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# Physicochemical Assessment of Effluents from Vegetable Oil Manufacturing Industries in Durgapura Area, Jaipur

Anuradha Mehta<sup>1</sup>, Nagendra Bhardwaj<sup>2</sup>

Department of Botany, S.S. Jain Subodh P.G. College, Jaipur, India<sup>1</sup>

Department of Botany, University of Rajasthan, Jaipur, India<sup>2</sup>

\*Corresponding Author Email id: dranuradhameta@gmail.com

**ABSTRACT:** The present paper concerns with assessment of the pollution generated by industrial discharges produced by two vegetable oil manufacturing industries viz. Raghuvan (India) Ltd. and Sri Secco Industries situated at Durgapura Area, Jaipur. The untreated and treated effluent samples from both the industries were analysed for various physicochemical parameters like pH, electrical conductivity, total dissolved solids, total hardness, Ca, Mg, alkalinity, acidity, COD, BOD, oil & grease and chloride. There were marked differences in quality of effluents and most of the parameters were above the permissible limits. Biological oxygen demand and chemical oxygen demand were significantly higher in untreated effluents. The effluents were loaded with fats and oils with varied concentration from 10mg/L to 5mg/l. Significant higher level of electrical conductivity, total dissolved solids and hardness were recorded in untreated effluents from both the industries however, these were within the permissible ranges in treated effluents. The results showed that the effluents have high load of pollutants and discharge of untreated effluents by industries may contaminate the groundwater and water bodies of the surrounding area that could pose serious environmental problems. It is suggested that industries should adopt advanced technology of effluent treatment and the effluent should be tested before being discharged in the water bodies to avoid further pollution of both water and soil.

**KEYWORDS:** Industrial effluents, pollution, physicochemical properties.

## I. INTRODUCTION

Wastewater discharged from edible oil industry bears a concentrated amalgamation of organic and inorganic substances (1). A typical edible oil-processing plant could discharge large amount of wastewater with high chemical oxygen demand, biological oxygen demand, electrical conductivity, Total Dissolved Solids, oil, grease and fats (2, 3). Jaipur district is a major centre for traditional as well as modern industries. Presently, there are 19,592 large, medium and small-scale units running here. The waste water generated in various manufacturing processes is subjected to primary and secondary treatment at the level of individual industry. Most of the industries have essentially installed Effluent Treatment Plant (ETP) while for the treatment of waste water generated in small scale industries Common Effluent Treatment Plants (CETP) have been installed by government organisations. All the wastes from municipal and industries are discharged in Amanisha Nala which is the largest element of drainage system of the city. The water from some parts of this nala is being used by farmers for growing vegetables and other crops. This direct use of waste water necessitates evaluation of the quality of the water. Earlier several researchers have analysed effluents from various industrial areas of Jaipur (4, 5, 6) and the findings indicated that wastewaters of the major industrial areas of Jaipur city were not suitable for discharge in water bodies or used for irrigation without prior treatment. The data indicate that physicochemical parameters exceeded the limits prescribed by APHA (7). Moreover, effluent concentration in the waste water of Amanishah nalla has considerably been increased during the past few decades.

These studies show that in the selected area of our study the continuous discharge of industrial waste water has polluted the water and land. The soil properties of the cultivable land of the nearby area are also affected. The negligence of the safe disposal of industrial wastewaters had led to deleterious effects on the biosphere as a whole. Hence, for the present study two major industries situated at Durgapura industrial area of Jaipur were selected.

1. Raghavar (India) Ltd. (Manufacturers of edible oil) (RI).
2. Shree Seco Pvt. Ltd. (Manufacturers of edible oil) (SSI).

## II. METHODOLOGY

### Collection and Analysis of effluent samples from industries in Jaipur city:

Samples of both treated and untreated effluents from the selected industries were collected and stored in polyethylene bottles. In total 3 samples each of treated and untreated effluents were collected. The effluent samples were analysed for various physicochemical parameters like pH, electrical conductivity, total dissolved solids, hardness, Ca, Mg, Alkalinity, acidity, COD, BOD, oil & grease and chloride according to the Standard Methods for the Examination of Water and Waste water (7) and compared with the standard tolerance limits for industrial effluent discharged into inland surface waters prescribed by the Bureau of Indian Standards (8). (Table 1.)

## III. RESULT AND DISCUSSION

The effluent samples from both the industries varied in their composition. The untreated edible oil industry effluent from RI & SSI were white, turbid and had an offensive odour. pH of untreated effluents of SSI was basic 9.25 while that of RI was slightly acidic 6.20. All the treated effluents were alkaline. Mkhize *et al.* (2) and Fayemiro *et al.* (9) have reported pH ranging from 5.55 to 9.8 in various samples of waste waters from an edible oil refinery over a period of six months. Total dissolved solids and electrical conductivity were much beyond the permissible limits prescribed by BIS. Maximum conductivity and dissolved solids were recorded in untreated effluents of RI (130600 $\mu$ mho/cm & 83500 mg/L) followed by SSI. Total hardness was higher in untreated effluent RI (550 mg/L) followed by SSI (480mg/L). Even the treated effluents showed hardness above the permissible limits. These results coincide with the findings of Adakole *et al.* (10) who reported electrical conductivity, total hardness higher than permissible limits in waste water samples from edible oil industry probably due to higher concentrations of PO4-P, NO3-N, sulphate, calcium and magnesium.

Chloride content in effluent samples ranged between 60.80 mg/L to 136.48 mg/L in treated effluents while it was 126.96 mg/L to 250.92 mg/L in untreated effluents. Highest chloride content was recorded in treated effluent of SSI. The increase in concentration of chlorides in the treated wastewater effluent was predominant probably due to additional chlorides from alum used in treatment process and the acid wastewater stream, which is earlier treated with calcium chloride Chipasa (11). Sankpal and Naikwade (12) reported average 8350mg/L of chloride in effluents from various fish processing industries which were higher than the prescribed limits. Calcium content was well within the permissible limits and ranged from 48.39mg/L to 96.20 mg/L in the studied samples. Magnesium content was recorded maximum in untreated effluent of RI (120.28 mg/L) and SSI (100.62 mg/L). Total alkalinity was above the limits with maximum value recorded in untreated effluents of SSI (540mg/L) and RI (221mg/L). High total alkalinity in edible oil effluent is due to refining process water which is basic in nature and caustic soda used in floor and equipment cleaning (13).

Highest acidity was recorded in untreated effluent of RI 530 while it was lowest in treated effluent of RI. Higher acidity of RI effluent is due to discharge of higher quantity of acidic waste water discharged from acid oil recovery plant which further joins refinery process effluent thus rendering the combined waste water to be slightly acidic. Ibrahim *et al.* (14) recorded total acidity values of 17.2mg/L and 4mg/L in untreated and treated effluents of vegetable oil processing industry in Owo, Ondo State. Maximum oil & grease content was recorded in untreated effluent of RI (10mg/l) followed by SSI (9mg/l). The main types of pollutant in edible oil plant effluents are free and emulsified fats and oils. Following neutralisation and soap splitting of the crude oil water is used for washing, giving rise to effluents known as soapy water and acid water which contain considerable quantities of fats and oils. Detergents used in wash down operations often emulsify oils leading to high levels of oils in the plant effluent which are difficult to remove. (15).

Maximum COD value was recorded in untreated effluent of RI (320 mg/L) followed by SSI (240 mg/L). The COD values were within the permissible limits in treated effluents. Highest BOD value was recorded in untreated effluent of SSI (60mg/L) followed by RI (40 mg/L). The organic matter consisting mainly of soap, oil and grease (SOG) and suspended solids are the major contributors to the high COD levels. The suspended solids are mostly generated during de-gumming of crude oil in refining process. Similarly in the present study the COD values of untreated effluent of RI

are also high because of the presence of soap, oil and grease and suspended solids. BOD values for untreated effluent of SSI and RI were found to be 60 mg/L and 40 mg/L respectively which were higher than the BIS limits (30 mg/L) while those of treated effluents of RI and SSI were close to the permissible limits (30 mg/L). Higher BOD values indicate that the amount of oxygen (mg/L) needed to oxidize these products was high. The values obtained might suggest that high amount of the product is lost to the waste stream. High levels of dissolved and suspended solids in the water systems increase the biological and chemical oxygen demand, which deplete the dissolved oxygen levels in the aquatic systems (16,17). Edible oil effluent entering the sewer system consists mainly of fats, oils, greases (FOG), sulphate and phosphates resulting in both high inorganic and organic loadings at the respective wastewater works. Higher contents of COD, BOD, oil and grease and TSS have been reported in composite effluent from fabricated metal industry (18). Industrial effluents and municipal sewage carry organic and inorganic substances which utilize dissolved oxygen resulting in oxygen depletion. (19). This makes water unsuitable for drinking and irrigation (20).

#### IV. CONCLUSION

Based on current research, it is determined that the two industries differ in the types of untreated and treated effluents they produce. This is because they contain different organic and inorganic substances that contribute to the pollution of the aquatic system. Both the untreated and treated effluent samples contained a significant amount of pollution in the form of dissolved solids, electrical conductivity, salinity, COD, and oil & grease. These levels exceeded the limits allowed by the BIS. These wastes cannot be released in their current form into the surrounding water bodies or land. It is recommended that industries should develop improved technology for the treatment and management of effluent. To prevent additional pollution of water and soil, it is advisable to conduct regular analysis of the effluents prior to their discharge into water bodies.

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S.NO	Parameters	Effluent Samples				BIS Limits IS 2490- 2009	
		RI		SSI			
		Untreated	Treated	Untreated	Treated		
1.	pH	6.20	8.25	9.25	8.15	5.5-9	
2.	Electric Conductivity ( $\mu$ mho/cm)	130600	1220	3000	1920	300	
3.	Total Dissolved Solids.	83500	730	2165	1250	2100	
4.	Chloride	126.96	60.80	136.48	250.92	1000	
5.	Total hardness	550	200	480	300	100	
6.	Ca Hardness	96.20	48.39	58.09	90.38	200	
7.	Mg hardness	120.28	40.11	100.62	70.93	100	
8.	Total Alkalinity	521	335	540	320	200	
9.	Total acidity	530	50	250	60	-	
10.	COD	320	230	240	150	250	
11.	BOD (3 days at 27°C)	40	30	60	30	30	
12.	Oil & Grease	10	7	9	5	10	

**Table 1.: Physicochemical analysis of effluent samples**

(Values in mg/l unit except pH and E.C.)

BIS- Tolerance limits for industrial effluent discharged into inland surface waters prescribed by the Bureau of Indian Standards (2009).



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