



ACCUMULATION OF HEAVYMETALS IN EXPERIMENTAL STUDY OF *Solanum melongena* L. (BRINJAL PLANT) DUE TO OIL & GAS SOLID WASTE

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Abstract - Due to lack of efficient solid waste management system and improper dumping of ISW as open landfills, the ground water and surface water in the Kakinada city is found to be contaminated in industrial area. Heavy metal contamination has been recognized as a major environmental concern in India over the last few decades. 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. In each pot solanum seeds were dibbled in equal distance and depth. A fortnight after only 3 seedlings were retained in each pot at equal distance and the rest were removed. After (Final) harvesting the 95th day *Solanum* plant (Experimental Study) levels of the Copper, Zinc, Iron and Manganese were exceeded in the Root, Shoot, Leaf, Fruit, Chlorophyll a, chlorophyll b and Total chlorophyll. **Levels of Heavy Metals concentrations in the Entire *Solanum melongena* L. Plant body:** Root > Shoot > Leaf > Fruit > Chlorophyll a > Chlorophyll b > Total Chlorophyll

Key words: Andhra Pradesh, East Godavari, Experimental area study, Heavy metals, *Solanum melongena* L.

I. INTRODUCTION:

Environmental pollution is one of the major problems associated with rapid industrialization to affect a rise in living standards of the people. Consequently, pollution from wastes has emerged as a by-product of growth and development. The problems relating to disposal of industrial solid waste are associated with lack of infrastructure and technology facilities for industries to take proper safeguards. Waste is a by-product of life. High standards of living and ever increasing population have resulted in an increase in the quantity of wastes generated. Industrial Solid Waste (ISW) is generally a combination of industrial activities refuse which is generated from the industrial community. Among the multitude of the environmental problem existing in the urbanizing cities of developing countries, ISW management and its impact on ground water quality have become the most prominent in the recent years.

Management of industrial solid waste is distinctly different from the approach used for municipal waste [1]. 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 [2]. 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 [3]. Heavy metals can accumulate in living organisms in living organisms and cause various diseases [4]. Heavy metal toxicity is potentially dangerous because of bioaccumulation through the food chain and this can cause hazards effects on livestock and human health [5] and [6]. 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 [7], [8], [9], [10] and [11].

II. STUDY AREA:

The Kakinada city is the capital of East Godavari District of Andhra Pradesh on the central east coast of India. The area under study Kakinada is located at 16°56'N 82°13'E. It has an average elevation of 2 metres (6 ft) and many areas of the city are below sea level. The present study deals with the Heavy Metal Contamination of Groundwater Due to Industrial Solid Waste Disposal in Kakinada, Andhra Pradesh, India.



Figure 1: Location Map of Kakinada

III. MATERIAL AND METHODS:

Experimental Study of Brinjal:

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. In each pot solanum seeds were dibbled in equal distance and depth. A fortnight after only 3 seedlings were retained in each pot at equal distance and the rest were removed. After (Final) harvesting the *Solanum* plant - 95th day the plant samples were dried in an oven for 48 h at 80°C. After oven dried (80°C) plant material was finely powdered in an agate mortar and used for the analysis of different heavy metals.

IV. RESULTS AND DISCUSSION:

Physico - Chemical characteristics of Plant metal analysis of After (Final) harvesting 95th day *Solanum* plant:

The pH reported for the root, shoot, leaf and fruit in the plant is 5.62, 5.64, 5.33 and 6.22 respectively. The Copper content of the root, shoot, leaf, fruit, chlorophyll content a, b and total chlorophyll in the plant is 10.05%, 9.11%, 8.11%, 7.55%, 0.071%, 0.039% and 0.147% reported respectively. The Zinc content of the root, shoot, leaf, fruit, chlorophyll content a and b and total chlorophyll in the plant is 8.30%, 8.31%, 7.40%, 6.94%, 0.080%, 0.058% and 0.155% reported respectively. The Iron content of the root, shoot, leaf, fruit, chlorophyll content a, b and total chlorophyll in the plant is 8.78%, 8.58%, 8.09%, 7.80%, 0.080%, 0.044% and 0.120% reported respectively. The Manganese content of the root, shoot, leaf, fruit, chlorophyll content a, b and total chlorophyll in the plant is 11.8%, 10.10%, 9.10%, 8.95%, 0.120%, 0.055% and 0.155% reported respectively.

Table 1: The Plant metal analysis of After (Final) harvesting the *Solanum* plant (Experimental Study)

Different parts of field area Plant	Accumulation of Heavy metals in After Harvesting Plant (<i>Solanum melongena</i> L.) (Experimental Study)
Root (%)	Mn > Cu > Fe > Zn
	11.8 > 10.05 > 8.78 > 8.30
Shoot (%)	Mn > Cu > Fe > Zn
	10.10 > 9.11 > 8.58 > 8.31
Leaf (%)	Mn > Cu > Fe > Zn
	9.10 > 8.11 > 8.09 > 7.40
Fruit (%)	Mn > Fe > Cu > Zn
	8.95 > 7.80 > 7.55 > 6.94
Chlorophyll a (%)	Mn > Zn > Fe > Cu
	0.120 > 0.080 > 0.076 > 0.071
Chlorophyll b (%)	Zn > Mn > Fe > Cu
	0.058 > 0.055 > 0.044 > 0.039
Total Chlorophyll (%)	Mn > Cu > Zn > Fe
	0.155 > 0.147 > 0.130 > 0.120

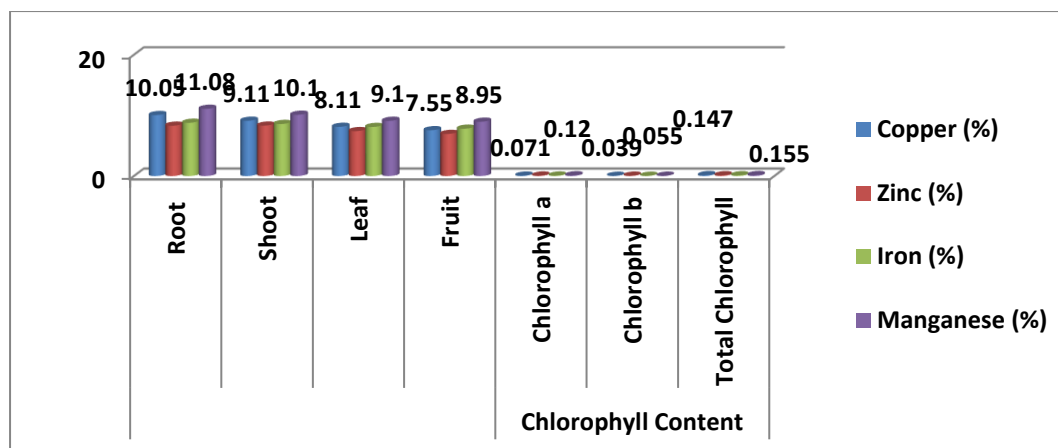


Figure 2: After (Final) harvesting the *Solanum* plant. (Experimental Study)

The Plant metal analysis of after (Final) harvesting the *Solanum* plant: (Experimental Study):

Root:

After Harvesting Plant (Experimental Study): Manganese concentration is more than Copper, Copper concentration is more than Iron and Iron concentration is more than Zinc.

Shoot:

After Harvesting Plant (Experimental Study): Manganese concentration is more than Copper, Copper concentration is more than Iron and Iron concentration is more than Zinc.

Leaf:

After Harvesting Plant (Experimental Study): Manganese concentration is more than Copper, Copper concentration is more than Iron and Iron concentration is more than Zinc.

Fruit:

After Harvesting Plant (Experimental Study): Manganese concentration is more than Iron, Iron concentration is more than copper and Copper concentration is more than Zinc.

Chlorophyll a:

After Harvesting Plant (Experimental Study): Manganese concentration is more than Zinc, Zinc concentration is more than Iron and Iron concentration is more than Copper.

Chlorophyll b:

After Harvesting Plant (Experimental Study): Zinc concentration is more than Manganese, Manganese concentration is more than Iron and Iron concentration is more than Copper.

Total Chlorophyll:

After Harvesting Plant (Experimental Study): Manganese concentration is more than Copper, Copper concentration is more than Zinc and Zinc Concentration is more than Iron.

IV. CONCLUSION:

Levels of Heavy Metals concentrations in the Entire *Solanum melongena* L. Plant body:

Root > Shoot > Leaf > Fruit > Chlorophyll a > Chlorophyll b > Total Chlorophyll

After harvesting the 95th day *solanum* plant in Copper (Cu), Zinc (Zn), Iron (Fe) and Manganese (Mn) in the Brinjal plant of Root, Shoot, Leaf, Fruit, Chlorophyll a, Chlorophyll b and Total chlorophyll contents levels were exceeded.

Proper methods of Industrial solid waste disposal have to be undertaken to ensure that it does not affect the environment ground water contamination around the area or cause health hazards to the people, Flora and Fauna living there. The results of the present study urge further research on all agricultural crops grown in the surroundings of the solid waste dumpsites of all industries in different regions and soils. Due to the oil & gas industrial solid waste disposal Copper, Zinc, Iron and Manganese concentrations are accumulated in the Experimental study of *Solanum melongena* L. plant body parts. The results of this study stress the need for environmental awareness, adequate regulations and proper management of waste sites by the local municipal

authorities. There is a need to check industrial water pollution by implementing strictly the pollution control laws and strict control on the disposal of untreated effluents around the industries needs to be enforced. High concentration of heavy metals and other hazardous substances in the groundwater quality in the Kakinada city in particular need to be evaluated.

V. RECOMMENDATIONS:

- 1) Screening of all agricultural crops to understand their response to the ISW contamination and also make necessary strategies to advise the farmers.
- 2) Urban local bodies may undertake collection, transportation and disposal of solid waste on cost recovery basis as per existing rules and may identify suitable sites for final treatment and disposal of industrial solid waste as per existing rules and regulations.
- 3) Urban local bodies should identify the areas from where industrial solid waste is generated.
- 4) Inventorisation of industries could be attempted through SPCBs or industries department for characterization of wastes.

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