# IMPACT OF SUGAR MILL EFFLUENT ON PHYSICO-CHEMICAL PROPERTIES OF MALIN RIVER IN NAZIABAD DISTRICT

## DR KHANNA[a], RAKESH BHUTIANI[b], VARUN TYAGI[c] AND FAHEEM AHMED[d]

[abcd]Department of Zoology, Gurukul Kangri University, Haridwar, Uttrakhand, India

## ABSTRACT

The present investigation was carried out on the Malin River, a non-perennial river formed by joining of many mountain springs in the Garhwal region, from January 2013 to May 2013. The river water quality was found to be adversely affected by the Kisan Sahkari Sugar mill effluent. The physico-chemical parameters analyzed during the work included temperature,pH, TDS, TS, TSS, Turbidity, dissolved oxygen, biological oxygen demand, chemical oxygen demand, free carbon dioxide, total alkalinity, chlorides and hardness. During the study period, the relative values of parameters were found within the range. Significant variations were observed in TDS, TSS. The present study also revealed that the physico-chemical parameters like Acidity, Alkalinity showed a great seasonal variation.

KEYWORDS : Malin River, physico-chemical parameters, seasonal variation

Water is an elixir of life and undoubtedly the life line of the environment. It also played an important role in the evolution of life from molecules. The aquatic media, such as lakes, rivers, ponds, stream and coastlines are national wealth for any nation. Pollution is an unavoidable harmful by product of industrial development. The socio-economic progress of any country depends mainly on the industrial growth but pollutant is a harmful by product. So, water quality monitoring is of immense importance to activity involving the use of water bodies in the management of fisheries, water supply, pollution, sewage reservoir and impoundment. The sugar industries in India are playing an important role in the economic development of the country. The sugar industries are of a seasonal nature and operate for about 120-150 days in a year. The effluents discharged during manufacturing of sugar contain high polluted contents, as generally the sugar mills are in rural areas where effluents pollute small rivers and give foul smell in nearby places of the mills. The present study was conducted to assess the impact of the sugar mill effluent discharge on the Malin River as it is the major source of water for agricultural purposes in the Najibabad district.

## Study Area

Najibabad is partially a hill station and is a municipal in the Bijnore District in the U.P state and is located at 29.63N, 78.33E, it has an elevation of 295 meter (1014 feet). The study sites were selected Malin River which is a non-perennial river and formed by the mountain springs in the monsoon season. The river is generally deprived in the summer season. The Kishan SahKari Sugar mill is situated in Sameepur village on the NH-119 (Najibabad-Kotdwara highway) at the distance of 6km from Najibabad. The Kishan Sahkari Sugar mill is agro based industry with an installed capacity of 3000 Mt per day. The effluent of mill mixes with the Malin river after passing a distance of 7 km with the help of small canal and pollute the Malin river at a great scale. In the present work, the attempt was made to analyse the physico-chemical properties such as Temperature, pH, Turbidity, TS, TDS, TSS, DO, BOD, COD, FreeCO$_2$, Acidity, Alkalinity, Hardness, Calcium, Magnesium and Chloride. The main sources of mill waste water were Mill house, Boiling house and Floor washing.

## MATERIALS AND METHODS

Analysis of water samples were done according to standard methods as prescribed in APHA (1998), and Khanna and Bhutiani (2007).

### Sampling Methods

A kit containing sample collection bottles, standard chemical reagents, glassware's, pH meter, thermometer and other accessories. Water samples for the examination of physico-chemical parameters were collected simultaneously. The sampling frequency was kept
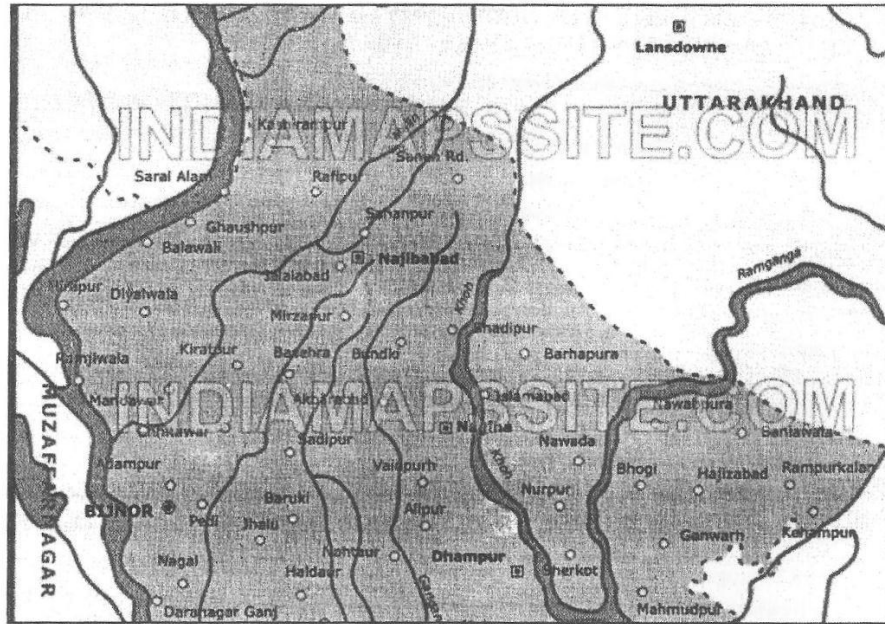
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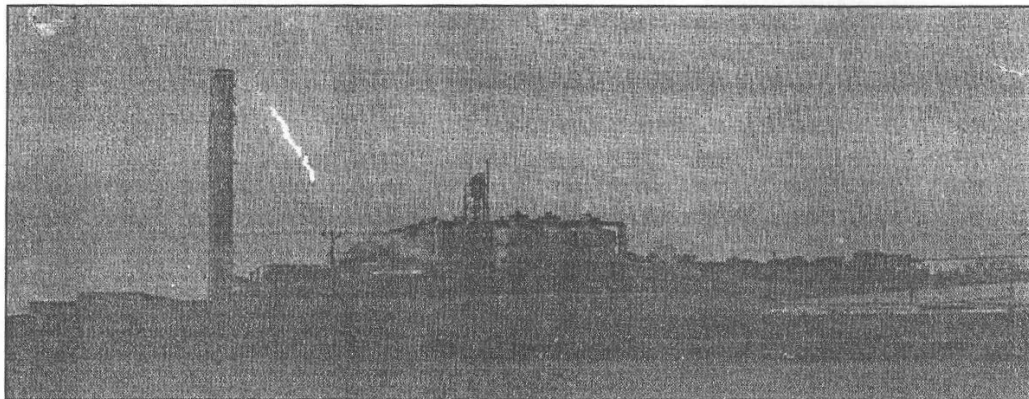Figure 1 : Map showing the location of Malin River



Figure 2 : View of Kishan Sahkari Sugar mill

Descriptions of four sampling sites are given below (Figure 1-4):

| SAMPLING SITE No | SAMPLING SITE NAME |
|---|---|
| SS 1 | Outlet Near Jaswantpur Village |
| SS 2 | Near Shahpur Village |
| SS 3 | Near Basanti Mata Place |
| SS 4 | Raw Bridge Near Kalheri Village |

## Sampling Site



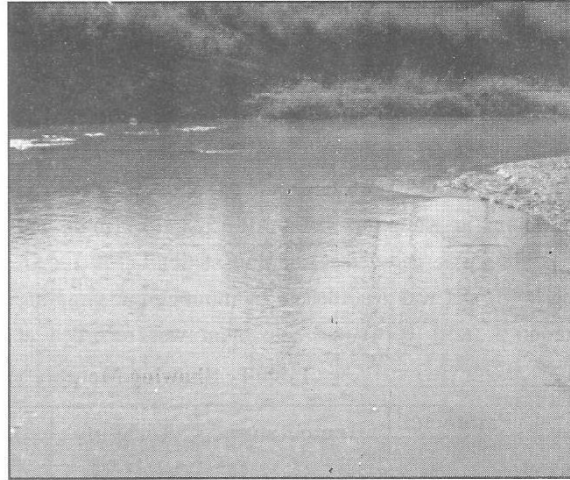Figure 4 : Sampling Site 1



Figure 5 : Sampling Site 2



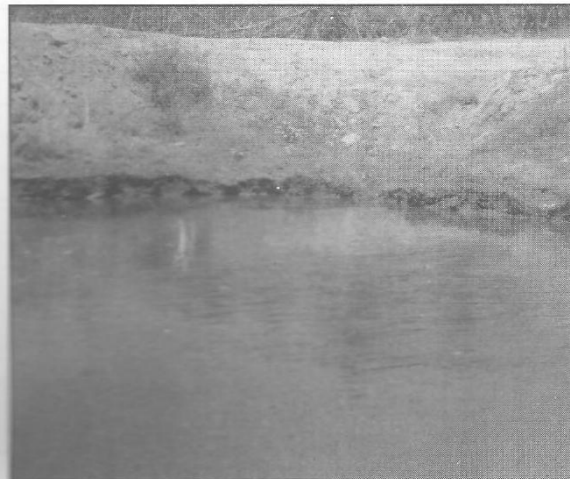Figure 5 : Sampling Site 3



Figure 6 : Sampling Site 4

weekly for all sampling stations in morning hours (7 A.M-11A.30). Grab water samples at four sites were collected in plastic jerry cans from about 15 cm below the surface water by keeping and openingJerri cans below the surface water. Caps of cans were removed after dipping the can and also closed in the water after filling up of can. Care was taken to avoid bubbling and prevent entry of leaves, twigs or debris in the sampling bottle .Some of the physico-chemical parameters were analyzed in the field.

## RESULTS AND DISCUSSION

Water temperature plays an important factor which influences the chemical, bio-chemical characteristics of water body. In the present study an average fluctuation of water temperature was observed23.3 1.85°C (minimum) and 28.8 ± 1.75°C (maximum) Table 1 and Graph 1. Monthly average values of temperature were recorded 25.15± 2.75°CA more or less trend has been observed in the Mothronwala swamp, by Gupta (2008). Turbidity represents a non-specific measure of a suspended solids concentration. The monthly average value of turbidity was

found 37 12.06JTU. A more or less similar trend was also observed by Jayalakshmiet al (2011) in water and waste waters in and around Vijayawada (A.P.). The average values of total solids were recorded 1105± 92.65mg/. Minimum average value of total solids was observed at sampling site II 1000 mg/l and maximum at sampling stationI 1200 mg/l.The total dissolved solids recorded to be minimum at sampling station II (528 76.71mg/l and maximum was recorded at sampling station I (750 104.18 mg/l).The pH was recorded to be minimum at sampling station I (6.91 0.14) and maximum was recorded at

sampling station II (7.4 0.1) Table 2 and Graph 2.These values are similar as observed by Shrivastava et al. (2011) Rāmgangā at Moradabad. Maximum dissolved oxygen was recorded at the sampling station II (9.40 0.78mg/l) and the minimum value of dissolved oxygen was observed at sampling station I (4.380.59)mg/l. The monthly average value of dissolved oxygen was observed 6.45± 1.14 mg/l. Same trend is also reported by Khanna et al.(2013) in the Ganga river system in foothills, of Garhwal Himalaya. Maximum BOD was recorded at 3.72 mg/l and the minimum value of BOD was recorded 1.79mg/l. The

**Table 1 : Showing Monthly Variation In Physical Parameters.**

| Parameter / Date | Temperature °C | Turbidity (JTU) | Total Solid (TS)(mg/l) | Total Dissolved Solid (TDS)(mg/l) | Total Suspended Solid(TSS)(mg/l) |
|---|---|---|---|---|---|
| 15-Jan-2013 | 22 | 25 | 1100 | 750 | 450 |
| 30-Jan-2013 | 25 | 25 | 1200 | 600 | 600 |
| 15-Feb-2013 | 23.3 | 55 | 1000 | 528 | 400 |
| 29-Feb-2013 | 25 | 55 | 1100 | 780 | 420 |
| 15-Mar-2013 | 27 | 25 | 1000 | 600 | 400 |
| 30-Mar-2013 | 27 | 40 | 1150 | 750 | 400 |
| 15-Apr-2013 | 27 | 35 | 1000 | 550 | 450 |
| 30-Apr-2013 | 29 | 45 | 1200 | 700 | 500 |
| 15-may-2013 | 20 | 40 | 1050 | 500 | 550 |
| 30-may-2013 | 28.8 | 25 | 1250 | 690 | 540 |
| Average ± SD | 25.15 ± 2.75 | 37 ± 12.06 | 1105 ±92.65 | 652 ± 94.84 | 471 ±72.33 |
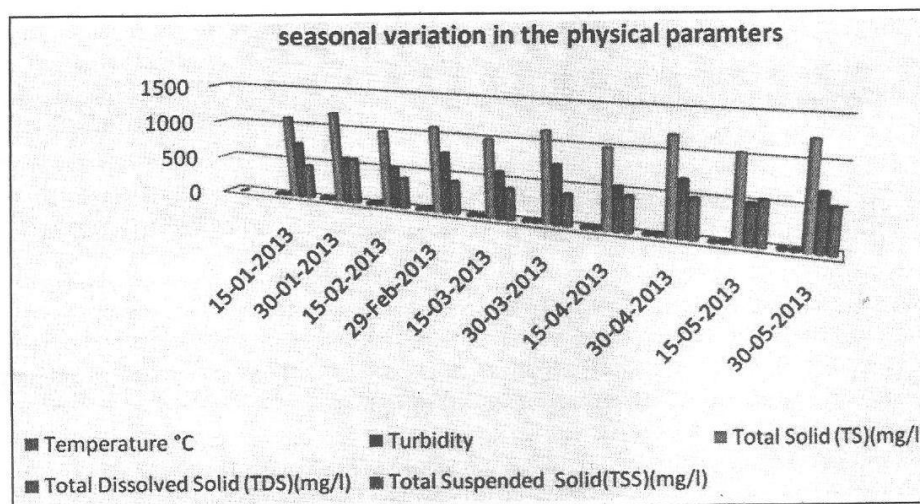


Graph 1: Showing Monthly Variation in Physical Parameters.

## Table 2: Showing Variation of Chemical Characters

| Date/ Parameter | pH | DO | BOD | COD | Free CO$_2$ | Alkalinity | Acidity | Chloride | Total Hardness | Calcium | Magnesium |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15-Jan-2013 | 7 | 4.38 | 3.0 | 11 | 11 | 40 | 50 | 22.01 | 222 | 90.18 | 200 |
| 30-Jan-2013 | 6.9 | 7.51 | 3.22 | 11.66 | 16.50 | 30 | 70 | 26.27 | 306 | 100.19 | 281.44 |
| 15-Feb-2013 | 7.1 | 9.43 | 3.72 | 12.75 | 24.20 | 100 | 95 | 19.17 | 321 | 95.20 | 299.78 |
| 29-Feb-2013 | 7.2 | 5.20 | 2.75 | 8.0 | 62.70 | 55 | 180 | 21.36 | 280 | 101.64 | 255.20 |
| 15-Mar-2013 | 7.0 | 6.50 | 2.72 | 8.75 | 56.10 | 70 | 220 | 26.98 | 292 | 88.18 | 270.48 |
| 30-Mar-2013 | 7.0 | 6.85 | 2.75 | 8.90 | 14.50 | 48 | 67 | 21.50 | 250 | 104.20 | 219.20 |
| 15-Apr-2013 | 7.4 | 6.15 | 2.95 | 12.20 | 12.10 | 45 | 65 | 19.88 | 249 | 90.18 | 219.60 |
| 30-Apr-2013 | 7.0 | 6.14 | 3.36 | 12.00 | 13.20 | 20 | 177.50 | 20.59 | 243 | 100.20 | 218.55 |
| 15-may-2013 | 7.2 | 6.20 | 2.42 | 8.50 | 13.20 | 60 | 120 | 29.82 | 232 | 98.65 | 217.15 |
| 30-may-2013 | 7.0 | 6.12 | 3.17 | 12.0 | 20.90 | 45 | 117.50 | 22.10 | 233 | 103.65 | 219.10 |
| Average ± SD | 7.0±0.1 | 6.45± 1.14 | 3.01± 0.38 | 10.5± 1.82 | 24.44± 18.93 | 51.3± 22.27 | 116.2± 58.34 | 22.97± 3.50 | 262.8± 34.40 | 97.23± 5.91 | 240.05± 33.86 |
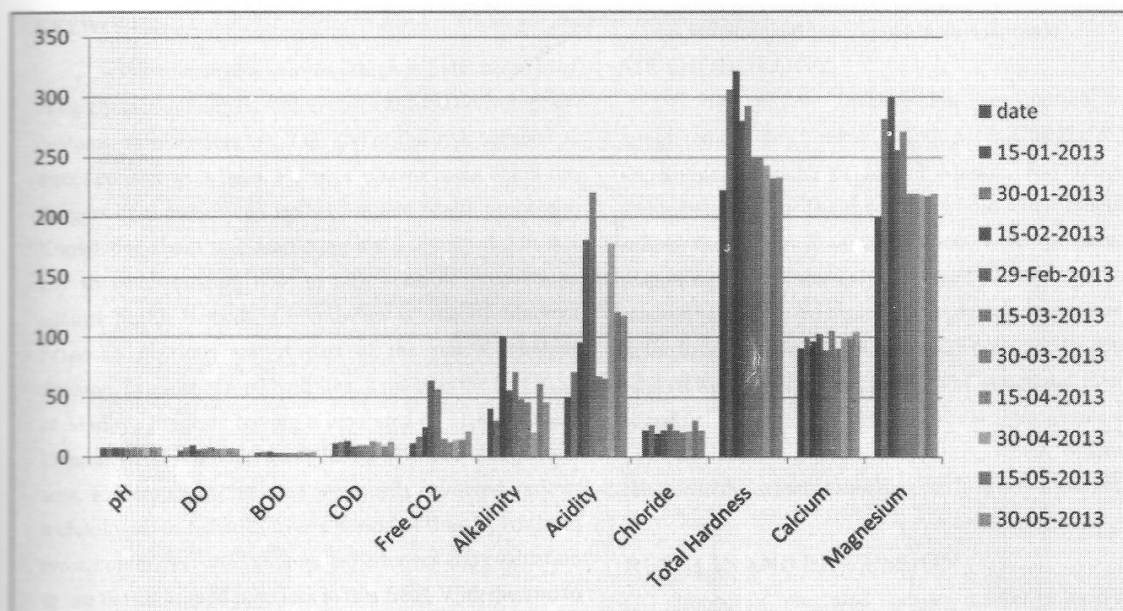


Graph 2: Showing Variation of Chemical Characters.

monthly average value of BOD was observed 3.03± 0.38 mg/l. Chemical oxygen Demand (COD) represents chemically oxidizable load of organic matter in water. The monthly average value of COD was noted 10.5 mg/l whereas, minimum value was found at 8 mg/l and maximum at 12.75 mg/l. Monthly average value of alkalinity was recorded as 51.3 ± 5.97. The monthly average value of acidity was recorded 116.20 ± 58.34, whereas maximum average value was recorded at sampling site I 177.5. The monthly average value of Chloride was

recorded 22.97 ± 3.90 mg/l, whereas maximum average value was recorded at sampling site I 29.82 mg/l, and the minimum average value was at sampling site II 19.17 mg/l.The monthly average value of Calcium was observed as 97.23 mg/l ± 5.91 and the maximum average value of Calcium was at sampling station III 104.20 mg/l whereas, minimum average value was at sampling station II 90 mg/l.The principal source of Mg in natural waters includes various kinds of rocks,sewage and industrial wastes are also important contributors of Mg. The monthly average value of

Magnesium was observed as 240.05 mg/l ± 33.86 mg/l and the maximum average value of Magnesium was at sampling site III 299.78 mg/l whereas, minimum average value was at sampling station II 200 mg/l.

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