EVALUATION OF SOIL QUALITY AROUND PAPER INDUSTRY : A CASE STUDY OF RAJAHMUNDRY

Environmental Science

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ABSTRACT

Paper is the pre-requisite for education and literacy and its use as an index of advancement in these two fields as well as the overall well being of the society. . Due to increasing human needs, the level of pollution in environment has raised to devastating extends leading to disastrous consequences. The evaluation of the soil quality at study area revealed that study area is contaminated with more Iron concentrations along with Manganese and Zinc. These contaminants can be removed through various phytoremediation and bioremediation techniques. And through the recovery and reusable processes, most of the soil pollution can prevent.

KEYWORDS

Pulp, sludge, raw material, solid waste.

INTRODUCTION:

An enormous industrial growth has taken place throughout the world in the past few decades. It has become so vast that, the environment has totally changed from what it was earlier. Due to increasing human needs, the level of pollution in environment has raised to devastating extends leading to disastrous consequences. Due to increasing human needs, the level of pollution in environment has raised to devastating extends leading to disastrous consequences (Chakrabarti, 2006). Pollution today is found in each and every thing that we need the most viz. air, water, soil, etc. Among the 17 most polluting industries identified by MOEF (ministry of environment and forests), paper industry is one amongst them. The pulp and paper industry is one of the oldest industries in our country.

In pulp and paper industry solid wastes are generated from various operations sucha as, raw material handling, rejects from screening and centri cleaners, coal or boiler ash from steam and power generation units. And also lime sludges from causticizing section of chemical recovery plant (Henneberger et al., 1989). The composition of solids (sludges) removed from liquid effluent treatment systems of paper mills varies, depending on their source. Solids from primary treatment principally consist of cellulose fibres (Ghosh, 1997). The major component of solids from secondary treatment is microbial cells. If the mill uses chlorinated bleaching agents, both primary and secondary solids may also contain chlorinated organic compounds, an important consideration in determining the extent of treatment required (Dahasahasra and Panse, 2005). Prior to disposal, sludges are thickened in gravity sedimentation units and mechanically dewatered in centrifuges, vacuum filters or belt or screw presses. Once sufficiently dewatered, sludge is disposed of in land-based applications (e.g., spread on arable or forested land, used as compost or as a soil conditioner) or incinerated. Improper disposal of this waste and pulp leads to serious health problems and soil quality change (Jappinen, 1987).

MATERIALS AND METHODS:

International Paper APPM Ltd. (formerly known as The Andhra Pradesh Paper Mills Ltd.), is one of the largest integrated paper and pulp manufacturers in India. Established in 1964 at Rajahmundry and the company produces writing, printing and copier papers for foreign and domestic markets. The surrounding areas of this industry are selected for this study.

Preparation of soil sample

Soil samples were collected from each horizon of the fifteen profiles. Surface samples numbering forty were also collected randomly from the sites of interest. The samples were air dried, pounded with wooden pestle and were passed through 2 mm sieve. Particles greater than 2mm were considered as gravel. The sieved soil samples were used for determination of physico-chemical and chemical properties (Tarar et al., 2000). Undisturbed samples were collected from each horizon using brass cylinders of 15 cm height and 5 cm diameter for determining hydraulic conductivity and metal cores of 5 cm diameter and 5 cm height for bulk density estimations.

Physico Chemical parameters analyzed for determining the soil quality:

Soil Reaction (pH)

The pH of the soil in 1:2.5 soil water suspensions was determined by digital pH meter.

Electrical Conductivity (EC)

The electrical conductivity of the soil was measured in 1:2.5 soil water extract with the help of digital conductivity meter and the results were expressed in dS m-1.

Free calcium carbonate

The free calcium carbonate content was determined by rapid titration method.

Available Nitrogen

The available nitrogen in the soil and plant was determined by alkaline permanganate method with the help of Kelpus nitrogen analyser and the results were expressed in kgha-1.

Available Phosphorus

The available phosphorus content was determined by extracting with 0.03N NH4F+0.025 N HCl and the phosphorus content was estimated calorimetrically using ascorbic acid method.

Available Potassium

The available potassium content was determined in neutral normal ammonium acetate extract using flame photometer.

Available sulphur

Available sulphur was extracted from the soil using 0.15 per cent calcium chloride solution and sulphur in solution was determined by turbidometry using Spectrophotometer (Spectronic 20-D) at 420 nm.

Available Micronutrients

The available micronutrients viz., zinc, iron, manganese and copper were determined in the DTPA extract of soil using Atomic Absorption Spectrophotometer (AAS).

RESULTS AND DISCUSSION:

The major pollutant of the paper mills is pulp waste. The basic structure of pulp and paper sheets is a felted mat of cellulose fibres held together by hydrogen bonds (Birdie and Birdie, 2008). Cellulose is a polysaccharide with 600 to 1,500 repeated sugar units. The fibres have high tensile strength, will absorb the additives used to modify pulp into paper and board products, and are supple, chemically stable and white (Nemade et al., 2003). The discharge of pulp and sludge in previous days at the surrounding areas of paper mill lead to change in the soil quality. After became this paper mill as international paper mill, the illegal dumping was reduced and recovery of various products also started. The generated pulp was selling for reuse purpose (Ansari, 2006). But the previous pollutant discharges still showing the impacts on the environment at the study area.

The analysis of soil samples at industry surrounding revealed the quality of soil. The analysis of physical and chemical parameters at

study area from the Fig-1 and 2.

From the graph-1, the analysis results revealed that the soil sample has 7.62 pH. the electrical conductivity observed as 233.8mS/m. The concentration of potassium and sodium is observed as 199 mg/l and 209 mg/l. The levels of calcium and magnesium are observed as 115mg mg/l and 44 mg/l. The chloride levels of soil is noticed s 128mg/l. The phosphorous levels are noticed as 0.8 mg/l which is less and cadmiums levels are reported as 10mg/l. The concentrations of sμlphates are observed as 1.2 mg/l.
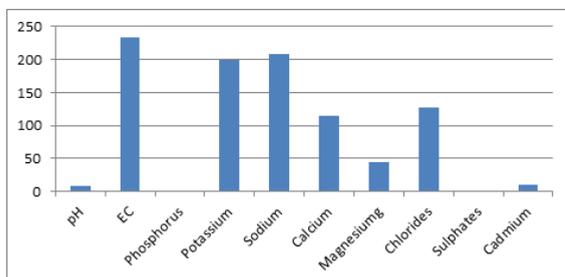

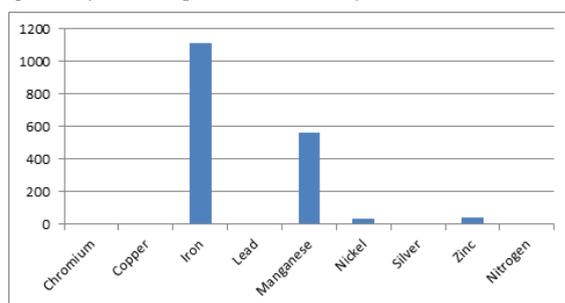**Fig:1 Analysis of Soil parameters at Study area**

Fig:2 Analysis of Soil parameters at Study area

From the graph-2, the concentration of chromium and copper are recorded as 4mg/l and 4mg/l. As well as 4mg/l lead levels are observed. The iron and manganese levels are observed as 1114mg/l and 562mg/l. The concentrations of nicked and silver are recorded as 37 mg/l and 4 mg/l. The zinc level are noticed as 45mg/l. Along with the concentrations of nitrogen is reported as 0.089 mg/l. High levels of Electrical conductivity is observed in the study area. The Sodium and Zinc concentrations also reported slightly high. But compared to all parameters, high concentrations of Iron and Manganese are observed in the study area.

CONCLUSION:
The evaluation of the soil quality at study area revealed that study area is contaminated with more Iron concentrations along with Manganese and Zinc. These contaminants can be removed through various phytoremediation and bioremediation techniques. And through the recovery and reusable processes, most of the soil pollution can prevent. Ash from power boilers can be used in road beds, as construction material and as a dust suppressant. Waste from lime kilns can be used to modify soil acidity and improve soil chemistry. Pulp can sell for preparation of egg trays.

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