

**INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH  
TECHNOLOGY****PHYSICO-CHEMICAL AND MICROBIAL ANALYSIS OF WATER AND SOIL  
SAMPLES IN PROPOSED COAL MINE AREA AT VIDHARBHA REGION,  
MAHARASHTRA, INDIA****S.R. Kondulkar\*, M.P. Barde, N. D. Kumre, A.K. Wanjari, U.E. Chaudhari**

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**ABSTRACT**

The present paper deals with the Physicochemical and Microbial analysis of soil and water samples collected from open cast coal mine, Shivaji nagar coal mining, wardha River, singada talav, area under the vidharbha region from Maharashtra state. Samples were collected in January 2016. Studies were carried out to check the quality of water; whether it is safe for drinking purpose or not by the comparative physicochemical and microbial analysis of water samples using standard methods. We also check the type of soil found there along with its physicochemical properties and characterise the different bacteria found in soil.

**KEYWORDS:** Physico-chemical analysis, Microbial analysis, vidharbha region, water analysis, soil analysis.**INTRODUCTION**

Soil is comprised of minerals, soil organic matter (SOM), water, and air. The composition and proportion of these components greatly influence soil physical properties like including structure, and porosity. These properties influence air and water movements in soil, and thus the ability of soil to function. Water is the one of the essential source of life on earth. It also performs unique and indispensable activities in earth ecosystem, biosphere and biogeochemical cycles<sup>1-2</sup>. Thus, high quality water is always a necessity for living organisms. Faecal pollution of drinking water causes water born disease which has led to the death of millions of people<sup>3-5</sup>. Ideally, drinking water should not contain any microorganisms known to be pathogenic or any bacteria indicative of faecal pollution. Probably the most important pathogenic bacteria transmitted by the water route are Salmonella typhi, the organism causing typhoid fever, and Vibrio cholerae, the organism causing cholera. Soil microorganisms also influence above-ground ecosystems by contributing to plant nutrition, plant health, soil structure, and soil fertility. The Climate of the area is characterised by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The temperature rises rapidly after February till May, which is the hottest month of the year. The mean daily maximum temperature during May is 42.8°C and the mean daily minimum temperature during December is 18.2°C.

**MATERIALS AND METHODS**

These samples were collected in the month of January 2016. All the chemicals used were AR grade of pure quality. Double distilled water was used for the preparation of all the reagents and solutions. Glasswares were cleaned with commercial HCl followed by distilled water. The physico-chemical parameters such as pH, Conductivity, DO, TDS, TSS and COD were determined using standard method<sup>4-5</sup>. Methods used for estimation of various parameters are shown in Table 1. All the results are depicted in table 2-6.

**Collection of sample:** Samples were collected from open cast coal mine, Shivaji nagar coal mining, Wardha River, singada talav of yawatmal district from different location shown in figure 3-6. For water sampling the method followed is as per the protocol described by Indian standard IS:3025 Part-I. For soil sampling the method followed is as per the

protocol described by Indian standard IS:2720 Part-I . Soil samples were collected (approx. 100g) in clean, dry and sterile polythene bags using sterilized spatula and water sample were collected in 50ml sterilized falcon tubes, reducing the chances of contamination as far as possible, and were carried to the laboratory and stored in refrigerator for further analysis.



Fig.1. Map of Maharashtra

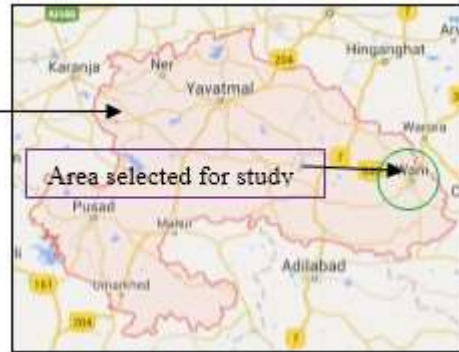


Fig.2. Map of Yavatmal District



Fig.3. Satellite view of wardha river



Fig.4. Satellite view of singada talav



Fig.5. Satellite view of opencast coal mine



Fig.6. Satellite view of Shivajinagar coal mine

Table 1: Methods Used For Estimation of Various Parameters

Sr. No.	Parameters	Method
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1	pH	pH Metrically
2	Electrical Conductance ( $\mu\text{S}$ )	Conductometrically
3	COD	Titration Method
4	DO	Winkler Method
5	TDS	Gravimetrically

## RESULTS AND DISCUSSION

**pH :** pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. pH of soil sample was found to be in the range 6.54 to 6.90 and for water 7.16 to 7.49.

**Electrical Conductance ( $\mu\text{S}$ ):** The determination of EC and TDS were carried out to know the extent of mineralisation of ground water in the study area. The EC value of collected water samples i.e. wardha river is  $1.86 \times 10^{-3} \mu\text{S}$  at  $25^\circ\text{C}$  with TDS 79 mg/ml, Singada talav is  $1.81 \times 10^{-3} \mu\text{S}$  at  $25^\circ\text{C}$  with TDS 34 mg/ml, opencast coal mine is  $1.89 \times 10^{-3} \mu\text{S}$  at  $25^\circ\text{C}$  with TDS 56 mg/ml, Shivajinagar coal mine is  $1.91 \times 10^{-3} \mu\text{S}$  at  $25^\circ\text{C}$  with TDS 47 mg/ml.

**Dissolve Oxygen:** If it is found that the water is too much warm then there is a deficiency of oxygen in it. When there are too many bacteria or aquatic animal in the area, they may overpopulate, using DO in great amounts. The DO value of collected water samples i.e. wardha river is 8.67 mg/l, Singada talav is 7.48 mg/ml, opencast coal mine is 8.45 mg/ml, Shivajinagar coal mine is 9.56 mg/ml.

**COD:** It is the major of oxygen consumed during the oxidation of oxydisable organic matter present in the water. The COD value of collected water samples i.e. wardha river is 218 ppm, Singada talav is 190 ppm, opencast coal mine is 201 ppm, Shivajinagar coal mine is 167 ppm.

*Table 2. Different physico-chemical parameter of soil*

Location	pH	% of Organic matter	% of $\text{CaCO}_3$	% of Moisture content
Wardha River	6.54	1.4123	16.89	12.78
Singada Talav	6.66	0.5470	18.54	14.21
Opencast coal mine	6.90	0.3754	20.78	8.45
Shivajinagar coal mine	6.67	1.2632	20.23	9.56

*Table 3. Different Physico-chemical parameter of water*

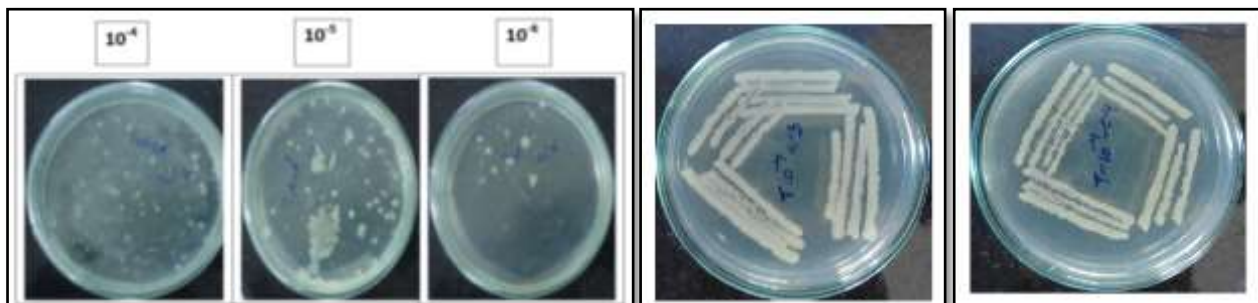
Location	pH	TDS (mg/ml)	TSS (mg/ml)	Dissolved oxygen (mg/ml)	Electrical Conductance ( $\mu\text{S}$ )	COD
Wardha River	7.49	79	387	8.67	$1.86 \times 10^{-3}$	218
Singada Talav	7.21	34	261	7.48	$1.81 \times 10^{-3}$	190
Opencast coal mine	7.43	56	289	8.45	$1.89 \times 10^{-3}$	201
Shivajinagar coal mine	7.16	47	322	9.56	$1.91 \times 10^{-3}$	167

*Table 4. Total bacteria count.*

Location	Dilution	Number colonies	of	Inoculums size	CFU/ml
Wardha River	$10^{-4}$	70		0.1	$70 \times 10^{-4}$
Singada Talav	$10^{-5}$	38		0.1	$38 \times 10^{-5}$

Opencast coal mine	$10^{-6}$	28	0.1	$28 \times 10^{-6}$
Shivajinagar coal mine	$10^{-7}$	21	0.1	$21 \times 10^{-7}$

**Fig. 7. Bacterial enumeration Pure culture isolated by streak plate method.**



**Table 5: Results of Different Biochemical Test**

Sr. No	List of Biochemical Test	Result
1	Gram Staining	Negative
2	Shape	Uniformly Bacilli
3	Catalase Test	Positive
4	Methyl red Test	Negative
5	Urease Test	Positive
6	Citrate Test	Positive
7	Indole Test	Negative
8	Oxidase Test	Negative

**Table 6: Comparision Between Enterobacter spp. And Unknown Bacteria isolated**

Sr. No	List Of Biochemical Test	<i>Enterobacter spp</i>	Result
1	Gram Staining	Negative	Negative
2	Shape	Uniformly Bacilli	Uniformly Bacilli
3	Catalase Test	Positive	Positive
4	Methyl Red Test	Negative	Negative
5	Urease Test	Positive	Positive
6	Citrate Test	Positive	Positive
7	Indole Test	Negative	Negative
8	Oxidase Test	Negative	Negative

## CONCLUSION

Physicochemical properties of water and soil samples collected from open cast coal mine, Shivaji nagar coal mining, Wardha River, singada talav of yawatmal district have been presented. All the parameters for each soil sample and water samples are within the permissible range. The soil pH is slightly acidic or slightly alkaline which preferable for the agricultural view. The water pH is also within the range of 6.5 to 7.5 which indicates that it can be used as drinking water. The soil was found to be sand type and black in colour. The microbial studies can be utilized for the prevention of any pathogenic diseases caused by the microbes found in soil and water. Regular check up of the aquatic life can help in maintaining ecological balance. The analysis of soil texture can be helpful for the farmers in their irrigation and vegetation purpose.

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