Impact of Pollutants on the Quality of Water of Mansa Region, Punjab

Geetu Nanda* and Arun Nanda**

*Department of Chemistry,
Dravidian University, Srinivasavanam, India
**Department of Mechanical Engineering,
Beant College of Engineering and Technology Gurdaspur, (PB) India

ABSTRACT: All the major rivers in the country are polluted as per the global environment system (GMES) and monitoring of national aquatic resource system (MNARS) Government Agencies and research organisations have published standardizes, variations analytical test methods, survey has been carried out by taking the samples of water from Mansa and Bathinda region. The value of BOD (.17 – 1.2 ppm) COD 3-4 PPM, CL content 301-337 ppm. Acidity 27-337 ppm. TDS 420-490 ppm. These values are above the standard values makes the water unfit for people use i.e. polluted waterborne contaminated water.

I. INTRODUCTION

Water pollution is the contamination of water bodies such as lakes, rivers, oceans, and groundwater caused by human activities, which can be harmful to organisms and plants that live in these water bodies. Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, like serving as drinking water, or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water. Water pollution has many causes and characteristics.

II. MATERIALS AND MATHODS

The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical or sensory changes such as elevated temperature and discoloration. While many of the chemicals and substances that are regulated may be naturally occurring (iron, manganese, etc.) the concentration is often the key in determining what is a natural component of water, and what is a contaminant.

Oxygen-depleting substances may be natural materials, such as plant matter (e.g. leaves and grass) as well as man-made chemicals. Other natural and anthropogenic substances may cause turbidity (cloudiness) which blocks light and disrupts plant growth, and clogs the gills of some fish species. Many of the chemical substances are toxic. Pathogens can produce waterborne diseases in either human or animal hosts.

Alteration of water's physical chemistry include acidity, electrical conductivity, temperature, and eutrophication. Eutrophication is the fertilization of surface water by nutrients that were previously scarce. Water pollution is a major problem in the global context. It has been suggested that it is the leading worldwide cause of deaths and diseases and that it accounts for the deaths of more than 14,000 people daily [4, 5].

III. LITERATURE SURVEY

Water quality is the physical, chemical and biological characteristics of water in relationship to a set of standards. In the United States, Water Quality Standards are created by state agencies for different types of water bodies and water body locations per desired uses.[1] The primary uses considered for such characterization are parameters which relate to drinking water, safety of human contact, and for health of ecosystems. The methods of hydrometry are used to quantify water characteristics.

In the setting of standards, agencies make political and technical/scientific decisions about how the water will be used [2]. In the case of natural water bodies, they also make some reasonable estimate of pristine conditions. Different uses raise different concerns and therefore different standards are considered. Natural water bodies will vary in response to environmental conditions. Environmental scientists are working to understand the functioning of these systems, which determines sources and fates of contaminants. Environmental lawyers and policy makers are working to define water laws that designate the fore mentioned uses and natural conditions.

The vast majority of surface water on the planet is neither potable nor toxic. This remains true even if sea water in the oceans (which is too salty to drink) is not counted. Another general perception of *water quality* is that of a simple property that tells whether water is polluted or not. In fact, water quality is a very complex subject, in part because water is a complex medium intrinsically tied to the ecology of the Earth. Industrial pollution is a major cause of water pollution, as well as runoff from agricultural areas, urban storm water runoff and discharge of untreated sewage (especially in developing countries). Though, India abounds in homicidal environmental misfeasance and ecological lawlessness (Year 1984), there are also sufficient constitutional safeguards for environmental protection, Until, 1976 environment protection as such did not figure anywhere in the Constitution. The Forty-second Amendment brought out in that year lays down in the section on Directive Principles of Sate Policy the following duties for the State and Citizen.

Article 48 state that

"The state shall endeavor[1] to protect and improve the environment and to safeguard the forests and wildlife of the country".

Article 51-A (g) inter alia, state that

"It shall be the duty of[1] every citizen of India to protect and improve the environment including forests, lakes, river and wildlife and to have compassion for living creatures".

The water (Prevention and Control of Pollution) Act, 1974

It was experienced that several law enacted earlier to control pollution, did not cover specific problem of water pollution [16]. The ministry of Health had appointed an expert committee on water pollution in 1962 which recommended that Central council of Local Self Government recommended, in 1963, for the enactment of a single law by Parliament to control water Pollution. A draft bill was circulated to all State Government in 1965 with the request to pass enabling resolution authorizing parliament to enact a law on their behalf as required in Article 252 (i). The Prevention of Water pollution Bill, 1969 was introduced in the Rajya Sabha after six State had adopted enabling resolution. Rajya Sabha decided to refer to bill to joint committee in 1972, which modified it in many respects and then presented it to the Parliament in 1972 which passed it in the year 1974.

Legal and Administrative Aspects of Water Pollution Control

The environmental guidelines for sitting industries require the following areas to be avoided.
1. Ecologically and/ or otherwise sensitive areas: At least 25 km depending on the geo-climate conditions and requisite distance shall have to be increased by the appropriate agency. Ecological and Sensitive areas are given in table 5.
2. Coastal areas : At lease ½ km for high tide line.
3. Flood plain of the riverine system: At least ½ km from flood plain affected by dam in the upstream or by flood control systems.
4. Transport/communication system: At least ½ km from highway and railway
5. Major settlement (3,00000 populations) : Distance from settlements is difficult to maintain because of urban sprawl. At the time of setting of the industry, if any major settlement is notified limit is within 50 km the spatial direction of growth of settlement for at least a decade must be assessed ant the industry shall be sited at least 25 km from the projected growth boundary of the settlement

Laws Related with Water Pollution[1]
Central Enactment
  - The River Boards Act. 1956
  - The Merchant Shipping (Amendment) Act. 1970
  - The Water (Prevention and Control of Pollution) Act, 1974
  - The Water (Prevention and Control of Pollution) Act, 1977

State Enactment
  - Orissa River Pollution Prevention Act. 1953
  - Maharashtra Presentation of Water Pollution Act. 1969.

Polluting industries required to Obtain Environmental Clearance for Sitting
1. Primary Metallurgical industries viz. zinc, lead, copper, aluminium and steel.
2. Paper, Pulp and Newsprint
3. Pesticides/Insecticides
4. Refineries
5. Fertilizers
6. Paints
7. Dyes
8. Leather Tanning
9. Rayon
10. Sodium/ Potassium Cyanide
11. Basic Drugs
12. Foundry
13. Storage Batteries (lead acid type)
14. Acids/ Alkalies
15. Elastics
16. Rubber-Synthetic
17. Cement
18. Asbestos
19. Fermentation Industry
20. Electro-Plating Industry
(Vide press note no. 10/60/83-LP, dated 10th December, 1984. Issued by the Department of Industrial Development, Government of India)

Ecological and/ or Other Sensitive Ares[4]
1. Religious and Historical Places
2. Archaeological Monuments (e.g. identified zone around Taj Mahal)
3. Scenic Ares
4. Hill Resorts
5. Beach Resorts
6. Health Resorts
7. Coastal Areas rich in Corals, Mangroves, Breeding Grounds for Specific species.
8. Estuaries rich in Mangroves, Breeding Ground of Specific
9. Gulf Areas
10. Biosphere Reserves
11. National Parks and Sanctuaries
12. Natural Lakes, Swamps
13. Seismic Zones
14. Tribal Settlements
15. Areas of Scientific and Geological Interest
16. Defence installations, Specially those of security importance and sensitive to pollution
17. Border area (International).

IV. EXPERIMENTAL DETAILS

Preparation of Solution

N/10 NaOH. Dissolve 4g of NaOH (Mol wt 40,. Eq. Water 40) Pellets in 1-litter of boiled-out distilled water. Standardize with N/10 oxalic Acid or against a known weight of Potassium Hydrogen Phthalate using phenolphthalein indicator. Make exactly N/10 by appropriate dilution with boiled - out distilled water.

Sodium hydroxide (N/50) Solution. It can be prepared by appropriate dilution of N/10 Sodium hydroxide solution with boiled - out distilled water.
For making N/50 NaoH solution we have to take 200 ml of N/10 NaoH solution and make it exactly 1 litter by adding boiled out distilled water.

Sodium thiosulphate (N/10). Dissolve 25 g of $Na_2S_2O_3$ $5H_2O$ in boiled out distilled water and dilute to one litter.

Standardization 20ml N/10 KIO₃, Solution and 2g A.R.Kl and shake. Add 10 ml of 1N HCl and titrate against thiosulphate using starch solution as indicator near the end Point. Make exactly N/10 by appropriate dilution.

Preparation of sodium thiosulphate (N/40). Prepare by appropriate dilution of the above solution with boiled out distilled water.
For making $Na_2S_2O_3$(N/40) we have to take 250ml of $N/10 Na_2S_2O_3$ solution and make it 1 litter by using boiled out distilled water.

Sulphuric Acid (N/10). Dilute 3 ml of concentrated Sulphuric acid to 1 litter. Make exactly N/10 by appropriate dilution. Sulphuric Acid (N/10) Prepare by appropriate dilution of the above solution. For making N/50 H_2SO_4 acid we have to take 200ml of N/10 H_2SO_4 and make it exactly 1 litter by using distilled water.

Postassium chromate indicator solution. Dissolve 50 mg of Potassium chromate in 100ml of boiled out distilled water.

Calcium Precipitating buffer. Dissolve 6g of Ammonium Oxalate in about 100mt of boiled out distilled water. Add 144mg of NH_4Cl, 13ml of Concentrated Ammonia solution and dilute it to 1 litter.

Ammonium chloride and ammonium hydroxide buffer. Dissolver 68 g of NH_4Cl in some boiled bout distilled water. Add 572 ml of concentrated ammonia Solution and dilute to 1 litter.

Erichrome Black-T indicator. Dissolve 2g of the solid dyestuff in 15 ml of triethanolamine and 5ml ethanol or dissolve 0.5g of dyestuff in 100ml of rectified spirit.

EDTA (N/56). Dissolve 3.7225g of E.D.T.A. (Mol. Wt = 372.25) dried at 80^oC in boiled out distilled water and dilute to 1 litter.

Hard Water. Add slowly small amount of dilute hydrochloric acid through a funnel to 1 g of Anhydrous $CaCO_3$ taken in conical flask. Boil gently to remove CO_2. Heat to dryness on a water bath. Dissolve in boiled out distilled water and dilute to 1 litter.

AgNO₃ (N/50). It can be prepared by the appropriate dilution of N/20 $AgNO_3$ with boiled out distilled water. $AgNO_3$ (N/20) solution can be prepared by adding 8.4945g of $AgNO_3$ (mol. Wt. 169.89, eq. wt. 169.89) in boiled out distilled water and dilute to 1 litter.
For making 1 litter N/50 $AgNO_3$ solution we have to take 400ml of N/20 $AgNO_3$ solution and dilute to 1 litter with boiled out distilled water.

Potasium Permanganate (N/10). Dissolve 3.2-3.25g of $KMNO_4$ in 1 litter of distilled water. Boil for 1 hour and cool. Filter through a plug of purified glass wool placed in the neck of funnel. Warm to $50-60_oC$ and titrate with oxalic solution. Make it exactly N/10 by appropriate dilution with water that has been redistilled form alkaline permanganate.

Manganous sulphate (48%). Disslove 48g of $MnSO_4 2 H_2o$ in distilled water. Filter and dilute to 1 litter.

Potassium oxalate (20%). Disslove 700mg of KOH pellets and 150g of A.R.K. I in distilled water and dilute to 1 litter.

Starch Solution. Add a little distilled water to about. 5g of soluble starch taken in a beaker. Stir with a glass and heat to make a transparent paste. Pour into it about 100ml of boiling distilled out distilled water with constant stirring and cool.

Ferrion. Dissolve 104.85g of O-phenanthroline monohydrate and 0.695g $FeSO_4$. $7H_2O$, in boiled out distilled water and dilute to 100ml.

Ferrous Ammonium Sulphate (N/4). Dissolve 49g ferrous ammonium sulphate in boiled out distilled water containing 10ml of concentrated Sulphuric Acid and dilute to 500ml. Standardise with N/4 potassium dichromate solution.

Potassium Dichromate (N/4). Dissolve 12.259 gms. of $K_2Cr_2O_7$ (Mol. Wt. 294.22, Eq wt = 49.35) dried at 100^c in boiled bout distilled water and diluted to 1 litter.

Silver sulphate and sulphuric Acid reagent. Add 5.5g of Ag_2SO_4 crystals to 1 kg of H_2SO_4 and let it stand for 1-2 days for complete dissolution.

Testing of Water Sample taken from Mansa Sewerage

Water is one of the most essential substances needed to sustain human life, animals and plants. It is needed for drinking, cooking, bathing, washing, cleaning for sanitary disposal of domestic and human wastes, and for agriculture. It is also one of the most important engineering materials and is used for steam generation, as a coolant in power plants, air-conditioning and fire-fighting, and in building and other concrete construction. Water has unique position in industry. It is needed for the production of such a wide variety of materials as steel and other metals. It is essential in paper, textiles, beverages, dairy products, petroleum and coal, rubber and plastics, automobile industry, and as a solvent in chemical processing. In fact, production units not using water for some purpose or the other may be hard to defined. It is for this reason that before setting up a production unit at a particular site, and quantity of water needed, the character and quality of water available and the effect of impurities in water on the process must be considered.

Use of impure water often leads to many problems like health complication, decrease in the efficiency of plants, increased cost, etc. However, of the wide range of impurities presents, only a few may affect a particular process. Therefore, removal or reduction in the concentration of only these impurities is necessary. The rest of impurities which do not adversely affect the process may be allowed to remain as such. For examples, water for laundries should be soft and free from colour. Water for steam generation should be free from all dissolved solids and dissolved corrosive gases but removal of bacteria is not required. Specification for drinking water are much more stringent with respect to the presence of pathogenic bacteria and certain toxic substance (Phenols<0.0005 ppm: As, Cr, Pb, Ag, Mn < 0.005 ppm Cd, Se, cyanide < 0.01 ppm: etc.) but may contain large amount of substances like Ca^{2+}, Na^+, K^+, $Cl^1So_4^{2-}$ etc.

The treatment methods depend on the nature of impurities present, which can be determined by analysis. A complete analysis, however, is usually not done. The extent of analysis is governed by the purpose for which water is to be used and the specification laid down for the purpose. Analysis of the treated water is also carried out to compare efficiency of different treatment processes and to choose the most efficient and economical process.

With the rapid growth in population, improvement in living standards and proliferation of industry, the demand for adequate supplies of suitable water is increasing. So the water used in most of the industries and in sanitary disposal of human and domestic wastes, the water which is not actually consumed but is polluted, has to be reused. The treatment methods for recycling and reusing water have to depend on the nature and extent of contamination and pollution which can be determined by analyzing the used water. A few of the routine tests that are carried out on water and waste water are discussed here.

**Determination of free CO_2 in a sample of water**

The CO_2 content of a water sample is important as it contributes to corrosion. When present in boiler-feed water, it may cause corrosion of even those part that lie at a distance from the boiler, such as super heater or the blades of stream turbines. In lime-soda process of water-softening, measurement of free CO^2 is necessary for calculating additional amounts of lime to be added. Because of its corrosive nature and the unacceptable taste it imparts to water, CO_2 it to be removed from municipal water supplies by aeration or by neutralization with lime; the choice of the method depending upon the amounts of free CO_2 present in the sample.

Reagents Required

1. Standard Na_2CO_3 solution (N/50) or NaOH solution (N/50)
2. Phenolphthalein indicator solution

Theory

Free CO_2 can be determined by titration with a standard solution of NaOH or Na_2CO_3 with which it reacts to give $NaHCO_3$

$CO_2 + OH^-$ ------------------------HCO_3^-
$CO_2 + CO_3^{2-} + H_2O$ ---------------- $2HCO_3^-$
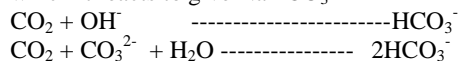
Phenolphthalein is used as indicators and titration is carried to pH 8.3 indicated by the appearance of pink color.

Observations and Calculations

Volume of water sample taken for each titration (Aml) = 100-ml

Concordat volume of N50 NaCO$_3$ used   for sample 1 = 24.3 ml

for sample 2 = 22.5 ml

for sample 3 = 22.5 ml

for sample 4 = 29.2 ml

Sample	Normality	Strength
1	.00486 N	106.92 mg/l
2	.0045 N	99 mg/l
3	.0045 N	99 mg/l
4	.00585 N	127.6 mg/l

Determination of acidity of a water sample

Observation and Calculations

Volume of water sample taken for each titration = 20 ml

Volume of N/50 Na OH used in presence of phenolphthalein indicator = 7 ml, 5.4 ml, 5.1 ml, 7.7 ml

Phenolphthalein Acidity = B x 50 x 1000

50 x 100

Sample	Phenolphthalein Acidity
1	35 ppm
2	27 ppm
3	55 ppm
4	37.5 ppm

Chloride Content

Observation and Calculations

Volume of the sample taken each time   =   20 ml

Concordant volume of N/50 AgNO$_3$ used   =   9.5 ml, 9 ml, 9.6 ml, 8.5 ml

Sample	Phenolphthalein
1	337 ppm
2	31935 ppm
3	340 ppm
4	301.75 ppm

Hardness:

Calculations :

Sample	Total Hardness	Permanent Hardness	Temporary Hardness
1	109.3 ppm	90.6 ppm	18.7 ppm
2	106.2 ppm	93.75 ppm	12.45 ppm
3	112.5 ppm	95.6 ppm	16.9 ppm
4	115.6 ppm	93.1 ppm	22.5 ppm

V. RESULTS AND DISCUSSION

As India is a large country so water is used as a important source for drinking, bathing and irrigation. So water has been regarded as the life line for the people of this country. But due to the increase in population and rapid industrialization, urbanization, and discharge of the wastes in expected tom bring about the change in quality of water and its sediments. The quality of water of Mansa sewerage was studied both was studied both physio-chemically. To study the impact of wastes and effluents on the quality of water at Mansa along with the change in water quality. The present studies were undertaken and this paper embodies our observations on the physio-chemical quality of water sample when taken from sewerage of Mansa.

Description of site:- for the present research work four samples from four sites of Mansa sewerage have been selected.

Site I: This sampling site is near Harijan Basti of Mansa, where large number of people take bath regularly.

Site II: This site is near Guru Ravidas Mandir of Mansa. This place is also used for bathing and disposal of house hold water and other type of waste material.

Site III: This site is situated near the Hinori Chowk. Here large number of effluents are drained into the water sewerage. Samples were colleted from this site. Water samples from the above mentioned sites were collected once and brought to the laboratory for analysis. While sample for the physio-chemical students were collected in sterilized glass wares.

The physio-chemical parameter of water samples were studied using the method described in APHA (1985) and ISI (1965). Our observation on physio-chemical characteristics of Mansa sewage water have been described below under separate headings.

The observation on physio-chemical parameters water sample of Mansa sewerage of four selected sites have been recorded in table. It would be quite clear from the data presented in table. The water sample collected from sites showed different concentration of different parameters than those of reaming there sites.

1. Physical Examination:
 Colour   :   Black
2. Smell   :   Unpleasant

Table 1.

		Sample I	Sample II	Sample III	Sample IV
1	Colour	Black	Brown	Black	Black
2	Smell	Unpleasant	Unpleasant	Unpleasant	Unpleasant
3	PH	6.67	6.85	6.20	6.03
4	Conductivity	$1.85 * 10^{-3}$ mho	$1.9 * 10^{-3}$ mho	$.72 * 10^{-3}$ mho	$.53 * 10^{-3}$ mho
5	Total dissolved solid	480 ppm	470 ppm	420 ppm	490 ppm
6	Total suspended solid	6 ppm	4.5 ppm	5.5 ppm	5.7 ppm
7	BOD	.20 ppm	.17 ppm	1.0 ppm	1.2 ppm
8	COD	3 ppm	3.2 ppm	3.6 ppm	4 ppm
9	D.O.	6 ppm	7 ppm	8 ppm	9 ppm
10	Total Hardness	109.33 ppm	106.2 ppm	112.5 ppm	115.6 ppm
11	Mg. Hardness	72.5 ppm	76.87 ppm	73.75 ppm	75.62 ppm
12	Ca Hardness	36.8 ppm	29.33 ppm	38.75 ppm	39.9 ppm
13	Cl content	337 ppm	319.5 ppm	340 ppm	301.7 ppm
14	Acidity	337 ppm	27 ppm	.255 ppm	37.5 ppm
15	CO_2 Content	194.4 mg/l	180 mg/l	203 mg/l	233 mg/l
16	Permanent Hardness	90.6 ppm	93.75 ppm	95.6 ppm	93.1 ppm
17	Temp. Hardness	18.7 ppm	12.48 ppm	16.9 ppm	22.5 ppm

3. PH: The PH value observed with that permissible limit range 5.85 to 6.67 respectively. Which is less than the PH of Northern Region which was found to be 8.015 mho.

4. Conducting: Four samples of Mansa sewerage were studied for the conductivity. The conductivity of all the samples come out to be different for different sample ranging from 1.82×10^{-3} mho to $.53 \times 10^{-3}$ mho. Which was quite high as found in Northern region of India. Which was ranging from 0.26×10^{-3} mho to 0.39×10^{-3} mho.

5. Total Dissolved Solid: Four samples were studied for calculating the total dissolved solid in the water sample that was came out to be 0.00033×10^{6} ppm to 0.0005×10^{6}. This concentration was quite high as compare to the value of total dissolved solid found in the northern region of the country which was ranging from .0023 to x 10^{6} ppm to $.00821 \times 10^{6}$ ppm.

6. Total Suspended Solids: Four samples were studied for the total suspended solid taken from four site of Mansa sewerage. From the study of samples it have been found that the value of sample-1 was quite different from the other samples taken from different sites and it were come out to be $.0066 \times 10^{6}$ ppm to $.008 \times 10^{6}$ ppm which is quite different from the value of water suspended solid found in Northern region of India which was ranging from 1110 to 1800 ppm.

7. BOD: Four samples from the four sites of Mansa sewerage have been studied for the BOD. The value of sample-1 was quite different from the other samples ranging from 66 ppm to 12 ppm. Which was quite high found in the northern region.

8. COD: Four samples from the four sites of Mansa sewerage have been studied fro the BOD. The value of sample-1 was quite different from the other samples ranging from 68 ppm to 112 ppm. Which was quite high found in the northern region.

9. Dissolved Oxygen: Four samples of Mansa sewerage were taken from four different site of sewerage for the detection of dissolved oxygen which was ranging from 0.01 ppm to 0.0114 ppm which was quite low as found in northern region which were ranging from 2.3 ppm to 6.6 ppm.

10. Total Hardness: As Hardness constitute one of the most important pollution indicating Parameter. Four samples were taken from the Mansa sewerage for the detection of total Hardness present in the water samples and its value ranging from 109.3 ppm to 115.6 ppm which is closely match with the value of Hardness found in the Northern region which ranges from 32 ppm to 126 ppm.

11, 12. Mg and Ca Hardness: Mg and Ca Hardness constitute one of the most important pollution indication parameter and it was found highest in the four sample of water sewerage. Which were collected from the four different sites of the sewerage and the value of Mg-hardness was ranges from 72.5 ppm to 76.87 ppm for different samples and value of Ca hardness ranges from 29.33 ppm to 39.98 ppm. The value of magnesium hardness was quite high as was found in Northern region (having range from 12.67 ppm to 27.0 ppm). This show that Mg hardness was the main parameter creating pollution in Mansa region. The ranges of Ca hardness varies from 9.62 ppm to 47.29 ppm fro the northern region.

The value of Ca-hardness of northern region were closely matched with the value of Ca-hardness found in our samples of Mansa sewerage water.

13. Chloride Content: As chlorides constitute one of the most important pollution indicating parameter and its concentration found higher in four samples of Mansa. Sewerage of water taken from four different sites. As compare to the Northern region. The value of chlorine content in Mansa Sewerage ranges from 310.75 ppm to 340 ppm. The value of chloride content in Mansa sewerage water comes out to quite high as compare to Northern region whose value varies from 156.2 ppm to 326.6 ppm.

14. Acidity: Four samples of Mansa sewerage water from four different sites for the studies of Acidic character was taken and it was found that the Acidic value ranges from 22.5 ppm to 37.5 ppm. This value show that water samples were quite Acidic in nature.

15. CO_2 Content: Four samples of Mansa sewerage was taken for the study Co_2 content present in the sewerage water. Its content range was found to be 180 mg/1 to 233 mg/l. From this studies it was found that Co_2 content was found quite higher.

16,17. Permanent Hardness & Temporary Hardness: Four samples of Mansa sewerage was taken for the study of permanent Hardness & Temporary Hardness present in the sewerage water. Its Value range was found to be 90.6 ppm to 95.6 ppm & 12.48 ppm to 22.5 ppm. From this studies it was found that values were found quite compare to Northern region

REFERENCE

[1]. Patern, B.C. (1973) Need for ecosystem Perspective in entropeication.

[2]. Modelling. Ind "Modelling the Eutrophicaiton Process" Middlebrooks, E.J.

[3]. D.H. Falkenborg and T.E. Maloney (eds). Utah State University, Logan, Utah.

[4]. Sawyer, C.N. (1968) J.New England Water Works Assn. 61: 109-127

[5]. Andelman, J.G. and Snodgrass, J.E. (1974). Critical review in environmental Control, 4:69.

[6]. Anoymous (1980). Guidelines for Canadian drinking water quality.

[7]. Ministry of supply and service Canada Supporting.

[8]. Arthur, D. Little (1971) Inorganic chemical pollution of fresh water. US.

[9]. Environmental Protection Agency, Washington. D.C. Commision of the European communities (1979). Trace metals: exposure and health effects. Pergamon Press. Oxford.

[10]. CSATA.S (1968). *Zeitschrift Fiir Urologia*, **61**: 327.

[11]. Dril, S. (1979). The environmental lead problem. An assessment of the lead drinking from a multi-media perspective. U.S. Environmental Protection Agency, D.C.

[12]. Govt. of India (1974). The water (Prevention and Control of pollution) Act. 1974. Act. No. 6 of 1974.

[13]. Haksted, J.A. Ronaghy, H.A. Abadi, P, Haghshenass, M. Amirhakemi, G.h. Baraket, R.M. and Rinhold, J.O. (1972) Zinc deficiency in man. American journal of Medicine, **53**: 277.

[14]. Harrison, R.M (1975). Water research 9:331.

[15]. Hill. M.J. (1973). British Journal of Cancer. 28:562.

[16]. I.A.R.C. (1980) Some metals and metallic compounds Monograph on the evaluation of the carcinogenic risk of chemicals to humans vol. **23.**

[17]. Lyon. International Agency for Research on Cancer Lyon.

[18]. International standing committee on water quality and treatment, *Aqua.* **1**: 5-24 (1974).

[19]. I.T.R.C. (1975) Out - break of paralysis in some villages of Unnao District, Uttar Pradesh - A Preliminary Epidemiological study: Industrial Toxicology Research Centre, Lucknow-1.

[20]. Jaffe, W.G. (1972), Archives Latinoancericanos de nutricion, **22**:5 95.

[21]. Jaffe, W.G. (1976), Proceedings of the symposium on selenium tellurium in the environment. Industrial Health Foundation Inc., Pitsburg.

[22]. Jolly, S.S. (1970). *J. Asso. Phys. Ind*., **18**: 459.

[23]. Jolly, S.S. Singh, I.D. Parsad, Satish, Sharma Raghupati, Singh, B.M. and Mathur, O.C. (1969). *Indian J.Med. Rers.*, **57**: 1333.

[24]. Kaufman, D.B. Dinicala, W. and Mcintosh, R. (1970). *American Journal of diseases of children*. **374**: 119.

[25]. Keshan Disease Research Group of the Chinese Academy of Medical Services (1979). *Chinese Medical Journal* 477: 92.

[26]. Lisella, F.S. (1972). J. Envi. Health. 30:157. Masirani, R. (1973) *Nutrition reports International*, 7: 51.

[27]. Allee, W.C. Emerson, A.e., Park, P.Park, T. and Schmidt, K.P. (1949). Principals of Animal Ecology, W.b. Saunders, Philadelphia and London.

[27]. Anderson. P.D. and D. Appollonia S. (1978) Aquatic Animals in "Principles of Ecotoxicology." Butler, G.C. (Ed), John Wiley and Sons, Chichester.

[29]. Armstrong, D.A. and Molleman, R.E. (1974) Mar. Biol. (Berl),. 28: 11-15.

[30]. Base, A.K. Rao, C.S.G., Dhyaneshwar, R.S. Mukherjee. G., Kutty, M.K.A. Ray, D. and Triuvedi, R.C. (1973). Proc. Sympo. On Environ Poln., 26-40, National Environmental Engineering Research Institute, Nagpur.

[31]. Batelle Columbus Laboratories (1971). Water quality criteria data book. Vol. **3**, EPA Project NO. 18050, G.M.V. Contract No. 68-01-0007.

[32]. Bennigton, S.L. Connors, P.G., Connors, C.M. and Risebrough, R.W. (1975). Environ. Conserv., 1975.

[33]. Buessa, B.J. (1977). Ag. Bota. **3**: 203-216.

[34]. Butler, G.C. (1978) Principles of Ecotoxicology, Scope 12. John Wiley and Sons. Chichester.

[35]. Caims, J. and Buikema, A.L. (1984). Restoration of habitats impacted by oil spills, Butterworth Publishers, boton.

[36]. Carmody, D.J. Pearce, J.B. and Yasso, W.E. (1973). Mar. Pollut. Bull. 4:132-135.

[37]. Chapman, V.J. (1976). Mangrove vegetation. Leuter Schausen, J. Cramer.

[38]. Chawla, G.Vishwanathan, P.N. and Devi., S. (1986). *Exp. Env. Bot*. **26**: 39-51.

[39]. Chichester, C.O. and Graham, H.D. (Eds) (1973). Microbial safety of fishery products. Academic Press, London and New York.

[40]. Cintron. G., Luga, A.E., Martinez, R., Cintron, B.B. and Encarnacion, L. (1981).

[41]. Impact of oil in the Tropical Marine Environment. Technical Publication, Division of Marine Research, deptt. of Natural Resources, Puetro Rico.

[42]. Conroy, J.W.H. and French, M.C. (1974). Br. Ant. Surv. Bull. **38**: 43-47.

[43]. Corner, E.D.S. Soutward, A.J. and Soutward, E.C. (1968), J. Mar. Biol. Ass. U.K. **48**: 29-47.

[44]. Dacre, J.C. (1974), Bull. Environ. Contam. Taxicol., **11**: 517-522.

[45]. APHA, (1985). Standard methods for the examination of water, sewerage and industrial wastes, 166th edn. American Public Health Association, New York.

[46]. Arora, H.C. Krishnamoorty. K.P. and Srivastava, H.N. (1965). Proc. Sym. In Problems in water treatment, Nagpur October (1964), 186-205.