Impact of Fertilizer Industry Effluent on Land Environment: A Review

Chitesh Y. Thakre[1] and Arif Khan[2]

[1]P.G. Student Nuva College of Engineering, Nagpur (India).

[2]Principal, Nuva college of Engineering, Nagpur (India)

Abstract- *Today Chemical Fertilizer has become extremely important to modern Agriculture to feed the rapidly growing population. Chemical Fertilizers are used in large manner in modern agriculture for improving crop yield. This paper reviews Impact of fertilizer industry effluent on soil. Paper summarizes the study done by various researchers.in many cases All the solid waste generated from fertilizer industries are disposed off at dumpsites surrounding fertilizer plant. The effluent from chemical fertilizer industry mainly contain organics, nitrates, alcohols, ammonia, phosphorous, heavy metals such as cadmium and suspended solids. The percolation of these surface pollutants through the soil cause soil pollution. Because of that soil pollution the fertility of soil decreases. Soil pollution is any chemical or biological alteration of soil that is harmful to living organisms.in addition to the Industrialization the wrong practice of agriculture has also adversely affect the ground water, surface and soil.*

Key words: Chemical Fertilizer, Soil Pollution , ammonia, Fertilizer Industry

I. INTRODUCTION

A Fertilizer is a material of natural or synthetic origin that is applied to soil or to plant tissues to supply one or more plant nutrients essential to the growth of plants. Fertilizer technology developes significantly as the chemical needs of growing plants were discovered. Modern synthetic fertilizers are composed mainly of nitrogen, phosphorous, and potassium compounds with secondery nutrients added. In present time chemical fertilizer has become extremely important to modern Agriculture to feed the rapidly growing population. Chemical fertilizers are used in large manner in modern agriculture for improving crop yield. The problem arising due to the improper disposal of fertilizer industry effluent. in many cases All the solid waste generated from fertilizer industries are disposed off at dumpsites surrounding fertilizer plant. The effluent from chemical fertilizer industry mainly contain organics, nitrates, alcohols, ammonia, phosphorous, heavy metals such as cadmium and suspended solids. The percolation of these surface pollutants through the soil cause soil pollution. Because of that soil pollution the fertility of soil decreases. Soil pollution is any chemical or biological alteration of soil that is harmful to living organisms.in addition to the Industrialization the wrong practice of agriculture has also adversely affect the ground water, surface and soil.

Due to increasing pressure of production of food in large amount to feed the geometrically growing population throughout the world can be met only through intensification of agriculture. which requires high yielding varieties, with high input of water and fertilizer. Fertilizer industry is one of the major water consuming industry, which is responsible for water and soil pollution. [1]. Soil health is a state defined by the delicate balance of various physical, chemical and biological properties of soil and its relationship with overall environment of which it is a part. From the agricultural point of view a healthy soil is that which produces good crops suitable for human and animal consumption and has the ability to recuperate to sustain production.[2]. Therefore the present paper attempts to review the context on broad range of topics covering impacts of effluents generated from fertilizer industry on soil.

II. LITERATUTRE REVIEW

Many Research has been done on the Impact of Industries effluent on soil. Here we summarized some of them after studying the works done by them. The literature Review of the work done by the various researchers are presented below.

Godson R.E.E Ana, Mynepali K.C Sridhar [2004] [3] Studied soil quality near a chemical fertilizer industry at Port Harcourt, Nigeria. The effluents, leachates and soil samples were analysed for physio-chemical parameters such as temperature, pH value, nitrate, phosphorous, potassium, iron, sodium, calcium and selected heavy metals such as Fe, Zn, Ni, Cd and pb using standard methods. The results revealed that the dumpsite leachate samples recorded very high concentration of Urea (2.05×10^5mg/l), phosphate (4.88×10^3 mg/l) and Zinc (74.9 mg/l). the effluent samples from outfall (final effluent channel) showed lower values for urea (10.4 mg/l), phosphate (127.0 ± 78.5 mg/l) and Zinc (3.04 ± 1.81 mg/l). The soil Environment around the dumpsite was most affected with the highest mean phosphate and potash level of 494.5 mg/kg and 32.3 mg/kg respectively.

Hemen Sarma and C.M. Sarma [2007] [4] studied impact of the fertilizer industry effluent on plant chlorophyll, proteins and total sugars. The plant species examine included Camellia, Sinensis, Aegle marmelos, Anthocephalus cadamba, Colocasia leaves (Black) and

Lantana camara which were growing in the area where the effluents were released. It was observed that most of the physic-chemical properties of the effluents such as colour, total solids, COD, BOD and alkalinity were above the permissible limits. The extent of damage caused by the effluents discharged by the fertilizer industries on biochemical properties of plant was investigated. The examined plants showed drastic reduction in essential biochemical parameters such as chlorophyll, protein and total soluble sugars.

R.P. Prajapati, Anand Sharma, D.R. Tiwari [2009] [5] studied impact of chemical fertilizer industrial waste on the quality of soil in the vicinity. The effluent sludge and soil samples were analysed for physio-chemical parameters viz pH values, phosphorous, sodium, chromium, bulk density, porosity, water holding capacity, electric conductivity, organic matter and cation exchange capacity of soil using standard methods. The results revealed that the dumpsite sludge sample recorded very high concentration of potassium and calcium. The effluent samples from the outside showed lower value of potassium and cadmium. The soil environment around the dumpsite was the most affected the highest mean value of potash and phosphorous respectively.

K. Brindha, K.V. Neena Vaman, K. Srinivasan, M. Sathis Babu, L. Elango (2014) [6] studied as per the BIS standards of 45 mg/l which is the maximum permissible limit, 18% of the groundwater samples did not comply with the standard, thus making it unfit for drinking purposes and domestic use. Field analysis of 97 soil samples showed that most of the soil is basic in nature. Nitrate nitrogen was low, i.e., about 10 kg/ha in most parts of the area. The sources of nitrate in ground water of this area were the fertilizers and animal wastes. If animal waste was used in the agricultural fields as manure and the application of fertilizers was reduced, more pollution to ground water could be curtailed. This study gave an understanding on the present status of nitrate in groundwater and soil of this area.

Y.N. Jolly, A. Islam and A.I. Mustafa (2012) [7] observed the irrigation with 5% treated effluent was the best for this purpose and could fulfill the fertilizer requirements of crops. But a negative effect was observed from the irrigation with 10% to 50% treated effluent. Soil pH is raised in the treated effluent irrigated soil than the untreated effluent one with the increasing percent of effluent. The soil pH shows an alkaline tendency in both the cases. Hence the treated dyeing industry effluent may be suitable for fields with acidic soils. Thus the use of the effluent after treatment not only solves the disposal problem but also serves as an additional source of fertilizer in liquid form.

Delia Teresa Sponza (2003) [8] resulted clearly that bioassay tests provide additional information on the toxicity potential of industrial discharges and effluents. Enrichment toxicity tests are novel applications and give an idea of whether there is potential toxicity or growth-limiting and stimulating conditions. Different organisms were used such as bacteria, algae, protozoa, and fish to represent four trophic levels. Furthermore, chemical oxygen demand (COD) fractionation results were compared with these tests to assess the effect of COD subcategories on the determination of possible toxicity. The toxicity test results were assessed with chemical analyses such as COD, biochemical oxygen demand (BOD), color, absorbable organic halogen (AOXs), and phenol. It was observed that the toxicity of the effluents could not be explained by using physicochemical analyses in four cases for the Fertilizer industry.

A.K. Satone, J.R. Bajoria, P.V. Tekade and N.P. Mahubansi (2011) [9] observed that Ph value of drinking water is an important index of acidity, alkalinity and resulting value of the acidic basic interaction of a number of its minerals and organic components. pH below 6.5 causes corrosion in pipes, resulting in release of toxic metals. pH of water in the studied region was found to be 7.2, which lies in the range prescribed by APHA. TDS values should be less than 500 mg/lit. for drinking water. In the present study, TDS was calculated to be 800 mg/lit. the findings indicate that the sample of MIDC just crosses the permissible limit suggested by WHO and Indian standards. The hardness values was not within permissible limit. However, temporary hardness was found to be 25.64 mg/lit. which can be removed by boiling. Permanent hardness was found to be 974.32 mg/lit.

Kiran D. Ladwani, Krishna D. Ladwani, Vivek S. Manik and Dilip S. Ramteke (2012) [10] highlighted Impact of Industrial Effluent Discharge on Physico-Chemical Characteristcs of Agricultural soil. When the physico-chemical parameters are taken into consideration, the physical parameters shows that the Ph, TSS are more, while the turbidity is far more as compare to the normal values. The decreases in chloride content means some quenchers are there in effluent. The high COD value from the effluent of the steel industry suggests that this industry is producing lots of organic substances. The level of sulfide was very high than the normal values. The heavy metals present in the effluent may come from the various metallurgical processes. The data suggest at near about concentrations of all the metals goes on decreasing which indicate that the effluent may contains metal quenchers.

III. EFFLUENT AND EMISSIONS GENERATED FROM FERTILIZER PLANTS

Effluent and emissions generated from fertilizer plants utilities are given in the table below:[11]

Table 1: Effluents from Fertilizer Industry

Plants	Liquids	Gases
Ammonia	1.Process condensate bearing ammonia & methanol from stream reformation of NG/Naptha 2.Oil bearing effluent from pumps and compressor section, leakages and washings of equipments, etc 3.Effluent bearing absorbent chemicals like K_2CO_3, methanol, DEA MEA, glycerin, etc., from carbon dioxide removal section owing to leakage spillage from the system. 4.Carry over from gasification process using fuel oil, containing suspended carbon, sulphide, vanadium, etc	1.Flue gas containing mainly CO_2, SO_2, NO_x, and particulate from primary reformer stack. 2.CO_2 3.Purge gas from synthesis gas section 4.H_2S from rectisol wash unit
Urea	1.Process condensate containing urea, ammonia and CO_2 from vacuum concentration section. 2.Effluents containing mainly oil from carbon dioxide compression section, leakages from pumps and washings of equipments	1.Dust from prilling tower and product handling 2.Ammonia fumes from the prilling tower and scrubbers.
Sulphuric acid	1.Waste heat boiler blow down and acidic wastewater due to spillage, leakage and washing of the plant and equipments.	1.off gases containing acid mist and SO_2 from the absorption tower stack.
Phosphoric acid	1.Effluent bearing phosphate and fluoride and suspended solid purged from recycle scrubber. 2.Hydrofluorosilicic acid containing condensate generated from the vacuum concentration section. 3.The gypsum pond overflow containing fluoride, phosphate and suspended solids.	1.Dust from rock handling and grinding section. 2.Fluoride compounds emitted from fume scrubbers.
Nitric acid	1.small quantity of boiler blow down and acidic wastewater from spillage, leakage and washing of the plant and equipment.	1.NO_x bearing gas emitted from absorption tower stack.
SSP	1.Effluent bearing phosphate, fluoride and SS from the scrubber.	1.Emission of fluoride compounds from acidulation of rock phosphate 2.Dust emission from rock grinding and handling section. 3.During curing of the product, dust and fluoride compounds are released.
	1.Effluent containing ammonia, nitrate, fluoride, phosphate and SS from scrubber used for controlling emissions. 2.Effluent containing ammonia, nitrate, phosphate and SS due to spillage leakage, washing, etc.	1.Rock Phosphate dust from grinding mill 2.NO_x, F and dust from reaction vessel. 3.NH_3 from calcium nitrate tetra-hydrate section, acid neutralization and ammonium nitrate evaporation section, prilling tower/ granulator. 4.Dust from prilling tower, granulator, product cooling section, drying section, etc.
DAP/APS/UAP	1.Wastewater from draining and washing of equipment: leakages from pump glands	1.NH_3 and small quantity of fluoride compounds from neutralization and granulation operation. 2.Dust emission from drying, screening and cooling section.
NPK	1.Wastewater from draining and washing of equipment; leakages from pump glands.	1.Dust emission from drying, screening and cooling section. 2.Fluoride compounds & ammonia fumes from neutralization and granulation operation.

III. CONCLUSION

From the above reviews conclusion can be drawn that, The improper Disposal of effluent from Fertilizer industries affect the Land Environment. The physio-chemical parameters of soil such as pH value, nitrate, phosphorous, potassium, iron, sodium, calcium and selected heavy metals such as Fe, Zn, Ni, Cd and pb found above permissible limit around plant area. It affect the health of human being, animals and plant. To overcome this problem it is necessary that careless disposal of the effluent wastes should be discourage and there is need for industry to install a waste treatment plant to treat effluent waste before being discharge on ground..

IV. REFERENCES

[1] Prabhakar Pratap Singh, Manisha Mall and Jaswant Singh, ”Impact of fertilizer fatory effluent on seed germination, seeding growth and chlorophyll content of gram (cicer aeritenum)”, Journal of Environmental Biology, vol 27(1), pp 153-156, January 2006

[2] P.K. Chonkar, S.P. Datta and H. Pathak, “Impact of Industrial Effluents on soil Health and Agriculture – Indian Experience Part II – Tannery and Textile Industries Effluents”, Journal of Scientific & Industrial Research, vol 59, pp 446-454, June 2000

[3]Godson R.E.E Ana and Mynepali K.C Sridher, “Soil quality Near a chemical fertilizer Industry of port Harcourt, Nigeria”, AJEAM-RAGEE, vol 8, pp 19-26, 2004

[4] Hemen Sarma and C.M. Sarma, “Impact of the Fertilizer Industry Effluent on plant chlorophyll, Protiens and Total sugars”, Nature Environment and pollution Technology, vol 6, No. 4, pp 633-636, 2007

[5] R.P. Prajapati, Anand Sharma, D.R. Tiwari, “Impact assessment of chemical fertilizer industry on quality of soil in and around Vijaipur, district Guna, M.P. (India)”, current world Environment, vol 4(2), pp 429-432, 2009

[6] K. Brindha, K.V. Neena Vaman, K. Srinivasan, M. Sathis Babu, L. Elango, “Identification of surface water-groundwater interaction by hydrogeochemical indicators and assessing its suitability for Drinking and Irrigation purposes in Chennai, southern India”, Appl Water Sci, vol (4), pp 159-174, 2014

[7] Y.N. Jolly, A. Islam and A.I. Mustafa, “Impact of Dyeing Industry Effluent on Soil and Crop”, Universal journal of Environmental Research and Technology, vol. (2), issue 6, pp 560-568, 2012

[8] Delia Teresa Sponza, “Application of toxicity tests into discharge of the pulp-paper industry in Turkey”, Ecotoxicology and Environmental safety, 54, pp 74-86, 2003

[9] A.K. Satone, J.R. Bajoria, P.V. Tekade and N.P. Mahubansi, “Monitoring of Drinking water Quality of MIDC of Wardha City, Maharashtra”, Rasayan J. Chem., vol. 4, No. 4, pp 910-913,2011

[10] Kiran D. Ladwani, Krishna D. Ladwani, Vivek S. Manik and Dilip S. Ramteke, “Assessment of Heavy Metal Contaminated Soil Near Coal Mining Area in Gujrat By toxicity characteristics Leaching Procedure”, Int. j. Life Sc. Bt. And pharm., vol. 1, No. 4, pp 73-80, October 2012

[11] Technical EIA Guidance Manual for Chemical Fertilizers.