

## Effect of Industrial Solid Waste on chlorophyll content of *Solanum melongena L.* (Brinjal)



### Engineering

KEYWORDS : Chlorophyll content, Chlorophyll Pigment, Industrial Solid Waste, Soil Amends and *Solanum melongena L.*

Srinivas J

Department of Civil Engineering, JNTU Kakinada, -533 003, Andhra Pradesh, INDIA

Purushotham A.V

MSN Degree College, Kakinada-533016, Andhra Pradesh, INDIA

Murali Krishna K.V.S.G

Department of Civil Engineering, JNTU Kakinada, -533 003, Andhra Pradesh, INDIA

### ABSTRACT

*Disposal of industrial solid waste is one of the major problems of Industrial area of Kakinada. The present study aimed to study the "Effect of Industrial Solid Waste on chlorophyll content of Solanum melongena L. (Brinjal)". The pot experiment of the soil amends in different concentrations of industrial solid waste 5%, 10%, 30% and 50% were taken. 21 d, 51 d, 81 d and 95 d of the chlorophyll content parameter were studied. The amounts of total chlorophyll of C plants recorded on 21, 51, 81 and 95 d were 0.223, 0.233, 0.618 and 0.093 mg/g, respectively. As such the total chlorophyll of C plants increased with the crop growth up to 81d and thereafter declined. The total chlorophyll content of the plants of grown in A1, A2, A3 and A4 soils have recorded lower chlorophyll values over C in all the harvesting days.*

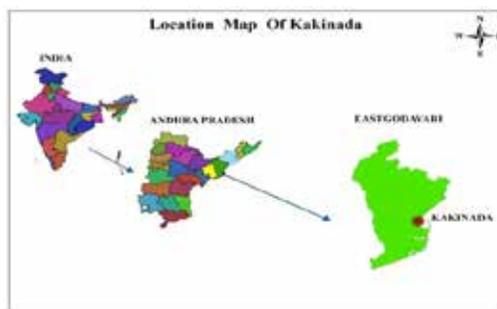
### INTRODUCTION

Environmental pollution is the major problem associated with rapid industrialization, urbanization and rise in living standards of people. Brinjal (*Solanum melongena L.*) is one of the most commonly grown vegetable crops of Solanaceae family and this plant is native to India (Tsao and Lo., 2006). Management of industrial solid waste is distinctly different from the approach used for municipal waste (Freeman 1989). There is a lot of similarity between the characteristics of the waste from one municipality or one region and another, but for industrial waste, however, only a few industrial sectors or plants have a high degree of similarity between products and waste generated (Woodard 2001). Nowadays industrial solid waste management is an important part of industry. The number of contaminated sites, which are polluted by industrial and hazardous waste, are increasing in developing countries (LaGrega *et al.* 2001). Due to the heavy involvement of industry in eliminating waste, extended producer responsibility is often an essential component of zero waste strategies (Spiegelman, 2006).

The contamination of Industrial solid wastes including mine wastes has become a worldwide concern. Several authors have shown a relationship between atmospheric elemental deposition and elevated elemental concentrations in plants and top soils, especially in cities and in the vicinity of emitting factories (Andersen *et al.*, 1978; Pilegaard., 1978; Harrison & Chirgawi., 1989; Larsen *et al.*, 1992; Sanchez-Camazano *et al.*, 1994). Several authors reported that all sites of historic and current mining and smelting operations have contaminated large areas of farmlands throughout the world (Asami., 1988; Dudka & Sajdak., 1992; Dudka *et al.*, 1995a and 1995b). In India, the problem appears to be more severe with relatively lower levels of enforcement and large areas under agriculture.

**STUDY AREA:** The Kakinada city is the capital of East Godavari District of Andhra Pradesh on the central east coast of India. The present study deals with the effects of industrial sludge on Chlorophyll pigment on *Solanum melongena L.* (Brinjal) in Kakinada, East Godavari District, Andhra Pradesh and India. Kakinada is situated between the latitude 16° 57' North and longitude 82° 15' East.

Figure - 1: Location Map of the Study are



### MATERIALS AND METHODS

**Industrial solid waste:** The Industrial solid waste samples were collected at the outlet of release channel of the "Oil and Gas Industry" at Kakinada; air-dried and was brought to the laboratory.

**Soil:** Soil from the conventional crop fields near the ITS India pvt ltd., factory (East Godavari District, Andhra Pradesh) was selected and used in the experimental studies on Brinjal.

**Seed Material:** The seeds of Brinjal, *Solanum melongena L.* variety; were procured from an Agricultural Cooperative Centre at Kakinada, East Godavari district, Andhra Pradesh.

**Pot Experiment:** The pot culture were conducted in the experimental farm of the "Department of Civil Engineering, Jawaharlal Nehru Technological University, Kakinada".

**Preparation of the Soil Amends for Pot Experiments:** The solid sludge was powdered and mixed with black soil and farm yard manure in the ratio 2:1, placed in 15kg pots in different concentrations (5%, 10%, 30% and 50%). The pots were watered with tap water at the rate of 2 l /pot/d.

**Chlorophyll content Experiment:** The Chlorophyll (Chlorophyll-a, Chlorophyll-b and total content) of the 21 Day, 51 Day, 81 Day and 95 Days were measured the (Brinjal) *Solanum melongena L.*

**Chlorophyll Pigments:** Chlorophyll-a, Chlorophyll-b and total chlorophylls were estimated following Harborne (1973). Fresh leaf material (200 mg) from plants grown in different concentrations of solid waste and that of control was ground in a mortar using 80% acetone in the presence of a pinch of Calcium carbo-

rate. The completely homogenized material was centrifuged at 300 rpm for 20 minutes and the supernatant liquid was filtered. The process was repeated till all the chlorophyll was extracted. The filtrate was diluted suitably to a known volume (50ml) with 80% acetone without exposing is to light. The absorbances of the acetone extract were read at two wavelengths 645 nm and 663 nm using UV - visible spectro - Photometer against 80% acetone blank. The amount of different chlorophyll fractions was calculated as mg of chlorophyll/g of leaf tissue according to the formulae given below.

$$\text{Chl - a (mg/g)} = (12.3 A_{663} - 0.86 A_{645}) \times V/100 w$$

$$\text{Chl - b (mg/g)} = (19.3 A_{645} - 3.6 A_{663}) \times V/100 w$$

Total Chlorophyll =  $(20.2 A_{645} + 8.02 A_{663}) \times V/1000 w$ ;  
 Where A = Absorbance of Chlorophyll extract at the specified wave length; V = F mal volume of 80% Chlorophyll extract; and W = Fresh weight of leaf tissue in gm.

**Results and Discussions:** Amounts of total chlorophyll of C plants recorded on 21, 51, 81 and 95 d were 0.223, 0.233, 0.618 and 0.093 mg/g, respectively. As such the total chlorophyll of C plants increased with the crop growth up to 81d and thereafter declined. The total chlorophyll content of the plants of grown in A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> soils have recorded lower chlorophyll values over C in all the harvesting days. Similarly *Solanum* plants grown in A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> soils showed less amount of chlorophyll compared to C soils. The contents of chlorophyll-a, and chlorophyll b exhibited almost similar trends and closely followed the values of total chlorophyll in C plants as well as in A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> plants. In C plants chlorophyll-a has increased steadily up to 81 d and then declined. Plants of A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> soils have also recorded an increase in chlorophyll-a content up to 81 d and then declined. The *Solanum* plants of A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> soils have recorded less chlorophyll-a values when compared to C plants. Similar to chlorophyll-a, the amount of chlorophyll b increased with the growth of the crop until 51d in plants of C and A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> soils and thereafter declined. The *Solanum* plants of A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> soils have recorded less chlorophyll-b values when compared to C plants.

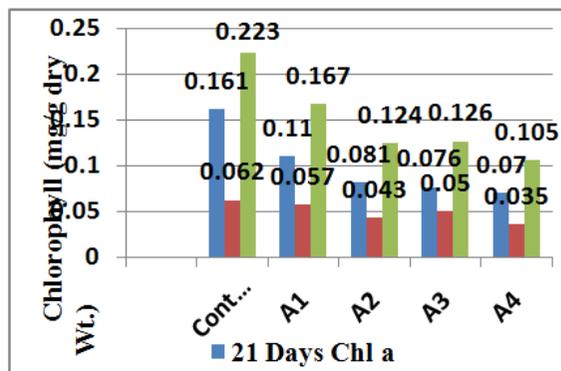
**Table 1: Effect of ISW on chlorophyll content (mg/g dry wt) of *Solanum melongena L.***

Concentration (%)	51 Days		
	Chl a	Chl b	Total Chl
Control	0.167	0.096	0.263
A1	0.146	0.095	0.241
A2	0.128	0.075	0.203
A3	0.081	0.060	0.141
A4	0.062	0.030	0.092

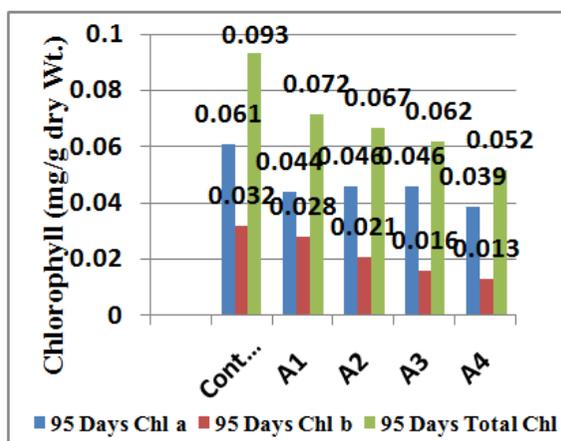
**Table 2: Effect of ISW on chlorophyll content (mg/g dry wt) of *Solanum melongena L.***

Concentration (%)	81 Days		
	Chl a	Chl b	Total Chl
Control	0.334	0.280	0.624
A1	0.276	0.260	0.536
A2	0.250	0.175	0.425
A3	0.185	0.223	0.408
A4	0.115	0.173	0.288

**Fig - 2: Effects of ISW on Chlorophyll (a and b) contents of (21 day Harvest) *Solanum melongena L.***



**Fig - 3: Effects of ISW on Chlorophyll (a and b) contents of (95 day Harvest) *Solanum melongena L.***



**CONCLUSION:** The Brinjal plants grown on Industrial sludge have shown decline in chlorophyll pigments with increase in ISW concentration. The reduced availability of essential minerals like Nitrogen, Phosphorous, Potassium, Calcium and Magnesium might have contributed to the decrease in chlorophyll pigments: chlorophyll - a and chlorophyll - b pigments.

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