

# Manifestation of Pharmaceuticals and Personal Care Products (PPCPs) and studies of Physico-chemical parameters of Morna River, Akola

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## ABSTRACT

Rivers are not only most crucial natural habitat for variety of living things but also serve as life line for humans and other terrestrial animals. River water is used for a variety of purposes by humans including for drinking purposes. Cultural activities like river dumping lead to change in various parameters of water bodies. After detailed survey and analysis of Morna river in and around Akola city, total 20 sampling sites were identified for investigation of presence of PPCPs and physiochemical parameters. All samples were processed for pH, Temperature, suspended solids, Sulphates, Nitrates, Total Hardness, Dissolved oxygen, biochemical oxygen demand and PPCPs like Parabens, caffeine and sodium lauryl sulphate. pH of all samples was alkaline and was in the range of 7.20- 8.23, high amount of organic matter and river dumping resulted DO in the range of 1.62-5.28 mg/l while highest BOD value was found to be 61.5 mg/l. Sulphates and nitrates were present in the range of 78.09 -218.60 mg/l and 0.11-1.42 mg/l. Highest number of suspended solids reported was 110 mg/l, total hardness was reported in range of 100-296 mg/l. Around 75% of water samples were positive of Parabens and 85% were positive for caffeine while 100% studied samples were positive of Sodium Lauryl sulphate (SLS). River dumping and untreated sewage discharge lead to affect parameters of water body even presence of PPCPs is serious threat to aquatic habitat and mankind.

*Key words : Morna Rivers, River dumping, PPCPs, Physico-chemical Parameters*

## Introduction

Water is vital resource required by living organisms. It is a most essential basic component to all living being as most of the bio- chemical reactions that take place through the metabolism and growth of living organisms involve water. Without water no life is possible to sustain on this planet earth hence it is termed as 'Natural liquid Gold'. (Smitha *et al.*, 2013). It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested for different physicochemical parameters. Selection of parameters for testing of water is solely depends upon

for what purpose we going to use that water and what extent we need its quality and purity. Water does content different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Some physical test should be performed for testing of its physical appearance such as temperature, color, odor, pH, turbidity, TDS etc, while chemical tests should be performed for its dissolved oxygen, alkalinity, hardness and other characters. for obtaining more and more quality and purity water (Patil *et al.*, 2012).

One such water body is the Morna River from Akola. The watershed of Morna lies mostly in the eastern Vidarbha region of Maharashtra state. The

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Morna River basin which is a tributary of the Purna River lies towards the northern and southern parts of the Akola district, and parts of the Washim district, covering an area of 941.39 sq. km. Morna is the main water source of the Akola district. It rises in the southern Barshitakli tehsil Maharashtra state, and flows northward, draining Maharashtra's Vidarbha region before merging with the Purna River. Akola is one of the districts of the Maharashtra state of India, situated at the Northern border; between the meridians of longitudes 76° 51' and 77° 44' East and between the parallels of latitudes 19° 51' and 20° 17' North. Its maximum length from North to South is about 145 km. Its total area is about 10,606 sq. km. There is a considerable variation in the topography, geology, and climate. In the vast fertile plain of the Morna River, the soil over the entire trap area varies from light reddish sandy loams on the ridges and black cotton soil. (Rothe, 2018).

The existence of pharmaceuticals and personal care products (PPCPs) in the water environment is an emerging problem. Pharmaceuticals are defined as prescription, over the counter and veterinary therapeutic drugs used to prevent or treat human and animal diseases, while personal care products (PCPs) are used mainly to improve the quality of daily life. PPCPs are a unique group of emerging environmental contaminants, due to their inherent ability to induce physiological effects in human at low doses (Ebele *et al.*, 2017). A number of pharmaceuticals have been detected in the environment. PPCP include prescription and non-prescription human drugs, illegal drugs, and veterinary drugs, as well as their subsequent metabolites and conjugates, including antibiotics, hormones, anticonvulsants, antidepressants, lipid regulators, antihypertensive, and non-steroidal anti-inflammatory drugs. The global consumption of PPCPs is increasing constantly due to advances in technology, unprecedented population growth, and increasing access to healthcare and medicines. PPCPs can be released from different sources, such as various point sources (industrial effluent, municipal wastewater treatment plants (WWTPs) and waste disposal sites, etc.) and non-point sources (agricultural runoff from bio solids and manure sources, storm water and urban runoff, etc.). Little information exists on the occurrence and the ultimate fate of pharmaceuticals in the water bodies in India despite being one of the world leaders in pharmaceutical production and consump-

tion (Balakrishna *et al.*, 2017).

## Materials and Methods

Present study was conducted on water of Morna River in and around Akola city of Maharashtra, India. Experimental work was carried in between December 2022 to April 2023. Water sample were collected from 20 different sites of Morna river, labelled and immediately transported to laboratory for further investigation. Water parameter like pH, temperature, turbidity was analyzed at sampling site itself while other physiochemical parameters like suspended solids, Sulphates, Nitrates, Total Hardness, Dissolved oxygen, biological oxygen demand were performed in Laboratory by following standard tests. Each test performed was reconfirmed and validated. Qualitative analysis of water samples for manifestation PPCPs like Parabens, caffeine and Sodium Lauryl sulphate (SLS) was done. Paraben detection from water sample was done using Ferric chloride and ethanol, dark purple coloration indicated positive test. Caffeine detection was done by Murexide test using potassium chlorate and hydrochloric acid. Presence of SLS was indicated by excess foam formation at sampling site and confirmed by 0.1 ml of a 0.1% w/v solution of methylene blue and 2 ml of 1M sulphuric acid, in which 2 ml of dichloromethane was added and shaken well, the dichloromethane layer is intensely blue indicate presence of Sodium Lauryl sulphate. All the data tabulated, analyzed and interpreted to determine extent of pollution river water.

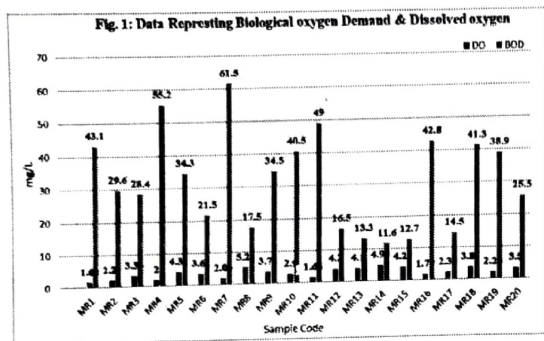
## Results and Discussion

In the present study, total twenty water samples were collected from different sites of Morna River. Estimating the water quality is very essential as water is the sole of life. On the basis of quantitative evaluation of water with the aid of usage of different physiochemical and qualitative evaluation by PPCPs detection of water had been completed. The physiochemical features of Morna River are prompted due to the discharge of domestic waste, agricultural wastes. The whole study was conducted in the Department of Microbiology of Shri R.L.T. College of Science Akola.

Extent of water pollution caused by river dumping was studied by knowing Dissolved oxygen and biological oxygen Demand. All the studied samples

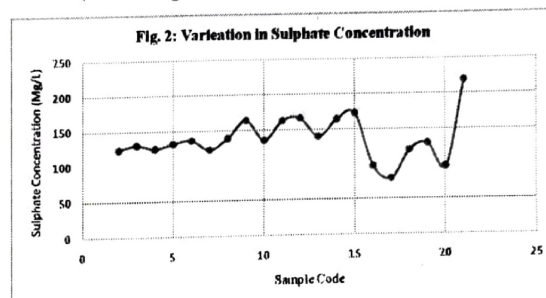


have shown presence of oxygen in limiting amount and high need of oxygen for decomposition organic matter present in river. Data indicates high amount of organic matter present in water body.



As indicated in figure all 20 water samples have DO in range of 1.62 mg/l to 5.28 mg/l Which much lower than BIS standards ( $\geq 5$  mg/l) given by Government of India for any waterbody which is alarming situation for aquatic life and humans as well. While Biological oxygen demand was reported too high due to presence on organic matter and mixing of untreated sewage water in river. Highest value of BOD was reported as 61.5 mg/l which is far above BIS standards ( $\leq 3.0$  mg/l). This makes river water unfit for bathing and other purposes and pose serious threat to normal flora & fauna of river.

Sulphate ( $\text{SO}_4^{2-}$ ) concentrations in freshwaters have increased globally over the last few years this increase in shocking as globally there is reduction in atmospheric sulphur (S) deposition has occurred. Though, the extent and effects of increased  $\text{SO}_4^{2-}$  concentrations in freshwater and terrestrial ecosystems is not properly understood yet. In present study highest amount of Sulphates reported was 218.60 mg/l which is within limit as per BIS Standards ( $\leq 400$  mg/l).



Nitrates are a form of nitrogen, which is found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia ( $\text{NH}_3$ ), nitrates ( $\text{NO}_3$ ), and nitrites ( $\text{NO}_2$ ). Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems. In present study reported Nitrates to be present within

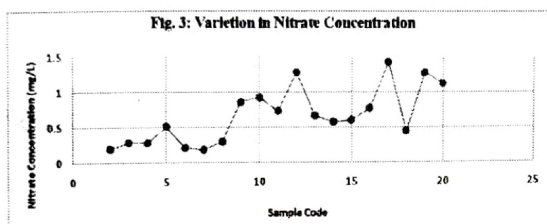
Table 1. Data of Suspended solids and Total Hardness & PPCPs in Morna River water

| Sample Code | pH   | Suspended Solids | Hardness | Parabens | Caffeine | SLS |
|-------------|------|------------------|----------|----------|----------|-----|
| MR1         | 8.21 | 44               | 140      | +        | +        | +   |
| MR2         | 8.23 | 58               | 104      | +        | +        | +   |
| MR3         | 8.11 | 39               | 110      | -        | -        | +   |
| MR4         | 8.03 | 39               | 100      | +        | +        | +   |
| MR5         | 8.06 | 69               | 156      | +        | +        | +   |
| MR6         | 8.11 | 41               | 158      | +        | +        | +   |
| MR7         | 8.04 | 95               | 150      | -        | +        | +   |
| MR8         | 7.81 | 47               | 296      | +        | +        | +   |
| MR9         | 7.71 | 33               | 146      | +        | +        | +   |
| MR10        | 7.69 | 38               | 148      | +        | +        | +   |
| MR11        | 7.63 | 43               | 180      | +        | -        | +   |
| MR12        | 7.73 | 39               | 140      | +        | +        | +   |
| MR13        | 7.9  | 27               | 180      | -        | +        | +   |
| MR14        | 7.61 | 31               | 210      | +        | +        | +   |
| MR15        | 7.63 | 34               | 200      | +        | +        | +   |
| MR16        | 7.61 | 110              | 244      | -        | +        | +   |
| MR17        | 7.53 | 43               | 140      | +        | +        | +   |
| MR18        | 7.22 | 38               | 152      | +        | -        | +   |
| MR19        | 7.59 | 44               | 160      | -        | +        | +   |
| MR20        | 7.54 | 29               | 123      | +        | +        | +   |

Where (+) is Present, (-) is Absent, All values except pH expressed as mg/l.

safer limits, highest reported Nitrate concentration was 1.42 mg/l. As there is no agricultural land around sampling site, direct mixing of agriculture run off water is not possible which kept Nitrates in river in safer limits.

All samples were found to have slightly alkaline pH and suspended solids in the range of 29 mg/l to 110 mg/l and Hardness in the range of 100-296 mg/l which is within desired limits.



Several studies of occurrence of PPCP compounds in freshwater resources as well as wastewater treatment plants are being reported. Till date no reports are published on occurrence PPCPs like Parabens, Caffeine and Sodium Lauryl Sulphate in Morna River. Detrimental effects of these PPCPs are already established and its impact on environment is of high concern. In qualitative estimation all water (100%) samples have shown presence of SLS which indicates discharge of detergents and Personal Care Products in River through sewage water. Similarly, 85% water sample reported caffeine in it which is indicative on kitchen waste being directly dumped in water. While 75% samples have shown presence of Parabens. Parabens are man-made chemicals used as preservatives in cosmetics, pharmaceuticals, foods, and beverages. They are generally found in makeup, moisturizers, hair-care products, and shaving creams, it can enter the body when pharmaceuticals, foods, and drinks containing parabens are swallowed or eaten. Parabens that enter the body are quickly excreted. Occurrence of it in water bodies clearly indicates river dumping and its presence in river affect its flora and fauna

Presence of PPCPs in river water in serious but

less discussed threat to health of humans and aquatic life. Due to the increased consumption of these PPCP compounds in day-to-day life, environmental risk on living organisms, including humans and animals, is increasing a lot. These compounds have been developed for making our life comfortable, so the products containing these compounds should be used in minimal quantity in a proper way. The waste containing these compounds (industrial, domestic, sewage effluents etc.) should be treated properly at point source so that environment is not negatively affected. There is need to understand the status of distribution of these compounds and other hazardous chemicals in various water resources.

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**Conflict of interest:** This work or part of it is not published anywhere else, there is no conflict of interest with any person or institute.

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