Physico-Chemical and Bacteriological analysis of Indrayani River Water at Alandi, Pune District (Maharashtra) India

S.D. Jadhav*, M.S. Jadhav, R.W. Jawale***
Bharati Vidyapeeth Deemed University, College of Engineering, Pune 411043.
(Department of Engineering Science)
**Sinhgad Technical Education Society's Sou. Venutai Chavan Polytechnic, Pune
(Department of civil Engineering)

Abstract:-

Without food, human can survive for a number of days, but water is such an essential compound that without it one cannot survive. Water is not only essential for the lives of animals and plants, but also occupies a unique position in industries. Simultaneously Groundwater is an important source of water supply throughout the world. The quantity and the suitability of groundwater for human consumption and for irrigation are determined by its physical, chemical and bacteriological properties. Its development and management plays a vital role in agriculture production, for poverty reduction, environmental sustenance and sustainable economic development. In some areas of the world, people face serious water shortage because groundwater is used faster than it is naturally replenished. Human development and population growth exert many and diverse pressures on the quality and the quantity of water resources and on the access to them. Water quality assessment of Indrayani river is done for the various parameters like pH, DO, BOD, COD, chlorides,sulphates,nitrates,calcium,magnesium,hardness, The water samples were also analyzed for the presence of fecal bacteria namely: Escherichia coli (E.coli),and total coliform bacteria present in river water.

Keywords:- Indrayani river, Physico-chemical parameters, fecal bacteria, total coliform bacteria, Alandi etc.

Introduction:-

Water is the most abundant and most useful compound in the world. And hence it is called *Jeevan* in Sanskrit. The contamination and pollution of water is of great concern in the world. For the developing countries like India, the question of water pollution has acquired a critical stage. River Pollution has become a menace these days. Even the most prestigious and sacred rivers of India have been facing the curse of pollution for a long time. This has not only adversely affecting the availability of fresh potable water in the country but also resulting in many contentious and dangerous diseases. River pollution, generally originates from discharge of domestic sewage, industrial effluents, or agricultural run-off into the river water. The assault on Indian rivers from growing population, agricultural modernization,

unplanned urbanization and industrialization is enormous and growing day- by- day. Broadly, the human causes are responsible for pollution of water. The rapid pace of growth of population in India is primarily responsible for the significant increase in the level of pollution of rivers. With the increasing rate of growth of population, the human activities around the bank of rivers also increased, which results in contamination of water. The impact of population on environment, in general and on rivers, in particular, is harsh. We can understand the effect of population growth on rivers every day. As of 2011 India census, Alandi had a population of near about 28,577. Alandi is situated on the banks of river Indrayani about 25 km away from city of Pune, Maharashtra. This is birth place of saint Dnyaneshwar. Saint Dnyaneshwar, after translating the Bhagavad Gita into Marathi and attained Samadhi at Alandi. Alandi is a place of pilgrimage and is venerated by many Hindus. It is great place to experience spiritual life of Indians.

Material and Methods

Experimental: - A study was undertaken from March 2010 to April 2011. Water samples were collected at one sampling station and analyzed to obtain variations in the quantity of physico-chemical parameters, bacterial contamination. The study site was chosen to give representation of all areas.

Sampling: Sampling for bacteriological analysis was done aseptically with care, ensuring that there was no external contamination of samples. For analysis, sterilized plastic poly ethylene (PET) bottles were used which were cleaned and rinsed carefully; given a final rinse with distilled water, and sterilized in boiling water for 15 minutes. Effectiveness of sterilization was checked with each run by using sterilization strips inside sampling bottles and glassware used. Sodium Thiosulfate ($Na_2S_2O_3$) solution (75 mg $Na_2S_2O_3$ per liter) was added to these sampling bottles before sterilization, to Dechlorinate the sample. Sometimes, this reagent was not added to the sampling bottles then after checking for chlorine, it was added to positive samples after filter. During sample collection, ample air space was left in the bottle to facilitate mixing by shaking, before examination.

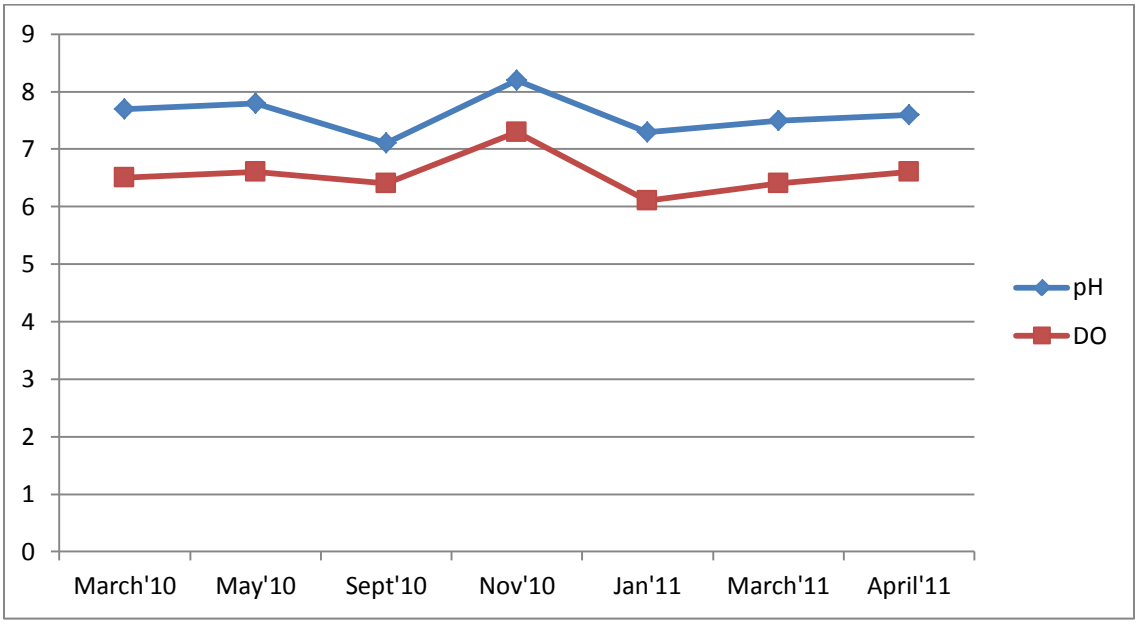
Table No.1 **Parameters studied and methods adopted with Indian Standards.**

Sr.No.	Parameters	**Method adopted**	**Indian Standard**
1	pH	Electrometric Method	6.5-8.5
2	DO (mg/L)	Azide modification	7.6-7.0
3	BOD (mg/L)	Azide modification	30
4	COD (mg/L)	Dichromate reflux	250
5	Chlorides (mg/L)	Argentometric Titrimetric method	250
6	Sulphates (mg/L)	Colorimetric Turbidimetric method	200
7	Nitrates (mg/L)	Colorimetric Turbidimetric method	45
8	Calcium (mg/L)	EDTA Titration Method	75
9	Magnesium (mg/L)	EDTA Titration Method	30
10	Hardness (mg/L)	EDTA Titration Method	300
11	Fecal Bacteria(E-Coli) MPN/ 100mL	E.coli Procedure	MPN 0/100 mL
12	Total Coliform MPN/ 100mL	Multiple-tube fermentation technique	2–20/100 mL.

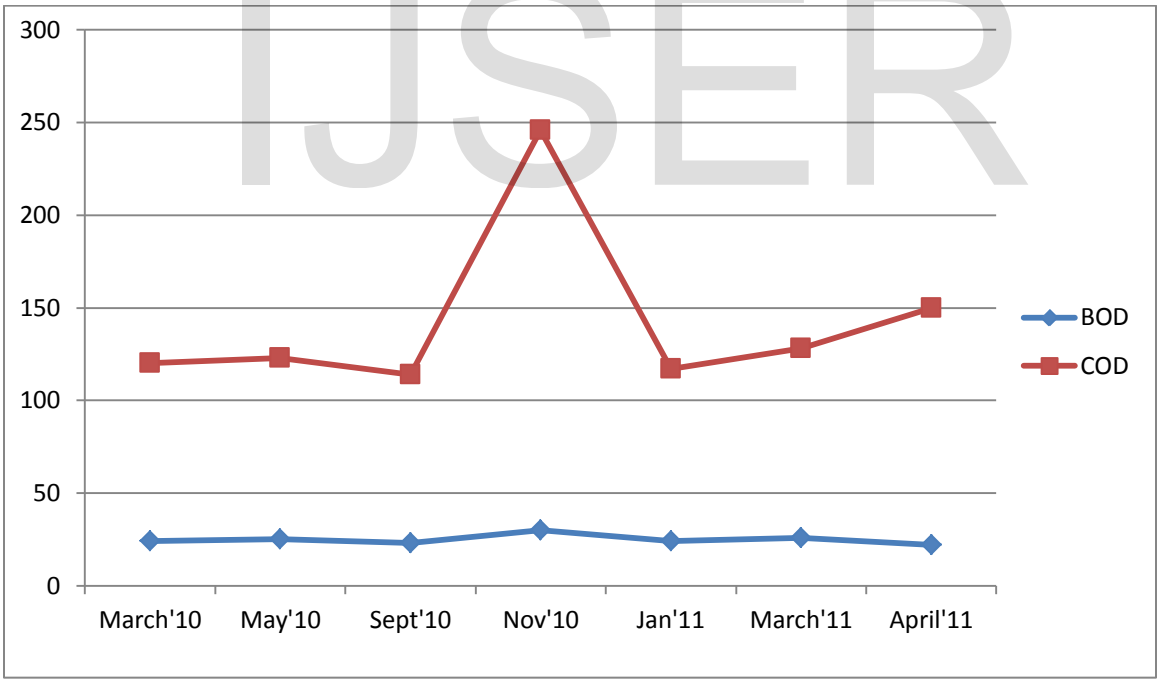
Table No. 2 **Physico-chemical analysis of Indrayani River from March 2010 to April 2011**

Sr.No.	Parameters	March 2010	May 2010	Sept. 2010	Nov. 2010	Jan. 2011	March 2011	April 2011
1	pH	7.7	7.8	7.1	8.2	7.3	7.5	7.6
2	DO (mg/L)	6.5	6.6	6.4	7.3	6.1	6.4	6.6
3	BOD (mg/L)	24	25	23	30	24	26	21.9
4	COD (mg/L)	120	123	114	246	117	128	150
5	Chlorides (mg/L)	208	206	204	261	198	209	225
6	Sulphates (mg/L)	36	34	31	61	28	33	38
7	Nitrates (mg/L)	23	21	20	31	19	24	26
8	Calcium (mg/L)	32	33	33	42	28	31	37
9	Magnesium (mg/L)	21	20	21	28	23	22	24
10	Hardness (mg/L)	61	58	62	80	74	71	73
11	Fecal Bacteria (E-Coli)MPN/100mL	00	02	01	07	02	03	04
12	Total Coliform MPN/ 100mL	16	18	14	22	12	14	18

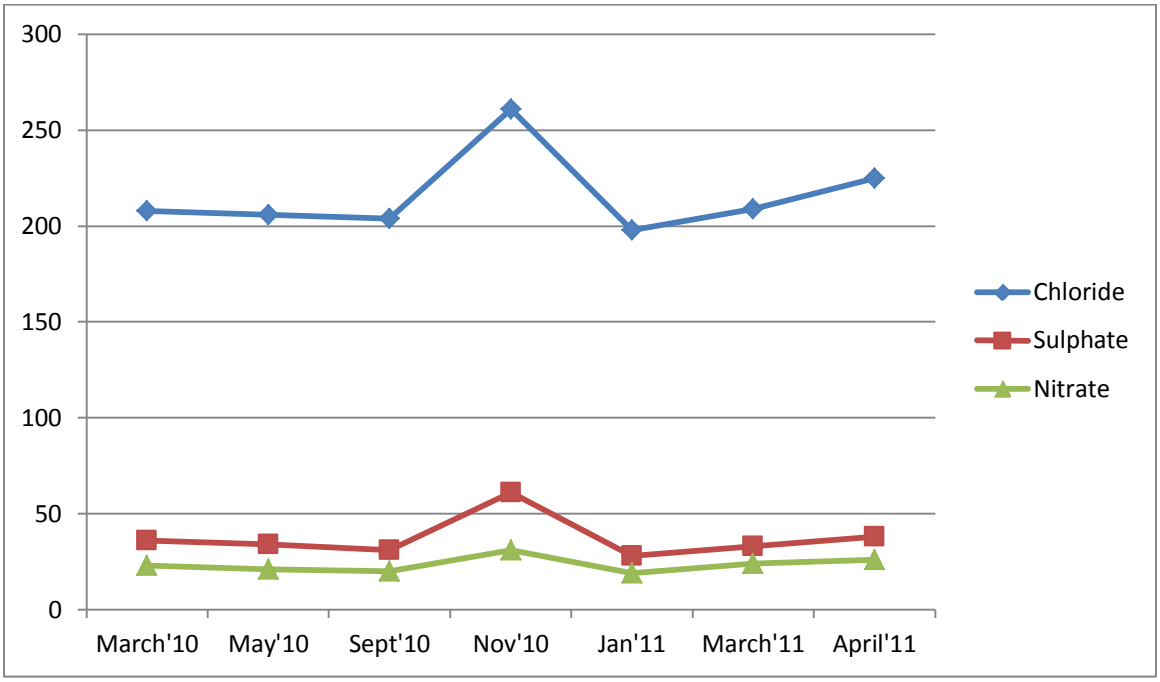
1) Graphical Representation of pH and DO



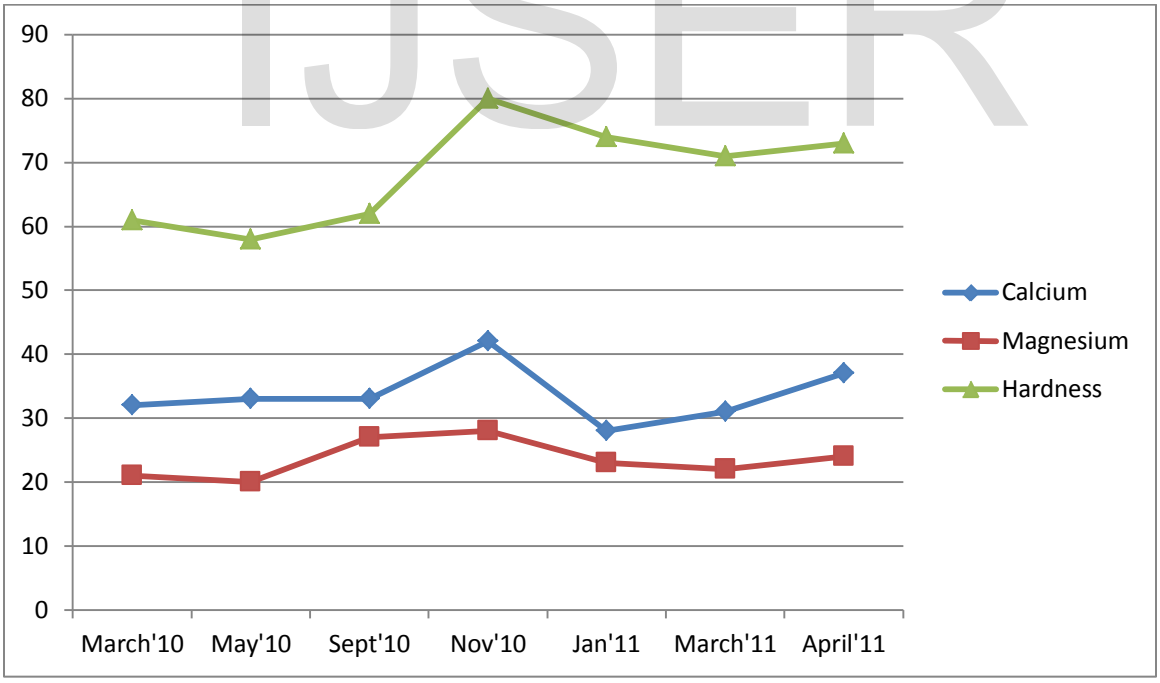
2) Graphical Representation of BOD and COD



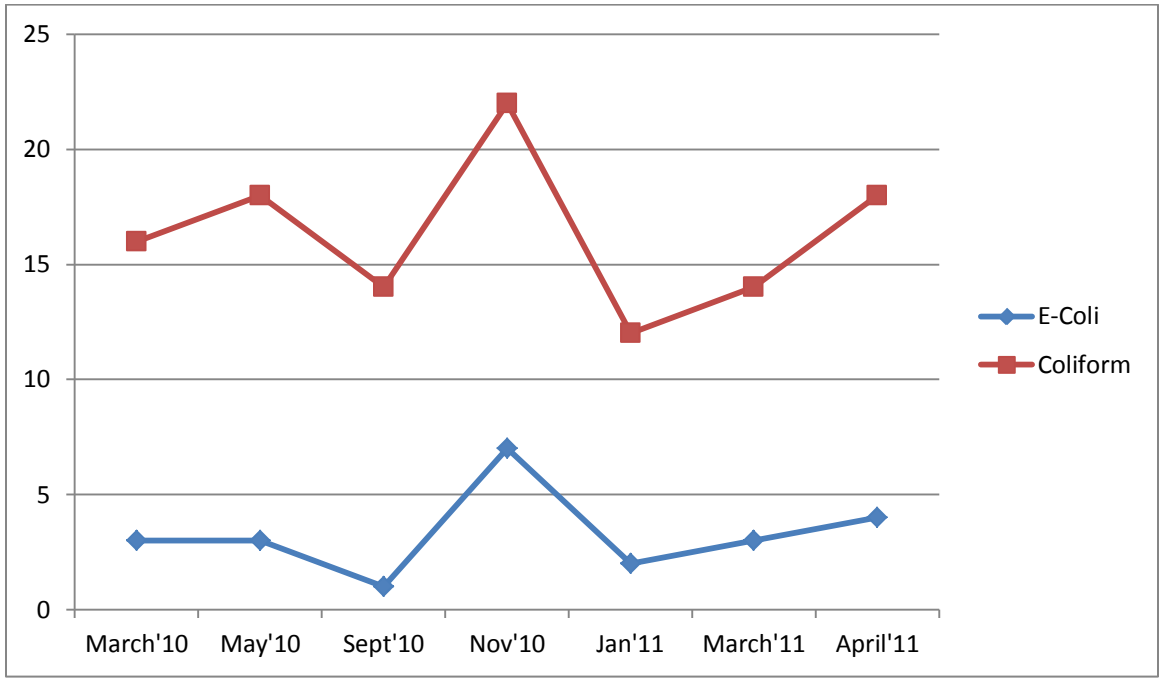
3) Graphical Representation of Chloride,Sulphate and Nitrate



4) Graphical Representation of Calcium,Magnesium and Hardness



5) Graphical Representation of E-Coli and Coliform bacteria



Results and Discussion:-

The water temperature of river is very important, as many of the physical, biological, and chemical characteristics of a river are directly affected by temperature.

1.1 pH: The pH level is a measure of the acid content of the water. Most forms of aquatic life tend to be very sensitive to pH. The pH level has profound effect on all body chemistry, health and disease. pH of water beyond permissible range can affect mucous membrane of cells and cause corrosiveness in water supply system. pH value determined for all the water samples collected from selected sites was found in the range of 7.1 to 8.2. All water samples were found to have pH within the limits of BIS / WHO i.e. 6.5 to 8.5.

1.2 DO : The dissolved oxygen test measures the amount of life sustaining oxygen dissolved in the water. Natural waters in equilibrium with the atmosphere will contain dissolved oxygen concentrations ranging from about 5 to 14.5 mg O_2 per liter depending on the water temperature, salinity, and altitude. The dissolved oxygen (DO) concentration present in water reflects atmospheric dissolution, as well as autotrophic and heterotrophic processes that respectively, produce and consume oxygen. DO is the factor that determines whether biological changes are brought by aerobic or anaerobic organisms. Thus, dissolved oxygen measurement is vital for maintaining aerobic treatment processes intended to purify domestic and industrial wastewaters. The optimum value for good water quality is 4 to 6 mg/L of DO, which ensures healthy aquatic life in a water body. DO value determined for all the water samples

collected from selected sites was found in the range of 6.1 to 7.3. All water samples were found to have Do within the limits of BIS / WHO i.e. 7.6-7.0

1.3 BOD: The Biochemical Oxygen Demand is a measure of the amount of food for bacteria that is found in water. It determines the strength in terms of oxygen required to stabilize domestic and industrial wastes. For the degradation of oxidizable organic matter to take place minimum of 2 to 7 mg/L of DO level is to be maintained at laboratory experimentation or should be available in the natural waters. BOD value determined for all the water samples collected from selected sites was found in the range of 21.9 to 30. All water samples were found to have BOD within the limits of BIS / WHO i.e. 30

1.4 COD: This is a measure of both the biologically oxidisable and biologically inert organic matter present in the sewage sample. It is an important and quickly measured parameter for steam and industrial waste water analysis and water treatment plant. Observed values of COD are in the range of 114 to 246 mg/L. All water samples were found to have COD within the limits of BIS / WHO i.e. 250

1.5 Chloride : Amount of chlorid**e** present in river water samples are in the range of 198-261 mg/L, which exceeds the permissible limit of 250 mg/L as per Indian standards as well as WHO Standards and this obviously affects the taste of the water. Water intrusion. Chlorine enters the body breathed in with contaminated air or when consumed with contaminated food or water. It does not remain in the body, due to its reactivity. Chloride is present in natural waters due to the dissolution of salt deposits, salting of roads, and effluents from chemical industries. Chloride is the most abundant anion in the human body. No evidence has been found suggesting that ingestion of chloride is harmful to humans. Chloride is a widely distributed element in all types of rocks in one or the other form. Its affinity towards sodium is high. Therefore, its concentration is high in ground waters, where the temperature is high and rainfall is less. Soil porosity and permeability also has a key role in building up the chlorides concentration.

1.6 Nitrates: Due to the presence of nitrogen, toxicity in infants causes methaemoglobiaemia. In adults it is less effective due to nitrate metabolizing triglycerides present at higher concentration. Nitrate was present in all drinking water samples and the level ranged from 19 mg/L to 31 mg/L. All water samples had nitrate content within permitted BIS (45 mg/L), WHO (10 mg/L) permissible limit.

1.7 Sulfates: This is a form of sulphur get into the water supply when sulfite ores are oxidized. Sulphur containing minerals are found in most of the rocks and soils around the world. As ground water seeps through the earth, some of this compound is sulphur and is dissolved by the water. Rain water that leaches into the ground is also a source of sulphur. The biggest problem of sulphur in drinking water is that its stinks. Drinking water which has high level of sulfate can cause diarrhea, especially in infants. Sulfate content in the drinking water samples ranged from 31 mg/L to 61 mg/L. All water samples contained sulfate content within the permissible limit as suggested by BIS / WHO i.e. 200 mg/L.

1.8 Calcium Hardness: Calcium is an important micronutrient in an aquatic environment Hardness of the river water is of considerable significance in connection with the discharge of the sewage and industrial effluent containing pollution, as indicated by variations in the concentration of the hardness of the water. Ca Hardness content in the drinking water samples ranged from 28 mg/L to 42mg/L. The concentration of Ca Hardness doesn't exceed the permissible limits in all the seasons.

1.9 Magnesium Hardness: Magnesium as co factor for various enzymatic transformations within the cell especially in the transphosphorylation in algal, fungal and bacterial cell. Mg Hardness content in the drinking water samples ranged from 21 mg/L to 28mg/L. The concentration of Mg Hardness doesn't exceed the permissible limits in all the seasons.

10 Hardness: The major sources of hardness in water are dissolved calcium and magnesium ions from sedimentary rocks whereas minor contribution to the hardness of water is made by ions of aluminium, barium, manganese, iron, zinc etc. The range of total hardness in all the drinking water samples was between 58 mg/L to 80 mg/L. However, all the water samples showed the range of hardness within permissible WHO/BIS (300 mg/L) limits.

11 Bacteriological Parameters:

Microorganisms:-

In drinking water microorganisms can cause sensory defects (odor, color, taste). Microorganisms are an important cause of the corrosion of steel pipes. Various health related problems due to contaminated waters are diarrhea, abdominal cramps and vomiting due to salmonella, cholera is due to vibro cholerae, infection of lungs due to mycobacterium. All the water samples are having E-Coli content between 01 to 07 and Coliform bacteria ranging from 12 to 22 MPN per 100mL which is beyond permissible limit.

Conclusion: - By going through all the river water parameters it is observed that in the month of November some of the parameters are having maximum values. This may be due to a big festival which was held at Alandi every year. At that time, it is visited by thousands of pilgrims.

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