IV

MATERIALS AND METHODS

PLATE –1

a. Site A of Rajaram Lake

b. Site B of Rajaram Lake

PLATE – 2

a. Site C of Rajaram Lake

b. Site D of Rajaram Lake

PLATE –1

a

b

PLATE –2

a

b

The development of industrial area and villages situated on the bank of lakes have introduced new problems of water pollution with the influencing of sewage water, industrial water and human activities into the lake water. Therefore, lake water, alters the aquatic environment considerably thus affecting the physicochemical status of water.

Aim of this study is to judge water quality and socioeconomic impact on the lentic water bodies. With these views in mind an extensive survey of the Rajaram, Rankala and Kotitirth lakes has been carried out during the year 2001-2003.

A. ABOUT SAMPLING SITES

- **Rajaram Lake**

- Site A : It is situated at the east side of lake and is near to the wall. This site is always used for animal washings by the people.
- Site B : It is situated near to site A. But it is situated at the opposite side of water supply pipe to Shivaji University. This site is always used by the people for cloth washing and swimming.
- Site C: This site is situated at the southern side of lake. This site is supported by a road going in the water like an island. People used this site for washing.

PLATE –3

a. Site A of Kotitirth Lake

b. Site B of Kotitirth Lake

PLATE –3

a

b

PLATE –4

a. Site C of Kotitirth Lake

b. Site D of Kotitirth Lake

PLATE –4

a

b

- Site D (near Sarnobatwadi) : This site is situated on opposite side to site A. This site is used for local activities like cloth washing, bathing and disposal of sewage by the people of Sarnobatwadi.

- **Kotitirth Lake**

- Site A (near Swami Samarth temple) : This site is situated at the east side of lake. This site is supported by steps. So people get easy way to laid down in water. This site is used for bathing and cloth washing.

- Site B : This site is near to the site A. People used this site for the bathing, cloth washings etc.

- Site C : This site is situated near to the newly constructed garden. This site is used for fishing by the people. This site is also used for animal washings.

- Site D (near Koteshwar temple) : This site is situated opposite to the slum area. This site receives domestic waste from slum area.

- **Rankala Lake**

- Site A : This is situated near Sandhya Math. This site is also called as 'Dhobi Ghat'. This site is always used for washing cloths, bathing, etc.

- Site B : It is near the chaupati. This site is also used for cloth washing, bathing and for fishing.

PLATE – 5

a. Site A of Rankala Lake

b. Site B of Rankala Lake

PLATE –5

a

b

PLATE – 6

a. Site C of Rankala Lake

b. Site D of Rankala Lake

PLATE –6

a

b

PLATE – 7

(Activities in Rankala Lake)

a. Fishing in Rankala Lake

b. Boating in Rankala Lake

PLATE –7

a

b

- Site C : It is the spot of boating. Boats were run from this site. Dump boats were also situated at this site.
- Site D : This site is situated in newly developed Pad-path Udyan Rankala. This site is called as 'Reserved *Eichhornia*'.

B. COLLECTION OF SAMPLES

Regular sampling has been done in the first week of every month from December 2001 to November 2003, from selected sampling sites. The samples were preserved, which were latter analysed, for the desired parameter on the same day of their collection. In the laboratory the physical and chemical parameters was determined using methods described in APHA (1980) and Trivedi and Goyal (1984).

C. METHODS OF ANALYSIS

The standard methods used for water analysis are as follows :

1. Physical Parameters

- **Temperature** (Temp.)

The temperature of water was recorded with the help of ordinary mercury thermometer of 0.50^0C accuracy.

- **pH**

pH is defined as negative logarithm of H^+ ion concentration to the base 10. pH was measured by Elico digital pH meter Model No. Li-120. The instrument was standard by using buffers (pH –4 and pH – 9.2) and then pH of the unknown samples was found.

- **Electrical Conductivity** (EC)

Electric conductivity is the ability of substance to conduct current in water. It is the property caused by various ions. Ionic strength of water samples was measured with the help of systronics electrical conductivity meter 304.

- **Total Solids** (TS)

Procedure

i. A porcelain evaporating dish was taken and weighed (W_1) and 50ml of unfiltered sample was taken in it.

ii. the sample was evaporated on a water bath and after cooling the dish it was again weighed (W_2). T.S. was calculated with the help of following formula :

$$\text{Total solids (TS) mg/L} = \frac{W_2 - W_1 \times 1000 \times 1000}{V}$$

Where, W_1 = Initial weight of the dish
W_2 = Final weight of the dish
V = Volume of the sample taken for evaporation.

- **Total Dissolved Solids** (TDS)

Procedure

The procedure described for T.S. was followed except that 50ml of filtered water sample was taken for estimation of TDS.

- **Total Suspended Solids** (TSS)

Procedure

Total suspended solid was determined by substracting TDS from TS.

TSS = TS – TDS

- **Colour**

The colour of water were recorded visually by taking water samples in clean bottles.

2. Chemical Parameters

- **Hardness**

Hardness was determined using EDTA method.

Procedure

i. 50ml of sample was taken and 1ml of buffer solution was added. If the higher amounts of heavy metal are expected, 1ml of Na_2S solution was also added in it.

ii. 100-200 mg Eriochrome Black T indicator was added and then titrated against EDTA solution till red colour of the solution turned blue.

The Hardness was calculated with the help of following formula :

$$\text{Hardness mg/L (as } CaCO_3\text{)} : \frac{\text{ml. EDTA used x 1000}}{\text{ml. of sample}}$$

- **Total alkalinity** (Phenolphthalein and Methyl orange)

Procedure

i. 100ml of sample was taken in a flask and 2 drops of phenolphthalein indicator was added. If solution remains colourless, then Phenophthalein Alkalinity (PA) considered as nil.

ii. If on addition of phenolphthalein indicator colour of solution turned pink, then solution was titrated against 0.1 N HCl till pink colour disappears and amount of titrant was noted (A).

iii. 2-3 drops of methyl orange indicator was further added in the same sample and titration was continued with 0.1 N HCl till yellow colour of solution turns pink again. The total amount of titrant was noted (B).

The phenolphthalein alkalinity (PA) and Total Alkalinity (TA) was calculated with the help of following formula :

$$\text{PA } CaCO_3 \text{ mg/l} = \frac{\text{A x Normality of HCl x 1000 x 50}}{\text{ml. of Sample}}$$

$$\text{TA } CaCO_3 \text{ mg/l} = \frac{\text{B x Normality of HCl x 1000 x 50}}{\text{ml. of sample}}$$

Where : A = ml of titrant used with phenolphthalein indicator
B = ml of titrant used with phenolphthalein and methyl orange indicator

- **Free Carbon Dioxide (Free CO_2)**

Rain water contain about 0.6 mg/L of free CO_2. For determination of free CO_2,

Procedure

i. 100ml of sample was taken and few drops of phenolphthalein indicator was added. If colour turned pink, free CO_2 were considered as absent.

ii. If solution remained colourless titrated against 0.05 N NaOH till pink colour appeared and ml. of titrant used was noted. Free CO_2 was calculated with the help of following formula :

$$\text{Free } CO_2 \text{ mg/ l} = \frac{\text{(ml x N) NaOH solution x 1000 x 44}}{\text{ml of sample}}$$

Dissolved Oxygen (DO)

For the determination of DO values Winkler's Iodometric method was used.

Procedure

i) BOD bottles of known volume (300 ml) was taken and filled with water samples and any bubbling was avoided. Trapping of the air bubbles was also avoided in the bottle after placing the stopper.

ii) 2ml of $MnSO_4$ and alkaline KI were added carefully and bottle was closed with the stopper.

iii) The bottle was shaken well and was kept to allow the precipitate to settle down in the bottom.

iv) 2ml of concentrated H_2SO_4 was added to it and again was shaken well to dissolve the precipitate completely.

v) 100 ml of this solution was taken and few drops of starch solution was added as indicator. It was then titrated against sodium thiosulphate till dark black to colourless in triplicate. DO was calculated with the help of following formula :

$$\text{DO mg/l} = \frac{(\text{ml} \times \text{N}) \text{ of titrant} \times 8 \times 1000}{V_2 \frac{V_1 - V}{V_1}}$$

Where : V_1 = Volume of sample water after placing the stopper
V_2 = Volume of the part of content titrated
V = volume of $MnSO_4$ and KI added

Biochemical Oxygen Demand (BOD)

Procedure

i) Dilution water was prepared by bubbling atmospheric air in distilled water for approx. 30 minutes.

ii) 1ml each of phosphate buffer, Magnesium sulphate, Calcium chloride and Ferric chloride solutions were added in 1 litre of dilution water and mixed thoroughly.

iii) The sample was neutralized to pH around 7.0 by using 1N NaOH or H_2SO_4.

iv) A suitable dilution of the sample was prepared according to the expected BOD range with the dilution water. The contents were mixed thoroughly by glass rod.

v) The two sets of BOD bottles were prepared by filling the samples in them and one set was kept in BOD incubator at 20^0C for 5 days. The DO content in another set was kept in BOD

incubator at 20^0C for 5 days. The DO content in another set was determined immediately.

vi) DO content of the incubated bottle was determined after the completion of 5 days. BOD values were calculated with the help of following formula :

BOD ml/ l = D_o - D_5 x dilution factor

Where : D_o - Initial DO in the sample

D_5 - DO in the sample after 5 day's incubation

- **Chloride**

Procedure

i) 50ml of sample was taken and 2ml of K_2CrO_4 solution was added in it.

ii) The contents were titrated against 0.002 N $AgNo_3$ till permanent red tinge appears.

Chloride was calculated with the help of following formula :

$$\text{Chloride mg/ l} = \frac{\text{(ml. x N) } AgNO_3 \text{ solution x 1000 x 35.5}}{\text{ml. of sample}}$$

- **Inorganic Phosphorus** ($PO_4 - P$)

Phosphorus was estimated according to stannous chloride method.

Procedure

i) 50ml of filtered clear sample was taken in a clean conical flask. If the sample contains colour and colloidal impurities, they can be removed by adding a spoonful of activated charcoal and then filtering the sample.

ii) 2ml of ammonium molybdate added, followed by 5 drops of $Sncl_2$ solution.

iii) A blue colour will appear. Readings were taken at 690 nm on a spectrophotometer using a distilled water blank with same amount of chemicals. Readings were taken after 5 minutes but before 12 minutes of the addition of the last reagent.

iv) Concentration were found with the help of the standard curve.

- **Nitrate** ($NO_3 - N$)

Procedure

For the determination of nitrate colorimetric method was used :

i) 50ml of filtered sample or an aliquot containing not more than 1 mg/L of $NO_3 - N$ were taken in an conical flask.

ii) An equivalent amount of silver sulphate solution was added to remove chlorides (1 mg/L Cl = 1 ml Ag_2SO_4 solution).

iii) Heated slightly and filter the precipitate of AgCl.

iv) Evaporated the filtrate in a porcelain basin to dryness.

v) Cool and dissolved the residue in 2ml phenol disulfonic acid and diluted the contents to 50ml.

vi) 6ml of liquid ammonia was added to develop a yellow colour.

vii) Readings were taken at 410 nm.

viii) Concentration of nitrate nitrogen were calculated from the standard curve.

ix) standard curve between concentration and absorbance was prepared from 0.0 mg N/L to 1.0 mg N/L at the interval of 0.1. Absorbance of the standard solution were found using the same procedure described for the sample except the removal of the chlorides as in step ii – iii.

- **Sodium** (Na), **Calcium** (Ca), **Magnesium** (Mg), **Potassium** (K), **Iron** (Fe), **Cadmium** (Cd), **Copper** (Cu), **Nickel** (Ni), **Zinc** (Zn), **Manganese** (Mn), **Lead** (Pb)

Procedure

For these minerals and trace metals following procedure were used :

Procedure

i) 50ml of water samples were filtered using Watman No. 42 filter paper.

ii) Then these samples were analysed with the help of Atomic absorption spectrophotometer (A. A. S.) Perkin Elmer A – Analyst 300 model in USIC, Shivaji University, Kolhapur.

3. Socioeconomic Impacts

a) In the month of September 2003 the water samples were collected from Rajaram and Kotitirth lake, before and after Ganesh idol immersion.

b) In the month of October 2003, after 'Navaratra' festival the water samples were collected before and after cloth washing.

4. Invasion of an Aquatic Weed

In Kotitirth lake the invasion of an aquatic weed *Salvinia molesta* Mitchell have been noticed. The water samples were collected soon after appearance and disappearance.

From these all water samples physicochemical characters have been analysed.

The following parameters like, EC, pH, temperature, hardness, alkalinity chloride, salinity, (Knudson method) phosphate, nitrate, free CO_2, Na, K, Ca, Mg, Mn, Pb, Cd, Ni, Zn, Fe, Cu were studied by the methods mentioned above.