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ENVIRONMENTAL ASSESSMENT OF EFFLUENT OF SOYA SOLVENT EXTRACTION PLANT OF PIPARIYA DIST. HOSHANGABAD

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ABSTRACT

Impact of soya solvent extraction plants on local groundwater of nearby industrial area of Pipariya, district Hoshangabad was studied. It was observed that the concentration of TDS, EC, hardness, chloride, BOD, COD and phosphate were higher in the groundwater samples.

Key words: DO, BOD, COD, Fluoride, Phosphate, Hardness, Alkalinity, pH, Extraction, ETP.

INTRODUCTION

Soybean is world's one of the most useful and cheapest source of protein. The botanical name of soybean is *Glycine Max*. M. P. has emerged as the soya state in India, with over 70% share of acreage as sell as production.

Soyabean is cultivated in a major portion of M.P. There are a number of soya solvent extraction plants in the state. The composition of soybean constituents are moisture (11% max) protein (48% min), fat (1.57% max), fiber (6.5% max), sand/silica (2% max) and urease (.30% max). In this paper, the adverse impact of chemicals used and discharged through ETP in soya industry on local groundwater has been studied.

EXPERIMENTAL

Materials and methods

Oil extraction process

Soyabean is mainly used for soya oil and vanaspati as cooking oil. The steps used for

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oil extraction are cleaning, cracking and cooking. Seeds are heated through jacked steam and open steam to soften the seeds. These are pressed between two rollers and then flakes are dried in expander using hot air. The dried flakes are sent to extractor and hexane is sprayed on material to extract oil. The hexane condensed out and is recycled back to process. The crude oil extract is heated up to 50^{o}C to 60^{o}C and water and phosphoric acid are added, to remove the phosphate and gum from the oil. Water and phosphoric acid remove the free fatty acid form the oil. Caustic soda is used to neutralize it. The bleaching agent is used to remove colour. Lastly, oil is then deodorized by heating at 220^{o}C. In the above oil extraction process, major chemicals used are hexane, phosphoric acid, bleaching agent and caustic solution. The effluent of the process is discharged in ETP for treatment and the treated effluent is finally used for irrigation or discharged outside, which affects on the ground water quality.

Sampling site and analysis

To study the effect of pollution on ground water, Kabra Oil Mill, Pipariya located in Hoshangabad dist. of Madhya Pradesh was selected and sample was taken form inside and nearby area of industry throughout the year. pH, electric conductance, TDS, turbidity, alkalinity, total hardness, Ca and Mg hardness, chloride, phosphate, fluoride, nitrate, sulphate, DO, BOD, COD and some heavy metals like copper, iron, zinc and manganese were determined using the methods given by APHA[1] and Trivedy and Goel[2].

RESULTS AND DISCUSSION

It was observed that the pH of all water samples during the year 07-08 were between 6.3 to 7.9. The samples were collected from industrial area near and inside the soya plant. It was observed that the value of EC of all samples were above the permissible limit indicating contamination of water through waste. High TDS values of monsoon (551) and post monsoon samples (537) were observed. Phosphate values of all samples (Fig. 1) are above the permissible limit, may be due to excess addition of phosphoric acid during oil extraction process of plant. Some water samples have nitrate above the permissible limit (Fig. 2). Excess of nitrate is particularly dangerous to infants less than six month old, causing a child disease methemoglobinaemia. Analysis of heavy metals during year 07-08 indicate that the values of Cu, Zn and Fe are within the permissible limits but the value of Mn is higher than permissible limit. Due to excess Mn, undesirable effect may be on taste, staining of laundry and discoloration of water.

The values of BOD and COD were higher than the permissible limits, Higher values of COD during the year (Fig. 3) indicates the contamination of water, High values of these parameters are harmful, if this water is used for domestic purpose.

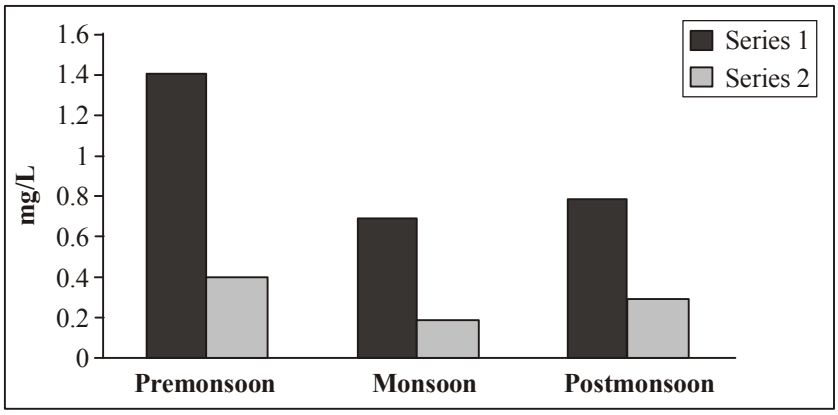

Fig. 1: Seasonal trends in the concentration of phosphate

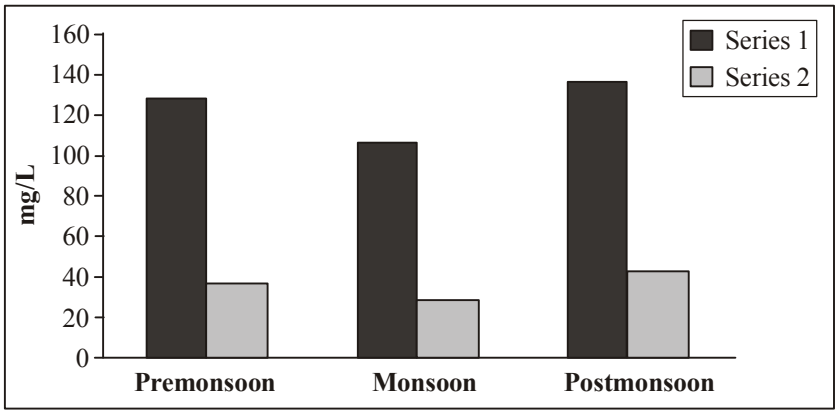

Fig. 2: Seasonal trends in the concentration of nitrate

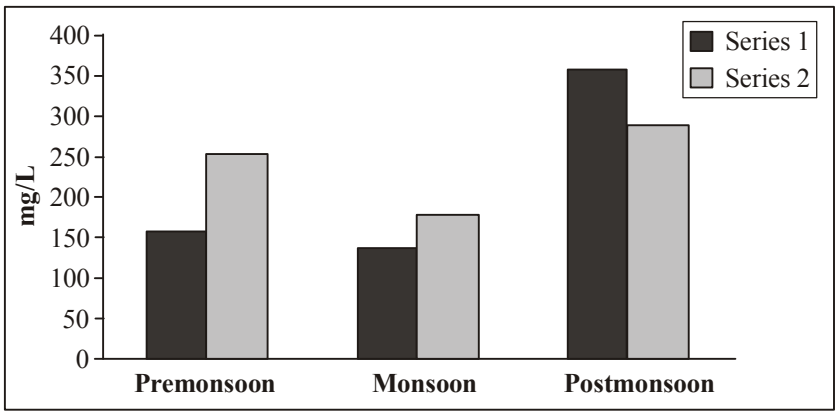

Fig. 3: Seasonal trends in the concentration of COD

Table 1: Mean values of physico-chemical parameters at sampling sites of soya solvent extraction plant at Pipariya

Parameter	Units	Permissible limits	Premonsoon		Monsoon		Postmonsoon	
pH		6.5-9.2	6.3	7.3	6.4	7.5	7.4	6.9
EC	Mhos/cm.	300	630	500	900	540	776	1085
T. D. S.	mg/lit	500	410	320	551	290	380	537
Total alkalinity	mg/lit	600	480	420	440	300	189	196
Total hardness	mg/lit	600	144	240	640	256	272	340
Ca Hardness	mg/lit	200	65	175	195	140	80	280
Mg Hardness	mg/lit	150	79	65	435	116	192.3	60
Chloride	mg/lit	1000	76	64	150	94	48.2	127.8
Fluoride	mg/lit	1.5	0.9	0.6	0.71	0.4	0.07	0.25
Phosphate	mg/lit	0.1	1.4	0.4	0.7	0.2	0.8	0.3
Nitrate	mg/lit	45	132	38	110	30	140	45
Sulphate	mg/lit	400	10.3	4.8	9.43	3.93	18.71	12.42
Salinity	mg/lit		0.672	0.580	1.116	0.587	0.752	1.075
Turbidity	NTU	20	030	002	034	002	017	003
DO	mg/lit	6	6.4	10.2	6.3	11.2	1.6	8.1
BOD	mg/lit	6	53	97	42	68	124	95
COD	mg/lit	10	160	256	140	180	360	290
Zinc	mg/lit	1.5	0.264	0.212	0.210	0.190	0.114	0.113
Copper	mg/lit	1.5	0.346	0.284	0.330	0.235	0.259	0.312
Iron	mg/lit	0.3	0.280	0.170	0.190	0.165	0.106	0.162
Manganese	mg/lit	0.05	0.060	0.164	0.040	0.120	0.137	0.133

Reason for high quantity of these parameters due to the accumulation of minerals, salts from the industrial waste water to the soil and leaching to the ground water.

CONCLUSION

Several physico-chemical parameters and their variability have been studied in relation to the pollution in ground water. Different parameters measured during the study have higher values, which affect the ecosystem. The chemical analysis showed that site of Kabra Oil Mill, Pipariya is polluted. The present study indicates that these is an impact of soyabean plant activity on ground water quality. These studies indicates that several policy changes and strict regulatory measures for water quality maintenance in the system are required.

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