourteen water samples were collected from selected agricultural lands of Gondia district, which includes ground water and lake water. The water samples were collected in pre-sterilized plastic containers. The urea residues were quantified by diacetyl monoxime method and diammonium phosphate residues were calculated by using amount of phosphate present in water sample, considering molecular weight of DAP and atomic weight of phosphate in DAP fertilizer. The pH and EC were measured by using pH meter and conductivity meter. Carbonates and bicarbonates were determined by titrimetric method. Calcium and magnesium were determined titrimetrically using standard EDTA method, sodium and potassium were determined by flame photometric method, chloride was determined by argentometric titration method. Nitrate was determined by phenoldisulphonic acid method.

Results and Discussion

The results of chemical fertilizer residues in Table-1 and physico-chemical characteristics of different water samples are presented in Table-2.

Urea: Urea is one of the nitrogenous fertilizers that have received wider attention in agriculture, because of its potential role for seedling damage, ammonia volatilization and water pollution problems. Urea enters surface and ground water through leaching and surface run off from agricultural lands. Its entry into ground water depends on physical properties of soil like texture. During the present investigation, in ground water, the urea residues ranged from 0.3 to 4.2 ppm, in lake water from 0.6 to 3.4 ppm highest concentration of urea was reported in ground water

Diammonium phosphate residues: The DAP residues in ground water range from a minimum of 3.06 ppm to a maximum of 5.18 ppm. In lake water, the DAP residues were from 2.92 to 5.42 ppm.

pH: pH is the measure of acidity or alkalinity of water. During the present study, pH of ground water samples ranged from a minimum of 7.09 to a maximum of 8.88. Similarly, in lake water, the variation of pH ranged from 7.34 to 8.51.

Electrical conductivity: Electrical conductivity is to measure capacity of water to carry electric current. It signifies the amount of total dissolved salts present in solution. During the present study, electrical conductivity of ground water ranged from a minimum of 650 to a maximum of 1688 mmhos/cm. Similarly, in lake water, the variation of EC was from 240 to 1455 mmhos/cm.

Total dissolved solids: The TDS of ground water ranged from a minimum of 380 to a maximum of 910 mg/l. In lake water, the variation of TDS was from 110 to 740 mg/l. High TDS values were reported in ground water.

Dissolved oxygen: During the present investigation the dissolved oxygen of ground water were from a minimum of 6.32 to a maximum of 8.32 mg/l. Similarly the dissolved oxygen in lake water were from a minimum of 5.09 to a maximum of 8.97 mg/l. The variation of dissolved oxygen of channel water was found to be from 5.09 to 8.10 mg/l. In all the sampling places, the dissolved oxygen content was found to be higher than the permissible limits, which indicates the presence of high oxygen content in water samples. The higher level of nutrient load and other factors result in decreased level of dissolved oxygen in water samples.

Chloride: Chloride occurs naturally in all types of water samples. Chloride in natural water results from agricultural activities or sometimes, it could be due to dissolution of chloride from chloride containing rocks. During the present study, the chloride values in ground water were from a minimum of 309.56 to a maximum of 2050.83 mg/l. Similarly, in lake water the variation of chloride were from 232.12 to 1973.44 mg/l.

Chemical oxygen demand: Chemical oxygen demand determines the oxygen required for chemical oxidation of organic matter. During the present study, the COD in ground water were from a minimum of 10.09 to a maximum of 16.08 mg/l. Similarly, in lake water, the variation of COD values were from 6.23 to 14.98 mg/l. water samples indicates low organic pollutants, while maximum concentration indicates higher concentration of pollutants.

Sodium and potassium: The sodium and potassium concentration in ground water ranged from a minimum of 240 to a maximum of 680 mg/l and 12 to 90 mg/l respectively. In lake water, the variation of sodium and potassium was from, 100 to 580 mg/l and 14 to 90 mg/l.In Ground water and surface water, the potassium contamination can result from the application of potassium fertilizers greater than the required concentration. Potassium leaching from the soil is important from the perspective of plant nutrition. If fertilizer use and application to irrigation water exceeds the crop requirement, excess water will carry with it, soluble salts including potassium, which were shown from, a significant correlation between urea and potassium for both ground and lake water with r-0.648 and r-0.806. This implies that, enrichment of potassium in surface and ground water is due to influence of urea fertilizers.

Carbonates and bicarbonates: Alkalinity of water is the capacity to neutralize a strong acid and it is normally due to the presence of carbonates, bicarbonates and hydroxides of calcium and magnesium. The carbonate values in ground water ranged from a minimum of 109 to a maximum of 610.4 mg/l. In lake water, the variation of carbonates was from 21.8 to 392 mg/l. The bicarbonate values in ground water were from, a minimum of 152.6 to a maximum of 828.4 mg/l. Similarly, in lake water, the variation of bicarbonates was from 130.8 to 784.8 mg/l.

Conclusion

The present study confirms that, the application of chemical fertilizers has greater influence on water quality. All the water samples Urea residues were detected. From the Observation, it concluded that, for all the water samples Chemical oxygen demand, sodium and potassium were found to be in high concentration. In order to overcome water pollution problems, introduction of legislation by the farmers restricting nitrate was strongly correlated with urea, which indicates surface and ground water contamination is mainly due to nitrogenous fertilizers. Similarly phosphate was highly correlated with DAP; which indicates that DAP was the major source to enrich phosphate in surface and ground water. In case of physico-chemical characteristics, in majority of the water samples, total dissolved solids, carbonates, bicarbonates, calcium, magnesium, the application of chemical fertilizers, splitting of fertilizer dose at required concentration will help to reduce pollution of surface and ground water.

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