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Industrial Effluents: A Major Threat to India

Ritesh R. Bhat
Assistant Professor, Manipal Institute of Technology, Manipal, India
EMAIL: ritesh.bhat@manipal.edu

Abstract

This review paper concentrates on the impact of industrial effluents on India, supported by CPCB data and other facts. Water is an important element for the survival of any living being. It is one of the element that makes our mother earth unique from all other planets in the universe. The resource has been taken for granted and is being polluted to such a manner that by near future, it is predicted that the country would not have much water fit for drinking and for commercial usage. The facts discussed in this paper would display the need of addressing this issue of industrial effluents.

Key Words:

Industrial effluents, Indian rivers, water pollution, BOD, Toxicity

Introduction

Water is one of the most important element that marks its presence in this planet. The U.S. Geographical Survey has categorized the use of water in eight classes namely commercial, domestic, Industrial, irrigation, livestock, mining, public supply and for power generation (Wayne, Pierce and Howard A). The term industrial effluent is defined as the liquid waste discharged into a river or sea by the industries. This paper deals with the impact of the industrial effluents on the Indian rivers and discuss about the various consequent problems associated with it. India is known for its agriculture & its allied sectors. It is reported that over 70% of the rural homes depends on the agriculture as prime means of livelihood.

Economically speaking this sector accounts for almost one third of the country's GDP and is its single largest contributor (India Brand Equity Foundation). This makes it clear that anything that affects the mentioned sector would directly result in a major downfall of Indian economy. Water being the main element required for this sector, industrial effluents have already initiated the damage to a large extent, which if not addressed now may cause a desperate situation amongst 114 million Indians in the near future (Mashru).

Another fact to be discussed is the impact of industrial effluents on the human life on this earth. The U.S. Geographical Survey estimates that an average person can survive only a week without water (Wayne, Pierce and Howard A). The World Bank has quoted that India is the second largest user of the ground water in world after China. It also has predicted that India only has around 20 years before its aquifers will reach critical conditions. World Health Organization (WHO), with concern to the public health has quoted that 97 million Indian lack access to safe drinking water, while 21% of the country's communicable diseases are transferred by the use of unclean water (Mashru).

The industrial wastes contaminating the water resources are majorly classified into two types – organic and inorganic, of which the former is found to be more problematic.

There are various parameters that could be used to determine the contamination of the selected water sample, of which 3 important ones are:

- **Oxygen demand** is one of the key parameters of effluents which actually means the amount of oxygen required to oxidize the organic material.
- **Biochemical Oxygen Demand (BOD_5)** is the degree of oxygen used by the microbes to oxidize the waste materials and is generally measured for a standardized period of 5 days incubated at 20^oC and expressed in mg/ltr (Dupont, Theodore and Ganesan).
- **pH** is an important chemical property of any aqueous solutions, which indicates the acidity of basicity of the substance (Dupont, Theodore and Ganesan).

Table 1 gives the data regarding the standard water quality criteria as per the Central Pollution Control Board of India.

Table 1 CPCB data of water quality criteria (Source IS2296:1992)

Designated Best Use	Criteria
Drinking Water Source without conventional treatment but after disinfection	1.Total Coliforms Organism MPN/100ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C, 2mg/l or less
Outdoor bathing (Organised)	1.Total Coliforms Organism MPN/100ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C, 3mg/l or less
Drinking water source after conventional treatment and disinfection	1. Total Coliforms Organism MPN/100ml shall be 5000 or less 2. pH between 6 and 9 3. Dissolved Oxygen 4mg/l or more 4.Biochemical Oxygen Demand 5 days 20 °C, 3mg/l or less
Propagation of Wild life and Fisheries	1. pH between 6.5 and 8.5 2. Dissolved Oxygen 4mg/l or more 3. Free Ammonia (as N) 4. Biochemical Oxygen Demand 5 days 20 °C, 2mg/l or less

Table 2 represents the comparison table of BOD of few of the Indian rivers – an evident to the harmful effect of industrial effluents.

Table 2 Comparison of BOD in Indian Rivers (Source: CPCB) and the calculated percentage of increase in BOD levels

River	Biochemical Oxygen Demand (mg/ltr)		Percentage Increase in BOD level per year
	2011	2010	
Umtrew	8.8	8.5	3.41
Bindusar	7.4	7	5.41
Bichia	8.5	8	5.88
Mahananda	6.6	5.5	16.67
Kansi	6.1	4.9	19.67
Brahmani	6.8	5.6	17.65
Chandrabhaga	10.5	9.2	12.38
Koyna	9	7.5	16.67
Kuakhai	6.5	5	23.08
Sonai	6	4.5	25.00
Pennar	6	4.4	26.67
Teesta	6.2	4.4	29.03
Darna	12	10	16.67
Waghur	10	8	20.00

Damodar	7.8	5.8	25.64
Burhidihing	9.8	7.8	20.41
Surya	7	4.4	37.14
Digboi	7	4.3	38.57
Brahmaputra	9.2	6.3	31.52
Kshipra	28	25	10.71
Nakkavagu	18	15	16.67
Vel	14	11	21.43
Karola	6.1	3.1	49.18
Disang	6.3	3.2	49.21
Chuntkol	7	3.8	45.71
Maner	9.5	6	36.84
Sina	12.2	8.4	31.15
Ramganga	12.4	8.6	30.65
Rihand	7.2	2.9	59.72
Dhansiri	6.8	2.4	64.71
Tambiraparani	8	3.1	61.25
Patalganga	16	11	31.25
Tungabhadra	8.2	3	63.41
Krishna	16	10	37.50
Penganga	15	9	40.00
Kadambayar	9.4	3.4	63.83
Vaitarna	10	3.5	65.00
Bhatsa	10	3.4	66.00
Sirsa	15	8	46.67
Tansa	11	4	63.64
Manusmar	10	2.7	73.00
Suswa	38	30	21.05
Harbora	12	3.5	70.83
Kalu	15	4	73.33
Nambul	30.5	19	37.70
Ram Rekha	15	3.5	76.67
Kalinadi (E)	**161**	**146**	**9.32**
Budhabalanga	22	2.2	90.00
Vindyadhari	26.8	6.6	75.37
Betwa	**104**	**78**	**25.00**
Jalangi	28	1.9	93.21
Pedhi	46	16.4	64.35
Thirumanimuthar	83.7	54	35.48
Musi	**145**	**110**	**24.14**
Panchaganga	67.5	28	58.52
Churni	64	3.7	94.22
Sarabanga	85	5.6	93.41
Kali (W)	**369**	**287**	**22.22**
Matha Bhanga	90	5.4	94.00
Wardha	**110**	**25**	**77.27**
Mithi	**175**	**75**	**57.14**
Damanganga	**354**	**32**	**90.96**
Vasista	**340**	**5**	**98.53**
Savitri	**525**	**5.4**	**98.97**

Analysis and Discussion

From the table it could be clearly observed that out of the 64 rivers listed in the table, not even one is meeting the requiring standard value of BOD. From figure 1 and 2 it is clear that the BOD level has increased in one year by a significant amount. In 2010, only 5 percent of the total data represented the rivers having BOD more than 100mg/ltr but just within a year, it has increased to 14%.

It could be also observed that none of the river has a BOD level specified by the CPCB and is hence not fit for usage, especially for drinking and domestic purposes.

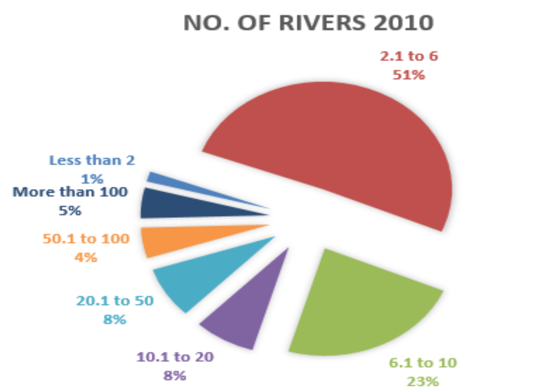

Figure 1 BOD in Indian rivers in 2010

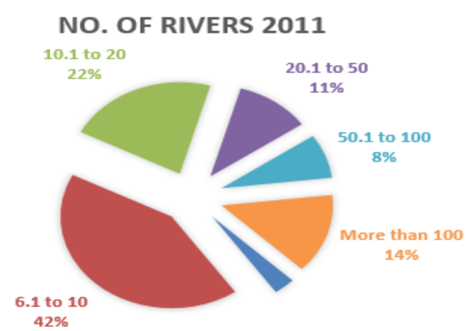

Figure 2 BOD in Indian rivers in 2011

From table 2 it could be observed that 7 out of 64 rivers selected are having a BOD level more than hundred. Water samples from Savitri River of Raigad district (Maharashtra), having a BOD level of 525mg/ltr when tested, inferred that it is polluted by more than 100 chemical plants situated near it, out of which few are releasing the chemical waste to the river without filtering it.

The pollution has resulted in an increasing number of diseases in the area like cancer, paralysis, asthma, etc. in the villages, where the population use the water from the river. Also it has affected the agricultural land in some of the villages surrounding the river (Kap). The chemical parameters as well as range of heavy metals are found to be above normal limits when compared with the WHO standards, which proves that there exists some problem with the functioning & efficacy of installed Common Effluent Treatment Plants (CETP) (Chavan and Jawale).

Vasista River in Attur (Tamil Nadu), which provided water for drinking and irrigation is today breeding ground for mosquitos. The holy river which runs for around 85 Km is smell foul due to dumping of industrial waste and untreated sewage and has a BOD level of 340mg/ltr. People today residing around this river complain of skin ailments and other health complications (Saqaf).

Damanganga River, which originates from Nasik (Maharashtra) and passes through different states is known as one of the most polluted river in India and has a BOD level of 354mg/ltr. Today the river no longer resembles a water body. Dye factories and the pharmaceuticals companies are the major contributors to the contamination of this river. The effluents have already handicapped the fishing work in the area and also has affected other livestock and goats. The contamination is of so high level that it has affected around 71,000 residents living in 12 villages, dependent on this river. CPCB has in fact categorized this river unfit to support life (John).

Generally villages situated at the banks of river are considered to be blessed but that isn't the case with the once situated at the banks of Kali River (Uttar Pradesh). Hepatitis B, infertility amongst people & animals and other fatal diseases are the gifts given by this river today to people residing in around 1200 villages, depending on it. 31 industries including sugar mills, paper mills, textile and distilleries along with slaughter houses emancipating their effluent into the river (Kang and Seth).

From the observing trend of increasing BOD levels and toxicity in most of the Indian rivers as depicted by the figures and tables of this paper, if not taken a suitable action, very soon the prediction of India being a water scarce country may come true.

Proposed Solution

Phyto-reduction process by broadleaf cattail (typha latifolia) and Kans grass (Saccharum spontaneum) could be used to reduce the BOD levels of the water by atleast 50% (Suhendrayatna, Marwan and Andriani).

Experiments have proved that since the effluents majorly comprises of non-biodegradable load the conventional biological treatment must be replaced with physic-chemical processes like advanced oxidation process. Fenton treatment of wastewater at optimized pH, H_2O_2 and $FeSO_4$ dosing can reduce the BOD by at least 68% (Lalwani and Devadasan). New biological treatments like sequential anaerobic-aerobic digestion if implemented in the effluent treatment process could help in reducing the toxicity being spread in the water (Murray).

Most of the effluent treatment methods are expensive or if not then they end up to be ineffective especially in the case of chemical toxins released by dye industries and hence the best option is to involve several steps like biosorption using locally available agricultural waste followed by biological treatment by making use of microbes like bacteria and Fungi (Ratna and Padhi).

Conclusion. This paper clearly depicts that the effluents are slowly and in some special cases rapidly contaminating the Indian rivers. From all the observation it could be inferred that its high time now to address this threat for which the conventional methods of effluent treatment must be replaced with either the newer efficient methods or the same methods must be used in a combined and efficient fashion. If ignored India would soon be a water scarce country and then line from the rhime of Ancient Mariner "water water everywhere not a drop to drink" would come true.

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