MINOR RESEARCH P*ROJECT REPORT

SUBMITTED TO THE

UNIVERSITY GRANTS COMMISSION, (WRO),

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MINOR RESEARCH PROJECT ENTITLED

"Study of Phenol contamination in Savitri River Water from Mahad industrial area in Raigad District (M.S.) using Spectrophotometric determination of phenol in Micellar medium method."

SUBMITTED BY

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EXECUTIVE SUMMARY OF THE MINOR RESEARCH PROJECT REPORT

Brief Introduction

Phenols are defined as hydroxyl derivatives of benzene, and its condensed nuclei occur in domestic and industrial wastewaters, natural wastes and potable water supplies. Odoriferous and objectionable tasting chloro phenols are formed as a result of chlorination of water containing phenols. Phenols are toxic substances, widely used in the manufacture of synthetic phenolic resins, dyes, plastics, lamp black paints, air fresheners, paper soaps, paint removers etc. It is introduced into the environment through industrial discharges from coke oven plants, petroleum refineries, drug manufacturing units, antioxidants and dye industries. Phenols may be present in raw water owing to the discharge of wastewaters from coke distillation plants, the petrochemical industry and numerous other industries where phenols serve as intermediates. They are also present in municipal waste water. Presence of phenols may lead to objectionable taste in chlorinated drinking water and hence its monitoring is essential.

Phenol as priority pollutant and set a discharge limit of 0.1 mg/l of phenol in waste waters. As per Indian Standards for disposal of treated effluents (IS: 2490 Part A), the permissible limit of phenol for the discharge of effluent into inland surface water is 1.0 mg/l and in public sewer and marine disposal it is 5 mg/L. The effect of phenol on the aquatic life is destructive at low concentrations; for fishes 5-25 mg/L is lethal depending on the temperature and state of maturity.

River is the major source of water supply for domestic as well as agriculture purpose, the toxic phenol if present will definitely enter in human food chain via

consumption of different flora ,fauna and water itself. The River Savitri is an important river flowing through Ratnagiri & Raigad Districts of Maharashtra State & is a major source of water for domestic, agricultural & industrial usage, the Industrial establishment in Raigad has been accelerated since 1970 due to prohibition of Industrial establishment in the nearby Mumbai metropolitans.

The water from this river is supplied to industrial area & some of the villages. Majority of industrial units are Chemical factories. Altogether there are about 27 industries almost all these industries release effluents in the savitri river

In present work an attempt has been made to determine phenol contamination in Savitri river water from Mahad industrial area spectrophotometrically.

During the study along with phenols other water quality parameters such as Temperature, pH, Electrical Conductance ,Dissolved Oxygen (D.O.),Biochemical Oxygen Demand (B.O.D.), Free Carbon dioxide (free CO_2),Total Hardness(T.H.) ,Chlorides, Alkalinity, Acidity have been determined of 11 sites, upstream and downstream of Savitri river.

Research Methodology

Duration of Research: Duration was of two years.

Jurisdiction of research: The research jurisdiction selected was Savitri river flowing near Mahad MIDC area in Raigad District.

Research Problem: River Savitri is flowing from Mahad MIDC area, water coming from different industries may pollute the river water. The researcher decided to know is their any contamination by toxic phenolic compounds.

Sampling Sites: 11 Different sampling sites were selected.

Materials and Methods

Apparatus: Spectrophotometer was used for spectral measurements. PH meter was used for pH measurements. All chemicals used were of analytical reagent grade and double distilled water was used for dilution.

Reagents: ***Phenol Stock*** **:** 1 mg mL-1 stock solution of phenol is prepared in 5% ethanolic solution. Working standards were prepared by the appropriate dilution of the stock.

Leucocrystal violet (LCV) [Eastman Kodak Co.]: 250 mg of Leucocrystal Violet (4,4',4'' methyldynetris (N, N'-Dimethylaniline) was dissolved in 200 mL of distilled water containing 3 mL 85% phosphoric acid (Merck) and the volume was made upto 1 litre with distilled water and was stored in amber coloured bottle away from sunlight.

N- Bromophthalimide (NBP) [Loba chemie]**:** 0.04 g NBP was dissolved in 8 mL acetic acid and the volume was made up to 25mL with double distilled water and was stored in amber coloured bottle.

0.5% Sodium hydroxide: 2 g sodium hydroxide in 100 mL distilled water.

Buffer solution: Buffer solution of pH 4 ±0.1 was prepared by dissolving 17.01 g potassium hydrogen phosphate in 490 mL water followed by drop wise addition of 85% phosphoric acid until the pH becomes 4 ±0.1 and volume was made up to the mark in 500 mL standard flask.

Waste water samples were collected from the Savitri River including Mahad MIDC area. They were filtered through Whatman No. 42 and stored in glass bottles .Then the samples were ready for analysis .Water samples were collected in triplicate after every two months for one year.

Procedure

Standard solution containing 0.5 – 7.0 µg of phenol were prepared, 1mL of NBP was added and warmed slightly. After 2 minutes, 1mL of buffer was added and stirred gently. To this 1 mL of LCV followed by 0.5 mL of 0.5% NaOH and 1mL of CTAB was added and mixed. The solution was diluted up to 25 mL and kept at 300C for full colour development. An intense violet colour dye having maximum absorption at 595 nm was obtained at ~ 4pH.The calibration curve was plotted absorbance against concentration in micrograms (µg/l).Same procedure was followed for samples of water and concentration of phenol in samples were calculated from calibration curve.

Objectives of the Research:

The research work was carried out, keeping in mind the following objectives.

- To investigate the level of toxic phenol and other physicochemical parameters in river savitri
- To investigate the possible source and causes of phenol contamination in Savitri river near Mahad MIDC Area
- To study if these effects can be attributed to the change in the chemical composition of the river water.
- To study the possible route of transmission of phenol to human through food chain by collecting information about the health status of people residing in the nearby villages on the bank of savitri river.
- Also to extend the applicability of the proposed method in solving the pollution problems created created by toxic phenol.

Findings

As per Indian Standards for disposal of treated effluents (IS: 2490 Part A), the permissible limit of phenol for the discharge of effluent into inland surface water is 1.0 mg/l and in public sewer and marine disposal it is 5 mg/L and for drinking water it is 0.001 to 0.002 mg/L

When we observe the phenol contamination of both years (2014 and 2015) the level of phenols detected in all months (except in May and few samples of March) are within the permissible limit recommended by Indian Standards for disposal of treated effluents (IS: 2490 Part A) and BIS specification for drinking water . It is observed that the levels of phenol fluctuate throughout the year depending on the month of sampling or the condition of the river.

During the Monsoon season i.e. July & September, the physico-chemical parameters as well as range of phenol contamination was slightly above normal limits when compared with ISI standards. The analytical study shows that the presence of physico-chemical parameters and phenol contamination was more in the month of September and further decreasing in the month of November & again there is increase in July.

Conclusion:

The higher values were normally observed when the river flow was significantly low i.e. during the dry spell from March to May. From July to January the level of phenol is significantly lower, with the average lowest values detected for September 2014 is 0.28 µg /L and for September 2015 it is 0.30 µg /L. This can be attributed to a dilution effect and perhaps also to microbial degradation. However, the average concentration in all months (except in May and few samples of March) are within the permissible limit recommended by Indian Standards for disposal of treated effluents (IS: 2490 Part A) and

BIS specification for drinking water. In the month May of 2014 and 2015 the highest values of phenol are observed for sample number 10.The values are 3.32 µg /L and 3.36 µg /L respectively. This is may be due to samples from the location nearer to the MIDC effluent outlet.

From the findings of other physico-chemical parameters and phenolic compounds during the present study it may observed that the untreated industrial effluents are released directly in the River water or even after treatment of industrial effluents at Common Effluent Treatment Plant CETP, there exists elevated range of phenolic compounds in river water. This may suggests that there are some minor problems with the functioning and efficacy of CETP.

Contribution to the Society:

The information from present study will definitely help to form the basis and foundation of future work. There is considerable scope for further studies to achieve final goal of qualitative and quantitative evaluation of the existence of pollution created by phenol. This study will help for planning of management and maintenance of effluents treatment methods. Once the tolerance

Limit of effluents is maintained, there is less chance of contamination of phenol and other hazardous pollutants in flora and fauna. More over the study will definitely forms the basis for further impact assessments and management of pollution at study area as well as other industrial areas.

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Spectrophotometric determination of phenol contamination in Savitri river water from Mahad industrial area in Raigad District (M.S)

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Abstract

Phenols are toxic in nature .In present study the phenol contamination in Savitri river water near Mahad MIDC area has been determined using calibration curve method spectrophotometrically.For that samples were collected from eleven different sites and analyzed. The results of all water samples show that observed phenol contamination is near about permissible limit. Through out the year this water can be used for domestic as well as irrigation purpose except few places in summer season.

Keywords: Spectrophotometry, Phenol, calibration, Savitri River, permissible limit.

Introduction

Phenolic compounds are toxic, widely used in the manufacture of synthetic phenolic resins, dyes, plastics, lamp black paints, air fresheners, paper soaps, paint removers etc. It is introduced into the environment through industrial discharges from coke oven plants, petroleum refineries, drug manufacturing units ,antioxidants and dye industries. Phenol as priority pollutant and set a discharge limit of 0.1 mg/l of phenol in wastewaters. As per Indian Standards for disposal of treated effluents (IS: 2490 Part A), the permissible limit of phenol for the discharge of effluent into inland surface water is 1.0 mg/l and in public sewer and marine disposal it is 5 mg/L. The effect of phenol on the aquatic life is destructive at low concentrations; for fishes 5-25 mg/L is lethal depending on the temperature and state of maturity.

River is the major source of water supply for domestic as well as agriculture purpose, the toxic phenol if present will definitely enter in human food chain via consumption of different flora ,fauna and water itself.

In present work an attempt has been made to determine phenol contamination in Savitri river water from Mahad industrial area spectrophotometrically.

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concentration in micrograms (µg/l).Same procedure was followed for samples of water and concentration of phenol in samples were calculated from calibration curve.

Result and Discussion

Observation Table No.1

Absorbance	Concentration of Phenol in µg /mL
0.07	0.5
0.14	1
0.21	1.5
0.28	2
0.35	2.5
0.42	3
0.49	3.5
0.56	4
0.63	4.5
0.7	5
0.77	5.5
0.84	6
0.91	6.5
0.98	7

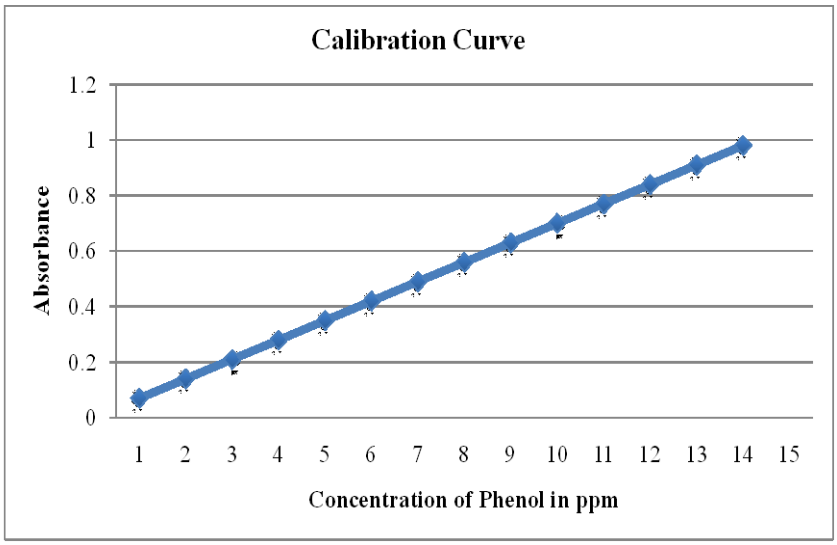

Table and Graph showing Calibration Curve of Absorbance Vs. Concentration of phenol in ppm (µg/l)

Observation Table No.2

Month	Concentration of phenol in µg/l.					
Sample No.	January	March	May	July	September	November
1.	0.47	2.05	2.89	0.35	0.41	0.51
2.	0.58	1.02	2.05	0.47	0.36	0.31
3.	0.67	1.22	1.55	0.26	0.15	0.35
4.	0.83	1.05	2.18	0.48	0.18	0.44
5.	0.49	1.95	2.03	0.32	0.19	0.61
6.	0.89	0.78	2.78	0.50	0.28	0.65
7.	0.44	0.97	2.44	0.13	0.37	0.58
8.	0.90	1.12	3.09	0.29	0.40	0.77
9.	0.75	1.14	1.89	0.22	0.34	0.64
10.	0.59	0.79	3.32	0.33	0.31	0.47
11.	0.60	1.33	2.27	0.51	0.11	0.51

The phenol concentrations in river water samples analyzed by spectrophotometric method. The values are given in Observation Table No. 2. Shows phenol concentration in micrograms per liter (µg/l) after every two months for one year.

Conclusion

In rainy season the concentration of phenol in water samples were found under permissible limit (1 to 2 µg/l) given by *Bureau of Indian Standard* for drinking water. But in summer season it is up to or more than the permissible limit for drinking purpose. If other alternatives are not available the people can use water containing phenol up to 2µg/l. But this water can be used for other purposes such as irrigation and marine aquatic life through out the year. (Central *Pollution Control Board, Pollution Control Acts, Rules, and Notifications issued there under. Fourth edition pp. 358-359. New Delhi, CPCB, Ministry of Environment and Forests. 897 pp)*

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