

Bioremedial measures for parameters of Pharmaceutical outlets At Jigini, Hoskote Industrial area

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Abstract- Environmental pollution remains a serious issue in the developing world, affecting the lives of billions of people, reducing their life expectancy and damaging children's growth and development. The discharge of effluents from pharmaceutical industries into the environment could easily lead to contamination of surface and groundwater with diverse drug active ingredients, the long effect of which may be detrimental to the health of those that use the water. Out of various pharmaceutical industries in India, the study area chosen is Hoskote. A sample of surface water around the industries at various points is collected and a composite sample is prepared. Analysis of water was done for pharmaceutical parameters like phenol, phosphate, chromium, BOD, COD, p^H, Total Solids, Coliforms and Sulphides. The result is then compared with BIS standards. Ground water quality for pharmaceutical parameters were within the permissible and surface water samples in Hoskote industrial area and its environs have phosphate beyond the permissible limit as prescribed by Indian Standards. The mathematical model precisely shows the variation of BOD and phosphate with respect to time. Suitable biotechnical remedied are followed to remove Phosphate from pharmaceutical effluents. The parameters above the maximum permissible limits such as Phosphate was removed up to 90% using Cyanobacteria within 15 days.

Keywords – Pharmaceutical Parameters, Mathamatical Model, Ground Water, Bioremediation, Ground water.

I. INTRODUCTION

Industry is the production of goods or related services within an economy. The major source of revenue of a group or company is the indicator of its relevant industry. Pharmaceutical waste is one of the major complex and toxic industrial wastes. The pharmaceutical industry employs various processes and a wide variety of raw materials to produce an array of final products needed to fulfill national demands. Generation of wastewater in industrial processes is sometimes unavoidable and in most of the cases a process to reduce the organic load. To remove part of the organic load, biological processes are usually used, because they are more economic than chemical processes. Many researchers have tried to find out

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different treatments for pharmaceutical wastewater to approaches worldwide; here an attempt is made to review some such researches done, with particular reference to Pharmaceutical wastewater effluent, in India and abroad also.

Pharmaceutical industry represents a range of industries with operation and processes as diverse as its product. Hence effluents coming from pharmacy industries vary from industry to industry. Thus it is almost impossible to describe a typical pharmaceutical effluent because of such diversity. Waste water is generally evaluated in terms of temp, pH, Total suspended solid (TSS), BOD, COD, Oil & grease, chlorides and sulphates. Various treatment methods for wastewater found in the literature have contributed greatly to our knowledge regarding the fate of these compounds in different treatment systems.

Generalizing compound behavior in these systems would allow further characterization of the fate and risk associated with water in the environment, yet this description of trends is hindered by the wide variation in removal efficiencies across therapeutic classes, treatment processes, and even among separate studies for the same individual compounds. The majority of studies summarized used “removal” to describe the elimination of parent pharmaceuticals. The disappearance of the parent compound cannot be considered synonymous with complete removal. If adequate controls for physical and chemical removal mechanisms are in place, the loss of the parent compound indicates biotransformation of an unknown degree and not necessarily mineralization. Only monitoring for metabolites or end products of mineralization can provide information about the degree of biotransformation. The wastewaters from pharmaceutical manufacturing plants is more problematic due to number of different treatment method. Effluent Treatment Plants (ETP) are used by companies in the pharmaceutical industry to purify wastewater and remove pollutant from it. These plants are used by all companies for environment protection.

II. OBJECTIVE OF THE STUDY

- To check the status of the Jigini, Hoskote Industrial area.
- Assessment of Ground and surface water quality for parameters of Pharmaceutical outlets such as pH, BOD, COD, phosphate, sulphate. Chromium, E-Coli etc.
- Analysis of data and to develop a regression model to study the effects of different components and to predict the future behavior of the parameters.
- Suggesting suitable Bioremedial measures for specific pollutants.

III. REVIEW OF LITERATURE

[1] **Karl J. Ottmar (2013)** Conducted a study on “Evaluation of a Prediction Model for Influent Pharmaceutical Concentrations” This research attempts to evaluate a previously developed model for predicting influent concentrations of prescription pharmaceuticals and understand why some drugs are more accurately predicted than others. It also investigates the impact of demographics on influent drug concentrations in municipal wastewater treatment plants (WWTPs). Samples from two WWTPs in the southeastern United States indicate that the model generates concentration estimates that are accurate to within at least one order of magnitude for a diverse set of drug compounds. Additionally, strategically timed sampling at college-town WWTPs, wherein 19–25% of the population comprises students ages 18–22, reveals that the influent concentrations of several drugs (atorvastatin, simvastatin, rosuvastatin, and metformin) generally prescribed to older-than-average persons increase while students are absent on holiday, whereas the influent concentration of one drug (17 α -ethynyl estradiol) prescribed to younger-

than-average persons decreases. These observations reveal the impacts of demographics on prescription drug concentrations in WWTP influents, offering some explanation for the wide variability among previously measured influent drug concentrations. It was also observed that hospital size is generally correlated with increased influent drug concentrations.

[2] **P. Chevalier et. al. (2000)** Conducted a study on “ Nitrogen and phosphorus removal by high latitude mat-forming cyanobacteria for potential use in tertiary wastewater treatment” biological wastewater treatment systems for cold climate areas four strains of filamentous, mat-forming cyanobacteria isolated from Arctic and Antarctic environments were evaluated for their nutrient stripping and growth capabilities. A tropical strain, *Phormidium bohneri*, known for its excellent performance in wastewater treatment, was used as a comparison. Experiments were done in artificial media under controlled batch culture conditions to avoid interactions with indigenous microorganisms such as bacteria and protozoa. The culture medium simulated real effluents containing high concentrations of nitrate and phosphate. Their results indicate that tertiary biological wastewater treatment at low temperatures (5 °C) cannot be anticipated with the polar strains tested, because they are psychrotrophic rather than psychrophilic and thus grow too slowly under conditions of extreme cold. However, it appears that these cyanobacteria would be useful for wastewater treatment at moderately cool temperatures (c. 15°C), which are common during spring and fall in northern climates.

[3] **P. K. Roy et. al. (2014)** Conducted a study on “ Study of impact on surface water and groundwater around flow fields due to changes in river stage using groundwater modeling system” explains the impact of pharmaceutical wastes on groundwater. Excessive ground water withdrawal can lead to ground water depletion, and this may have serious social and economic consequences. Attempts to limit groundwater pumping have been commonly based on the concept of safe yield. In this study, in order to evaluate safe yield, short- and long-duration pumping tests have been performed at four different sites (Purulia District, India) on Damodar River bed. The lithological survey was carried out along the river bed at regular intervals from 500 m to 10.5 km, covering a total stretch of 10-km up-stream and 0.5-km down-stream, to determine the soil profile and other soil characteristics. The points, where the maximum depth of porous medium was obtained, were selected for carrying out the pumping yield tests. The appropriate hydrogeologic approaches were employed to estimate the values of aquifer parameters, viz., specific yield (Sy), transmissivity(T), and hydraulic conductivity (K) for the aforesaid sites under study, which were found to be in the range of 0.043–0.175, 2082–3983, and 219–603 m/day, respectively. A hypothetical aquifer-stream water interaction system has been developed using GMS software (groundwater modeling system) not only to represent the hydraulic head fluctuations in the groundwater system around well fields but also to quantify the flow rate due to change in river stage, recharge due to rainfall, and also to determine how the surface water could affect groundwater due to pumping .

[4] **Sanjay Kumar Dubey et.al (2011)** Conducted a study on “ Potential use of cyanobacterial species in bioremediation of industrial effluents” This study investigated the potential degradation of industrial effluents by environmental species of cyanobacteria. Cyanobacterial species isolated from the Pharmaceutical and Textile industries Mandideep, Bhopal were exposed. Isolation and utilization of the locally generated cyanobacterial biomass for remediation of private industrial activities will generate a

source of revenue in Bhopal localities. Biodegradation and biosorption capacity of some potential cyanobacterial species: *Oscillatoria* sp., *Synechococcus* sp., *Nodularia* sp., *Nostoc* sp. and *Cyanothece* sp. dominated the effluents and mixed cultures showed varying sensitivity. Contaminant was removed by all the species, either as individuals or mixtures, at both concentrations. The abundance of cyanobacteria in this effluent was due to favorable contents of organic matter, rich calcium and nutrients such as nitrates and phosphates with less dissolved oxygen. Removal efficiencies of the different contaminants were evaluated and compared. Results confirmed the high efficiencies of the investigated species for the removal of the target contaminants which were species and contaminant-dependent. The contaminants removal efficiency (RE) percentage of cyanobacterial species ranged between 69.5 and 99.6% with a maximum of 97.0 to 99.6% at 5 ppm, 83.9% and 99.7% at 10 ppm and maximum between 95.5 and 99.7%. Mixed culture RE percentages ranged between 91.6 and 100% at 5 ppm with a maximum range of 99.3 to 100%, while at 10 ppm, the RE percentage ranged between 90.4 and 100%, with a maximum range of 96.0 to 100%. Results indicate the potential of natural resources as efficient agents for pollution control.

IV. MATERIALS AND METHODOLOGY

Details Of The Study Area

It is a taluk in Bangalore Rural District. Headquartered at the Hoskote town, it consists of five hoblis - Anugondanahalli, Jadigenahalli, Kasaba, Nandagudi and Sulibele. Agriculture, apiculture and horticulture are primary occupations of people here, although the industrialization in the recent times in Hoskote and places around has thrown up new opportunities for the people. Hoskote is the largest taluk in Karnataka having 333 villages. Hoskote town is the headquarters of the Hoskote Taluk, and lies at the intersection of NH-4 and NH-207 and as such is a busy town with both resident and floating population. Hoskote has a medical college and research institute known as MVJ Medical College & Research Centre. Hoskote is known for its moderate climate throughout the year. The town is around 900 m above sea level making its climate usually 1 or 2 degrees cooler than Bangalore.

Yele Mallappa Shetty Lake

- The study area lies in the North part of Bangalore ,at the
- Latitude 13° 8', 13°12'
- Longitude 77°33',77°37'.
- The altitude varies from 860-954m in the study area covering in topographical map of 57 G/12 NE of 1:25000 scale.

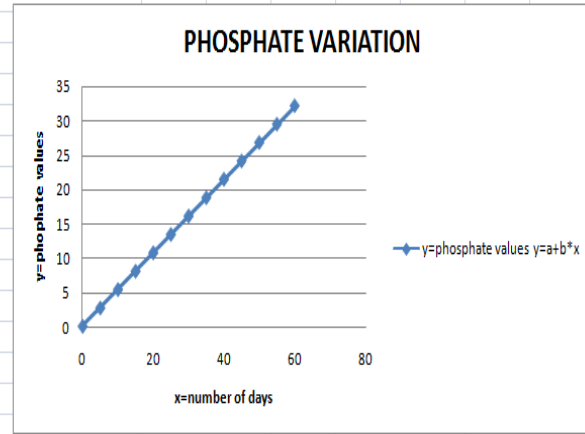
V. METHODOLOGY

Based on study area appropriately 30 to 35 groundwater sampling points and surface sources was selected for analyzing the water quality parameters in watershed. Coordinates of each sample point locations was recorded in field through handset GPS. The water quality parameters included pH, BOD₃, COD, TSS, Phenolics, Sulphide, Phosphate and Species of Colliform in this study. These water quality parameters of each sample were analyzed in laboratory by using appropriate standard methods, tabulations are done using excel sheet and led to statistical treatment.

A mathematical model is a description of a system using mathematical concepts and language. The process of developing a effects of different components, and to make predictions about behavior. Based

1 PHOSPHATE VARIATION WITH TIME

x=no of days	y=phosphate values	a	b
	$y=a+b*x$		
0	0.2	0.2	0.532
5	2.86	0.2	0.532
10	5.52	0.2	0.532
15	8.18	0.2	0.532
20	10.84	0.2	0.532
25	13.5	0.2	0.532
30	16.16	0.2	0.532
35	18.82	0.2	0.532
40	21.48	0.2	0.532
45	24.14	0.2	0.532
50	26.8	0.2	0.532
55	29.46	0.2	0.532
60	32.12	0.2	0.532



on the results obtained, to develop a Regression

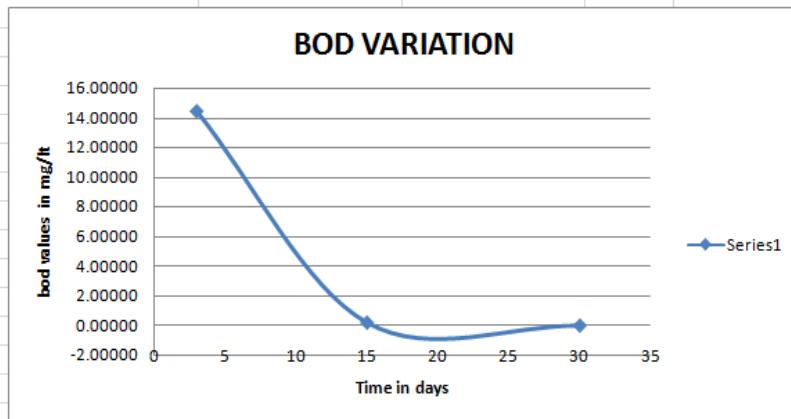
model was developed using advanced scientific tool. A model may help to explain a system and to study the future trends. Then finally Providing a Bio-Technical solutions for specific environmental parameters is carried out by cyanobacteria.

Parameters Tested-----COD, BOD, pH, Phosphate, Chromium, Sulphides, Total Suspended Solids, E-Coli and Phenols.

VI. RESULT OF THE TREATMENT

BOD VARIATION WITH TIME @27 C

yt=bod values (mg/l)	L	$1-10^{(-kd*t)}$	Kd	time ' t'(days)	Yt=bod values(mg/l)
23	37.44371611	0.614255271	0.1379	3	14.44372
23.3	23.50071558	0.991459172	0.1379	15	0.20072
24.32	24.32177417	0.999927054	0.1379	30	0.00177



Variation Of BOD with Time.

Variation Of Phosphate With Time

IV. CONCLUSIONS

The following

conclusions were drawn by analysis and microbiological treatment.

- The groundwater quality was within the limits for pharmaceuticals parameters near Cipla industrial area.
- The surface water quality showed that BOD, COD and phosphate exceeded the permissible limits.
- Bio-remedial measure which is suggested was found to be effective and economical.
- Cyanobacteria was very effective in removing phosphate from pharma effluents to about 90% within 15 days. .
- The mathematical model precisely shows the variation of BOD and phosphate with respect to time.

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