

## **IMPACT OF EFFLUENTS OF SUGARCANE INDUSTRY ON SOIL PHYSICO CHEMICAL AND BIOLOGICAL PROPERTIES**

**M. NAGARAJU \* G. NARASIMHA \* AND V. RANGASWAMY \*\***

\* Department of Microbiology, National P.G. College, Nandyal 518 502, India

\*\* Department of Microbiology, Sri Krishnadevaraya University, Anantapur, India

**Key words :** Sugarcane Industry, Physico-chemical and biological properties.

### **ABSTRACT**

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**Impact of Sugarcane effluents on black cotton soil was assessed for physico-chemical and biological properties in the present study. Discharge of Sugarcane effluents onto the soil caused changes in physico-chemical and biological properties of soil. These changes included drop in pH of the soil from 8.30 to 7.26, and raise in water holding capacity 0.28 to 0.34, electrical conductivity. There is increase in clay, organic carbon, total nitrogen and phosphorus also. Higher bacterial and fungal population was recorded in polluted soil in comparison to control soil.**

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### **INTRODUCTION**

Sugarcane Industry is an agro based industry, effluents generating from this industry contain considerable amounts of organic and inorganic chemical components such as fibers, cellulosic wastes, wood dust, chlorine compounds, carbonates and bicarbonates (Mishra & Sahoo, 1989). Direct discharge of effluents from this industry may have profound influence of soil physico-chemical and biological properties. Though a wealth of information on occurrence of changes in properties of soils due to discharge of effluents from other industries is available (Swaminathan and Ravi, 1987; Monanmani *et al.* 1990; Kannan *et al.* 1993; Pervej and Pandey 1994; Kumar and John 1995; Narasimha *et al.* 1999 and Kansal *et al.* 2005). An attempt was made in the present study

to find out effect of effluents of sugarcane industry on physico-chemical and biological properties in a black cotton soil.

## MATERIALS AND METHODS

Black cotton soil which was contaminated with Sugarcane effluent was collected from M/G Rayalaseema Sugars and Energy Limited, located in Nandyal, Kurnool district of Andhra Pradesh and the same soil without effluents (control) from adjacent to sugarcane industry was also collected. These soil samples were air dried and mixed thoroughly to increase homogeneity and shifted through <2 mm sieve. Physico-chemical and biological properties of soil samples were determined by standard procedures. The soil particles like sand, silt and clay contents were analyzed with use of different sieves by the method of Alexander (1961). Water-holding capacity, Organic carbon, total nitrogen and soluble phosphorous of samples with/without effluents were determined by the method of Jackson & Ulrich (1960), Walkey-Black (Jackson, 1971), Micro-kjeldhal (Jackson, 1971) and Kuprevich & Shecherbakova (1972) respectively. Electrical conductivity and pH were measured by ELICO conductivity meter and pH meter. Biological properties of soil in terms of bacterial and fungal population were quantified by serial dilution techniques

## RESULTS AND DISCUSSION

Soil samples of both with /without sugarcane effluents discharges were analyzed for their physical and chemical properties and results were represented in Table 1. Soil sample discharged with sugarcane effluents underwent changes in all measured parameters of physical and chemical properties in comparison to control. The soil texture in terms of percentage of sand, silt and clay were 51, 19, 30 and 64, 22 and 14 in polluted and control soil respectively (Table 1). The above results indicated that effluents discharged soil had relatively lower sand, silt and higher clay contents than control soil. Similar results reported by Abdelnaim *et al.* (1987) and Narasimha *et al.* (1999) in which application of long term sewage effluents to soil led to increase in clay content and improved soil texture and structure. Higher water holding capacity and electrical conductivity were observed in contaminated soil than control, values were found 0.34 mL/g, 1.71  $\mu$ Mhos/cm and 0.28 mL/g, 0.24 mMHos/cm respectively (Table 1). Increased water holding capacity and electrical conductivity in contaminated soil may be due to accumulation of organic wastes and salts in the sugarcane industrial effluents (Table 1). Similarly, soil discharged with effluents from cotton ginning mills (Narasimha *et al.* 1999) and paper mills (Medhi *et al.*, 2005) increased the water holding capacity and electrical conductivity. In contrast, soils polluted with cement industries had low water holding capacity and higher electrical conductivity (Shanthi, 1993 and Siva Kumar *et al.* 1995). The pH of polluted soil was reduced from 8.30 to 7.62 upon release of effluents from sugarcane industry (Table 1). Slightly lowered pH in polluted soil than the control soil can be explained in terms of release of effluents containing agro based chemicals from sugarcane industry. Zende *et al.* 1996 reported that discharge of cane sugar residues from sugar-

**Table 1**

Physicochemical characteristics of soil samples polluted with/without sugarcane effluents

Characteristics	Polluted soil	Control soil
Color	Thick Black	Gray
Odor	Bad	Normal
pH	7.62	8.30
<b>Texture</b>		
Sand (%)	51	64
Silt (%)	19	22
Clay (%)	30	14
Electric conductivity (mMHos/cm)	1.71	0.24
Water holding capacity(ml/g soil)	0.34	0.28
Organic matter (g/Kg of Soil)	6.432	3.602
Total Nitrogen (g/ Kg of soil)	0.22	0.14
Available potassium (Kg/A)	332	170
Phosphorus (mg/g)	8	2

4.25

**Table 2**

Microbial population in terms of CFU/g soil\* in soil discharged with/without effluents of sugar cane industry

Parameter	Polluted soil	Control soil
Bacteria	192 X 10 <sup>4</sup>	64 X 10 <sup>4</sup>
Fungi	15X10 <sup>4</sup>	7X10 <sup>4</sup>

\*Microbial population in terms of Colony forming unit/g of soil.

cane industry reduced soil pH. Organic matter content of contaminated soil was 6.432 g/kg and control soil 3.602 g/kg. Higher Organic matter content of polluted soil may be due to the discharge of effluents in an organic nature. The contents of total nitrogen and phosphorous in effluent soil were 0.22 g/kg, 8.21mg/g against 0.14 g/kg and 4.25 mg/g respectively. Similar reports were made by Narasimha *et al.* 1999 in discharge of effluents from cotton ginning industry increased the total nitrogen and phosphorous contents compare to the control soil. The micro flora of both soil samples were enumerated and listed in the table 2. Three fold higher bacterial and two fold higher fungal populations were observed in polluted soil compare to the control soil. Higher microbial population in sugarcane effluent discharged soil could be probably due to presence of high organic matter and low pH in soil due to release of acidic effluents rich in organic matter contain. Similarly Monanmani *et al.* 1990, and Narasimha *et al.*, 1999 reported increase in microbial population in soil polluted with effluents from alcohol and cotton ginning mills respectively.

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