

Study of industrial effluent from Hindustan Phosphate Limited and its treatment with lime and alum

PREETI JAIN¹ and SUCHETA KHOWAL²

¹Department of Chemistry, ²Medicaps Institute of Technology and Management, Indore (India).

(Received: January 30, 2009; Accepted: March 10, 2009)

ABSTRACT

For the present study phosphate fertilizer unit was selected which were posing a great threat to environment. A study was made on Hindustan Phosphate situated at Pithampur Industrial area sec.no.1. It is situated 22 km away from Indore. Sample was collected in the month of May 2008 and following parameters were analyzed in laboratory – Temperature, pH, Total solids, and chlorides, BOD, COD, Phosphate, Sulphates, Nitrates, and Fluorides. The Hindustan Phosphate has got their treatment plants. So the study of both untreated and treated factory effluent was carried out. After treatment with lime followed by alum & PAC the following results were obtained, it is compared with the treated value. (Treatment with lime and alum). And comparative graphs were plotted. The COD value before treatment is 4,208 ppm and after treatment it is 1,328 ppm. Phosphate content before treatment is 292 ppm and after treatment with lime the value is 16 ppm. Similarly fluorides, pH, Suspended solids load get reduced in the effluent after treatment with lime and alum. Such effluent can cause corrosion of pipes due to low pH, Eutrophication problems in receiving water bodies due to high phosphate content, Fluorides concentration found to be greater than 1.5 mg/L . which affect whole aquatic system.

Key words: Fertilizer, alum, lime, BOD, COD, Phosphate, Effluent, pH, etc.

INTRODUCTION

The rapid growth of fertilizer industry has caused serious concern to the environmental scientist. The situation is so alarming that its needs a proper as well as immediate attention of everyone. Pollution due to fertilizer industry is found in varying degree in air, water and soil. Man has always been making increasing demands upon its surrounding resources and there by has been altering his own natural environment and that of all other organisms living on earth. The demands go on increasing day by day not only because of the rapid growth of human population but also due to increase in the level of the living standards.

Waterways and the sky above us can't be treated as waste dumping ground. The old method of getting rid of air and liquid waste should be changed. At the same times it is a liability on the part of industry to accomplish the feat of providing good breathable air & potable water for use of the community. The most important of this study is to estimate the environmental impact of the various pollutant discharged by fertilizer industry. This includes estimation of the total quantity of discharged effluent to the environment. The present study emphasizes on the super phosphate fertilizer. Phosphatic fertilizer constitutes a very significant & indispensable input for agriculture in India. A typical phosphoric acid or super phosphate plant consist

of sulphuric acid plant based to produce straight fertilizer or phosphoric acid from rock phosphate and sulphuric acid.

MATERIAL AND METHODS

For the present study Hindustan phosphate fertilizer unit was selected which were posing great threat to environment. The unit is situated at Pithampur industrial area sec.no.1. It is 22km away from Indore. This factory causing hazards and deteriorate to environment of air, land & water. The samples were collected from tube well inside the factory premises & also from inside the plant. Different parameters were tested for the waste water sample in the month of may 2008.

The volume of sample collected was proportional to the flow. 2-3L. of sample were collected from effluent stream for analysis. Water samples were collected in 2-4L polyethylene jerry canes for physicochemical studies. For calculation of dissolved oxygen, samples were collected in 300ml D.O bottles. All the chemicals used in the analysis were Loba/BDH. grade. Distilled water was always used in the analysis & in all the solution preparation.

Before collection the container were rinsed with the sample being collected. Care was taken in collecting a sample containing oil. For collecting such samples, clean & dry glass stopper bottles were used. Samples for the determination of BOD, BOD bottles were siphoned to avoid aeration. Hot samples were cooled to atmospheric temperature & then collected.

Hindustan phosphate has got their treatment plant. So the study of treated effluent was also carried out. The parameters which were analyzed are as follows.

Temperature, pH , TDS, chlorides, BOD, COD, DO, phosphate, nitrates & fluorides.

After analysis, the effluent was treatment with lime & alum followed by PAC which helps to reduce the various parameters like excess COD, phosphates, fluorides, pH value.

RESULT AND DISCUSSION

Hindustan phosphate Ltd. Situated at pitampur, we find that appearance of the effluent was turbid and odour was very unpleasant. The

Table 1: Hindusthan phosphate (Pithampur) description of sample effluent from holding tank Results-may 2008

S.No.	Water quality Parameters	Untreated	Treated
1	Appearance	Turbid	Clear
2	Odour	Unpleasant	Unpleasant
3	Temperature (°C)	41	25
4	PH	2.9	3.8
5	Total solids	19086	18146
6	Dissolved solids	18,306	16657
7	Suspended solids	1,780	1342
8	Chlorides	10,680	9200
9	BOD	Nil	08
10	COD	5,505	4202
11	Phosphates	290	292
12	Sulphates	2,496	2,402
13	Nitrates	258	195
14	Fluorides	23	20

Table 2: Hindusthan Phosphate (Pithampur) Treatment with lime followed by alum/PAC Results-May 2008

S. No.	Dose(%)	Colour		pH		Suspended solid	
		Before	After	Before	After	Before	After
1	10	Turbid	Clear	2.9	8.2	1780	100
2	20	Turbid	Clear	2.9	8.4	1780	98
3	30	Turbid	Clear	2.9	8.4	1780	95
4	40	Turbid	Clear	2.9	8.5	1780	93

Table 3: Hindusthan phosphate (Pithampur) Treatment with lime followed by alum/PAC Results-May 2008

S. No.	Dose(%)	COD		Phosphate		Fluoride	
		Before	After	Before	After	Before	After
1	10	5505	1345	290	25	23	16
2	20	5505	1335	290	22	23	15
3	30	5505	1330	290	19	23	14
4	40	5505	1328	290	16	23	12

highest temperature recorded 41°C in month of May. The pH recorded as 2.9 to 3.8. Thus the sample was highly acidic and it may be due to presence of sulphuric acid and phosphoric acid.

ranged from 18146 to 19086 in the month of May.

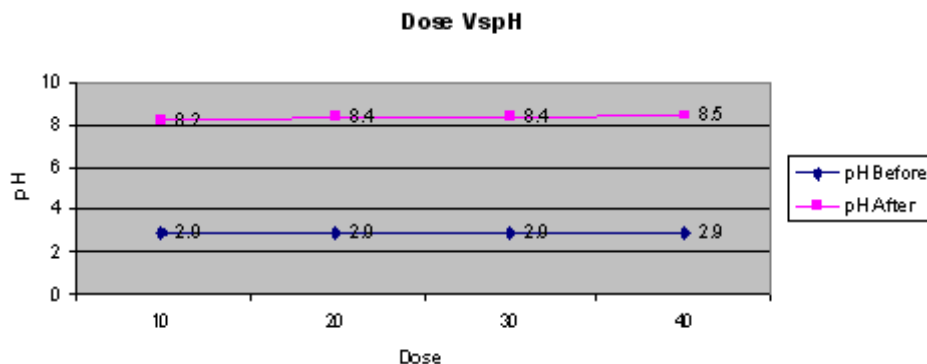
Indian standard of dissolved solids is 2100mg/L maximum whereas in case of Hindustan phosphate the value ranged from 16657 to 18306.

Total solid content in Hindustan phosphate

Suspended solids according to Indian standard are

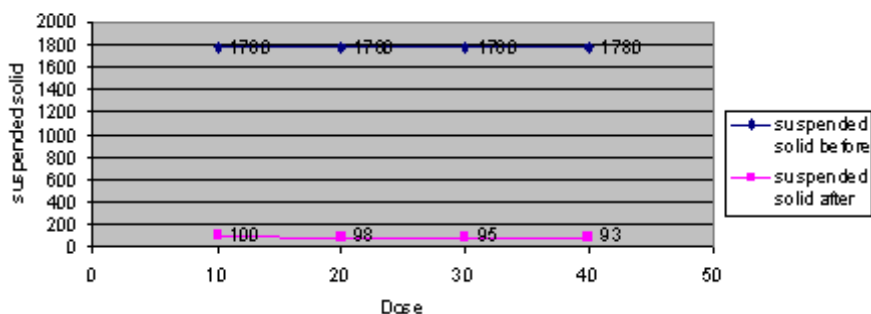
Graph 1: pH vs Dose of lime and Alum

Dose	10	20	30	40
pH Before	2.9	2.9	2.9	2.9
pH After	8.2	8.4	8.4	8.5

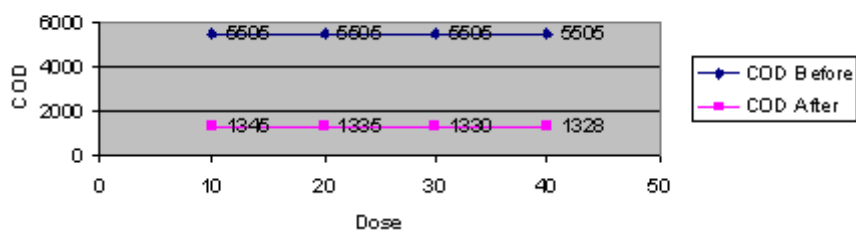


Graph 2: Suspended solid Vs dose of lime and Alum

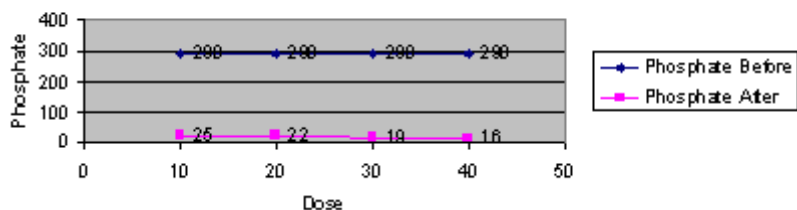
Dose	10	20	30	40
suspended solid before	1780	1780	1780	1780
suspended solid after	100	98	95	93

Dose vs suspended solid**Graph 3: COD vs Dose of lime and Alum**

Dose	10	20	30	40
COD Before	5505	5505	5505	5505
COD After	1345	1335	1330	1328

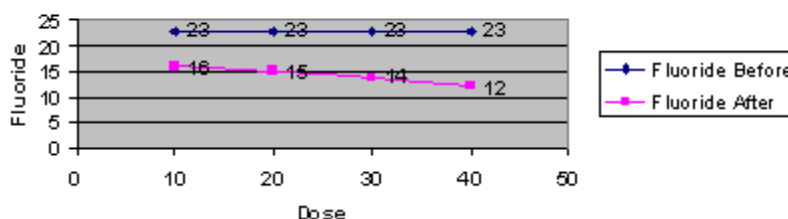
Dose vs COD**Graph 4: Phosphate vs dose of lime and alum**

Dose	10	20	30	40
Phosphate Before	290	290	290	290
Phosphate After	25	22	19	16

Dose vs Phosphate

Graph 5: Fluoride vs Dose

Dose	10	20	30	40
Fluoride Before	23	23	23	23
Fluoride After	16	15	14	12

Dose vs Fluoride

100mg/L whereas in case of Hindustan phosphate the value ranged from 1342 to 1780.

The desirable limit of chloride is 250mg/L and permissible up to 600mg/L. The chloride content of untreated factory effluent of Hindustan phosphate ranged from 9200 to 10680. Thus we see that this effluent is highly acidic having large amount of chloride content therefore it can not be used for irrigation purpose without treatment.

The BOD value was under the permissible limit. In case of COD value ranged from 4202 to 5505 mg/lt. The permissible limit for COD value is 250mg/lt. The permissible limit for phosphate is 5mg/lt. while it as observed that in case of Hindustan phosphate the value ranged from 279 to 296.

The value of sulphate ranged from 2402 to 2496 for the effluent whereas the permissible limit for sulphate is 1000mg/L.

High amount of nitrate are generally indication of pollution. The nitrate value ranged from 195 to 258. Fluoride concentration in terms of Indian standard is 2mg/lt whereas the recorded value is very much higher 23 to 20 mg/L. Thus we can clearly say that effluent is very much polluted in case of Hindustan phosphate Ltd.

After treatment with lime followed by alum the above values for various parameters get reduced. The maximum reduction was noted at the dose of 40mg/L in all the parameters. It is shown in tables and the graph.

ACKNOWLEDGEMENTS

Authors are thankful to Director Medi-Caps Institute of Technology and management for providing laboratory. facility and chemicals for completion of work.

REFERENCES

1. JS Knapp, PS Newby Water Research, Elsevier. *Water Research.*, **33**(2): 575-577 (1999).
2. F Elbaz-Poulichet, C Dupuy, A Cruzado, Z Velasquez *Water Research.*, Elsevier *Water Research*, **34**(12): 15 A (2000).
3. Gomez CE, Contento L, Carsen AE., Toxicity tests to assess pollutants removal during wastewater treatment and the quality of receiving waters in Argentina. *Environ Toxicol* **16**: 217-224 (2001). August 2000, Pages 3222-3230.
4. Mukhopadhyay, DK Saxena, DK Chowdhuri - *Environmental Health Perspectives*, ehponline. org **111**(16): (2003).
5. Tünay, GE Zengin, I Kabdaplıy, Ö Karahan - *Journal of Environmental Science and Health*, Part A, informaworld.com, Part A,

- 39**(7): 1891-1902 (2004).
6. E Chiacchierini, D Restuccia, G Vinci - *Food Science and Technology International, Fst. Sagepub.*, **10**(6): 427-428 (2004).
 7. Banaoui, JF Chiffolleau, A Moukrim, T Burgeot, A Marine Pollution Bulletin., Elsevier **48**(3-4): 385-390 (2004).
 8. GREE Ana, MKC Sridhar, JF Olawuyi - *Journal of Environmental Health Research, Cieh. Org.*, **8**: 19-26 (2005).
 9. TM Mazzo - *Analytical Letters, informaworld.com* **39**(14): 2671-2685 (2006).
 10. M Gavrilescu, Y Chisti - *Biotechnology Advances*, –Elsevier Volume 25, Issue 3, May-June 2007, Pages 294-306
 11. Othman, MS Al-Masri - *Applied Radiation and Isotopes*, Elsevier **65**(1): 131-141 (2007).