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Analysis Of Marigold Plant Growth On Flyash Amended Soil : A Research

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***Abstract*— Phytoremediation is a great natural process which protect soil and environment from various pollutants. Using an ornamental plant for phytoremediation is also a beneficial experiment from economical point of view. The experiment required 10 pots containing fly ash amended soil in the concentration of 0%, 10%, 20%, 30% and 40%. The soil was prepared checked on different parameters. Some supportive growth fertilizers are added to the mixture and plantlet were planted. The plant was left for two months for growth and plant growth was noted and observed. After that the leaf and flowers were harvested and separated. After that all the required heavy metals were analysed and calculations were done. The results were good which shown that the fly ash amended soil with maximum concentration shows highest productivity. Heavy metals present in soil were up taken by marigold plant. The detailed processes and results are discussed in this research paper further.**

***Index Terms*— Flyash, Heavy metals, phytoremediation, leaf and flower digestion.**

I. INTRODUCTION

The research attempted a great deal in the favour of agricultural field and also in the field of pollution control. Flyash is a greatly captured buy electrostatic precipitator or other particle filtration equipment before the fuel gas reacts the chimney of coal fire power plant and together with bottom of the furnace is in the case jointly known as coal gas. Chemical composition of flyash is Sio2, Al2o3, Fe2o3, CaO, MgO, SO3 in the ratio of 59.38%, 23.59%, 6.11%, 1.94%m, 0.97%, 0.76% respectively. According to ASTM- C_6I_8, Flyash is classified into two groups. Class C which is lignite and Sub bituminous coal (> 10% CaO) where as Class F is bituminous(> 10% CaO). In many ways fluash shows various beneficial activity by showing its pozzolanic activity, containing cementing agent such as Portland cement.

Inspite of these things it has lots of hazardous activity in field of human welfare like toxic constituent depend upon the specific coal bed makeup, but may include one or more of the following elements or substances in quantities from trace amount to be several percent. As, Be, CO, Pb, B, Cd, Mn, Mg, Se, St, Ti and V along with dioxins and PAH compounds.

Phytoremediation is an natural plant process which carry capability of remove or stabilize organic and inorganic pollutants from soil and water sediments with low to moderate level of contamination. It uses different plant species for the removal of contaminants which includes certain heavy metals, pesticides, explosives, crude oils e.t.c.

Flyash contain trace amount of toxic metal like U, Th, Cr, pb, Hg, Cd etc, which may have negative impact on human and plant health. So2 and No2 reacts from PPP causes acid rain, which corrodes structural surface and may affect agriculture, by causing yellowing of leaf. Thermal pollution due to disposal of surface water sources disrupted aquatic life where as toxic materials contaminate underground water resources. 2011 report "EPA" Behind spot: Hexavalent chromium in flyash: Flyash may be the secret of cancer causing chromium in our drinking water and flyash also contains 1 ppm mercury. Light and continuous prolonged inhalation causepneumonitis allergy, asthma, lung fibrosis, bronchitis, cancer and silicosis by observing all hazardous activity of flyash we planted a strategy of amendment of flyash with soil and its utilization in the field of this research played an innovative results and by utilizing flyash with soil amendment and by growing an ornamental plant i.e. marigold on flyash amended soil. Work on this project shows that on different concentration ratio flyash in soil, the growth of marigold plant and its flower was influenced and heavy metal uptake study was also remarkable.

Flyash posses serious environmental problems as regards to its safe disposal. Heavy metals are among the most important contaminant in the environment. Several methods are already used to clean up environment from these kind of contaminants, but most of them are adverse and costly to get optimum results. This research work aims to compile about some heavy metals of Cu, Cd, Pb and Mn and studies on these heavy metal uptake on flyash amended soil through marigold plant by the process of bioaccumulation.

II. MATERIALS AND METHODS

The process of ornamental plant growth on fly ash amended soil is done to check the ability of plant for the removal of heavy metals present in fly ash. The various materials used are Soil**,** Fly ash**,** Bone meal**,** Potash**,** Farm yard manure. These materials are used for soil preparation for the plantation of marigold plant.

The mud pot was used for the experiment which is used for the plantation purpose of marigold plants. Soil was prepared by mixing the fly ash into it in different proportions. The five set was prepared, each set was having two pots. The five set of pot was prepared as 0%, 10%, 20%, 30% and 40% presence of fly ash.

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0% Pot	**5000gm soil + no fly ash**
10% Pot	**4500gm soil + 500gm fly ash +500gm bone meal+ 50gm Potash**
20% Pot	**4000gm soil + 1000gm fly ash +500gm bone meal+ 50gm Potash**
30% Pot	**3500gm soil + 1500gm fly ash +500gm bone meal+ 50gm Potash**
40% Pot	**3000gm soil + 2000gm fly ash +500gm bone meal+ 50gm Potash**

Table- Concentration of different flyash with plant growth and soil

The soil was checked and various parameter were recorded i.e. pH. The soil was prepared after its digestion and sterilization through hot air oven. 30gm of each soil sample taken in a beaker and 60 ml of distilled water was added and mixed properly with the help of glass rod. Then pH was determined by using pH meter after calibration.

Pot with different concentration of fly ash	pH
0% Pot	6.175
10% Pot	6.205
20% Pot	6.310
30% Pot	6.300
40% Pot	6.325

Table- pH concentration of different pots

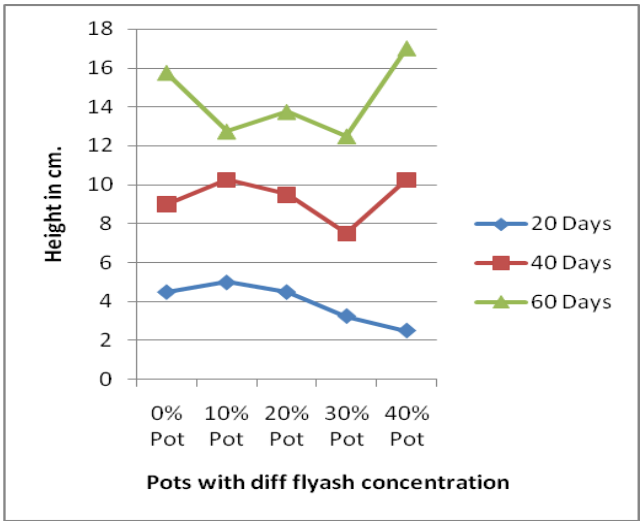
After all of the above process the plantlets were sown in each pots and the date was noted. Watering to plants was done daily for their better growth. The height of plant was noted on every 20- 20 days until plant is harvested.

Results

The plant were harvested on 60th day of plantation. The leaf and flowers were separated and allowed to check for the different parameters. Firstly as the plant height was noted on each 20 days, the graph was observed. On 20th day the count of plant height in 0%, 10%, 20%, 30% and 40% was noted as 4.5, 5, 4.5, 3.25 and 2.5 cm respectively . On 40th day the average height was 9, 10.25, 9.5, 7.5, 10.25 cm respectively but on 60th day the growth of 40% pot was maximum which was noted as 17 cm. the readings of 0%, 10%, 20% and 30% were noted as 15.75, 12.75, 13.75 and 12.50 respectively.

	20 Days	40 Days	60 Days
0% Pot	4.5cm	9 cm	15.75 cm
10% Pot	5 cm	10.25 cm	12.75 cm
20% Pot	4.5 cm	9.5 cm	13.75 cm
30% Pot	3.25 cm	7.5 cm	12.50 cm
40% Pot	2.5 cm	10.25 cm	17 cm

Table- Calculation of mean height of marigold plants of pots with different flyash concentration (height in cm)



Graph- Deviation in height of moong plant cultivated in different concentration of flyash amended soil

III. Discussion & Calculations

The conducted experiment shows tremendous results. According to its result fly ash amended soil is an useful idea for cultivation of ornamental flower plants like marigold and it is also beneficial from economical point of view and waste management system. The plant up taken the heavy metals present inside flyash and protects the earth damage. We have calculated the amount of heavy metals uptake by plant parts. This is calculated after harvesting and digesting the marigold mature plants.

For the digestion of leaf and flowers laboratory methods are taken. Silica dishes were weighed and 1 gm of each leaf and flower sample was also weighed. These samples were oven dried at 108^{o} C for 1 hr and then cooled. Dishes were weighed with samples and moisture content was taken out by using formula

Loss of weight / sample weight x 100 = % of moisture

Where, Loss of weight = total weight – total weight after oven drying

Total weight = sample weight + dish weight

Different value (in gm) of each powdered leaf and flower tissue was ashed in a muffle furnace (lunar), initially at 450^{o}C for 45 minute for charring to avoid the graphical formation then at 850^{o}C for 1hr. Now the ash is ready for digestion.

The resulting ash was dissolved in 25ml of 6N HNO_3 and heated at low temperature at about 70^{o}C for whole day on a hot plate to extract total leaf metals. Sample was cooled and filtered through whattman 42 filter paper into a 50ml volumetric flask with distilled water. After dilution, samples were ready for metal analysis by AAS.

	Digestion of leaf	Digestion of flower
0% Pot	1.8583 gm	3.24685 gm
10% Pot	2.8765 gm	3.1145 gm
20% Pot	2.1631 gm	3.1452 gm
30% Pot	1.6533 gm	3.4549 gm
40% Pot	1.90005 gm	4.3434 gm

Table- Mean calculation of digestion of leaf and flower of marigold plant (weighed in gm)

IV. HEAVY METAL ANALYSIS

The heavy metals (Cu, pb, mn and Cd) analysed for this study was chosen because all are common anthropogenic pollutant that are frequently investigated in studies analysing the metal content of soil and plant tissue. Determination of the concentration of Cu, Pb, Cd and Mn in leaf, flower and soil extract was carried out by flame atomic absorption spectroscopy using a 'Thermo Scientific M series' Atomic Absorption Spectrometer. This instrument was calibrated using standard solution known concentration of each metal Standard solution was prepared by diluting 1000 ppm of high purity stock solution (MERCK standard solution) of each metal in acidic water of pH <2. These external standard solution were used to generate calibration curves for assessing the concentration of each metals in the soil and leaf sample. Analysis is done by using respective wavelength of Cu- 324.7 nm, Mn- 279.8 nm, Pb- 217 nm, Cd- 228.8nm.

Data quality was assessed by preparing and analysing a replica of every soil and leaf samples and by periodically reading the standard solution during analysis. All metal concentration values are reported as mg/kg and are based on soil or leaf dry weight. Formula for heavy metal analysis:

$C/10^6$ x V x 100/ W

Where; C= concentration of sample, V= volume of flask and W= weight

The heavy metal analysis in flower of marigold plant showed that Cu accumulation was maximum by 20% flyash pot which was calculated 16.321 mg/kg. Mn accumulation was maximum in 40% flyash pot which was calculated 68.009 mg/kg. Pb accumulation was maximum in 20% flyash pot which was calculated 23.686 mg/kg and Cd accumulation was macimum in 30% flyash pot which was calculated 0.104 mg/kg but was in very little amount.

In Flower	Cu	Mn	Pb	Cd
0% Pot	12.654 mg/kg	39.327 mg/kg	14.904 mg/kg	0.4035 mg/kg
10% Pot	11.611 mg/kg	29.548 mg/kg	10.893 mg/kg	Bdl
20% Pot	16.321 mg/kg	41.860 mg/kg	23.686 mg/kg	0.5085 mg/kg
30% Pot	7.179 mg/kg	54.669 mg/kg	12.492 mg/kg	0.104 mg/kg
40% Pot	7.7642 mg/kg	68.099 mg/kg	15.339 mg/kg	Bdl

Table- Calculation of mean value of accumulation of cu, mn, pb, cd (mg/kg) in flower of marigold plant.

The heavy metal analysis in leaf of marigold plant showed that Cu accumulation was maximum in 30% flyash pot which was calculated 24.430 mg/kg. Mn accumulation was maximum in 30% flyash pot which was calculated 215.925 mg/kg. Pb accumulation was maximum in 10% flyash pot which was calculated 9.4043 mg/kg and Cd accumulation was macimum in 20% flyash pot which was calculated 0.412 mg/kg but was in very little amount.

In Leaf	Cu	Mn	Pb	Cd
0% Pot	3.7275 mg/kg	198.574 mg/kg	8.9835 mg/kg	0.3385 mg/kg
10% Pot	12.3175 mg/kg	297.667 mg/kg	9.4043 mg/kg	0.138 mg/kg
20% Pot	6.8005 mg/kg	188.9043 mg/kg	6.4275 mg/kg	0.412 mg/kg
30% Pot	24.430 mg/kg	215.925 mg/kg	7.038 mg/kg	Bdl
40% Pot	14.7825 mg/kg	198.539 mg/kg	7.005 mg/kg	0.198 mg/kg

Table- Calculation of mean value of accumulation of cu, mn, pb, cd (mg/kg) in plant leaf of marigold plant.

CONCLUSION

To achieve the objective of the present study, marigold flower and leaf samples and soil samples were analyzed using various methods. Those samples were analyzed for pH, moisture, digestion, filtration and heavy metal analysis of Cd, Pb, Cu and Mn. The analytical data were evaluated in terms of the chemical characteristics of the flower leaf and fly ash amended soil and compared. Analysis of soil, leaf and flower samples shown the successful result in concern to the experiment.

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