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A Preliminary Analysis on Impacts of Industrial Effluent on Morphology of Amaranthus sps

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Abstract

In India, most of the industries are releasing out their effluents without any treatment processes. This release of hazardous effluent to the nearby water resources or open land area results in serious environmental issues. In concern to this, the present study is an attempt to observe the impacts of industrial effluent on the morphology of the *Amaranthus* species. The periodic addition of effluent made drastic changes in the growth rate of the *Amaranthus* plant species. The treatment of plant with the effluent was for duration of five weeks with different treatment concentrations of 10%, 20%, 30%, 40% and 50%. In the first week of effluent addition, the shoot length and the number of leaves of plant in the control set were 5.1cm and 6 respectively, for 10%, it was 5.2cm shoot length and 6 leaves, for 20%, 30% and 40% was 5.1 shoot length and 6 leaves but in the 50% was 5.1cm shoot length and 7 leaves. So there were noticeable changes in the morphology at different treatment concentrations. But after the treatment of five weeks, the control plant had the highest shoot length of 21.7cm and 15 leaves; it gets decreased to 17.3cm of shoot length and number of leaves 9 in the 50% concentration. Plants treated with 10% effluent gave 20cm shoot length and 13 leaves, 20% showed 18cm shoot length and 12 leaves, 30% showed 17.8 cm shoot length and 10 leaves and 40% showed 15cm shoot length and 10 leaves. From these observations, it was very clear that the effluent releasing from the industries is capable to make desired changes in the normal growth rate of the plants and it is not suitable for the irrigation purposes.

Key words: Industrial effluent, Amaranthus sps, Shoot length, Morphology

Introduction

Industrialisation had made many environmental issues such as the air pollution, water pollution, soil pollution etc. As the population increases the need for the goods also increases, increased need by the people increases the production and establishment of new industries. Industrialisation has a major role in the economic development, but along with it also makes serious harm to the environment through the release of hazardous waste release. The major issue facing by the nation is the disposal of hazardous industrial wastes (treated or untreated) in limited land area so generally the liquid wastes or the effluent releasing from the industries are releasing to the nearby water resources. The quality of dissolved minerals in water depends upon the source of water and its path before use (Ahmed *et al.*, 1993)[1]. Soil ecosystems throughout has been contaminated by various anthropogenic activities results in health hazards to animals and plants through food chain (Tu *et al.*, 2000; Dahmani-Mueller *et al.*, 2001; McGrath *et al.*, 2002)[8][2][6]. So in order to reduce these effects the treatment of the effluent before the release to the open land area or to the water bodies are very necessary. *Amaranthus sps* is a leafy vegetable with high nutritional value and short life span, these are one of the important food

source to the people living in china and south India. The current study is based on the effect of industrial effluent on the morphology of *Amaranthus* sps (shoot length and number of leaves) at different concentration of 10%, 20%, 30%, 40% and 50% for a treatment period of 5 weeks. The result showed that the effluents are capable to cause desired changes to the morphology of the plant. Industrial wastes are major sources of
pollution in all environments and require on-site treatment before discharge out to the open land or to the nearby water resources (Emongor *et al.*, 2005)[3].

Materials and methods

This study was based on the impacts of industrial effluent on the growth rate and morphology in *Amaranthus* sps. The *Amranthus* sps (red spinach) (figure 1) is a leafy vegetable with high nutritional value. It is a short- lived perennial plants. It is a summer annual plant mainly considered as a leafy vegetable. It has a life span of three months.

Fig 1: Amaranthus sps

Classification of Amaranthus sps
Kingdom: Plantae
Class: Eudicots
Order: Caryophyllales
Family: Amaranthaceae
Genus: Amaranthus

The experiment was done in two stages, stage 1 and stage 2. In stage 1, the seedlings of spinach was sawed in five sets of grow bags and treated with the industrial effluent of four different concentrations as 100%, 75%, 50% and 25% and the remaining one was kept separate as control and treated with normal water. The treatment of effluent was done twice in a week and changes were observed.

Results and discussions

After three days of the first addition of the effluent only the seedlings sawed in the control sample set was germinated. One day later the seedlings in the 25% effluent treated sample were observed as germinated and the remaining sets had been seeing unchanged. The number of seedlings and the health of seedlings germinated in the 25% treatment sample was less when compared with the control sample set. The second effluent treatment destroyed the remaining

seedlings germinated in the 25% sample set. Due to the complete degradation of the samples the experiment was shifted to the stage two. Bishwas *et al.*, 2002[7] found that the increasing concentration of the effluent induced gradual reduction in the germination percentage and seedling growth. In stage 2 the germinated seeds from the control set was split to five sets and the treatment concentration was reduced to 10%, 20%, 30%, 40%, and 50% respectively. And the effluent treatment was reduced by once in a week. Shoot length, no of leaves present are observed periodically once in a week. The observations are listed out in the table 1and 2 below.

Table 1: Morphological observations of plant at different treatment concentrations

Observation periods	Treatment concentrations					
	Control		10%		20%	
	Shoot Length(Cm)	No of Leaves	Shoot Length(Cm)	No of Leaves	Shoot Length(Cm)	No of Leaves
1st week	5.1	6	5.2	6	5.2	6
2nd week	8.6	7	8.4	7	8.1	7
3rd week	14.3	12	14.1	8	12.2	7
4th week	18.1	13	17.5	11	14.1	9
5th week	21.7	15	20	13	18	12

Table 2: Morphological observations of plant at different treatment concentrations

Observation periods	Treatment concentrations					
	30%		40%		50%	
	Shoot Length(cm)	No of Leaves	Shoot Length(cm)	No of Leaves	Shoot Length(cm)	No of Leaves
1st week	5.1	6	5.1	6	5.1	7
2nd week	8.3	7	7	7	7	7
3rd week	10.2	7	9.6	8	7.3	6
4th week	12.9	8	12.5	9	9.8	8
5th week	17.8	10	15	10	17.3	9

After the effluent treatment of first week, it was observed that the control set had the shoot length of 5.1cm and 6 leaves, 10% has 5.2cm shoot length and 6 leaves, 20% had 5.2cm shoot length and 6 leaves, 305 has 5.1cm shoot length and 6 leaves, 40% has 5.1cm shoot length and 6 leaves and the 50% treatment set has 5.1cm shoot length and 7 leaves. In second week of treatment the control set had the shoot length of 8.6cm and 7 leaves, 10% had the shoot length of 8.4cm and 7 leaves, 20% had the shoot length of 8.1cm and 7 leaves, 30% had the shoot length of 8.3cm and 7 leaves, 40% had 7 cm shoot length and 7 leaves and 50% had the 7 cm shoot length and the 7 leaves. In third week the control set had the shoot length of 14.3cm and 12 leaves, 10% had the

shoot length of 14.1cm and 8 leaves, 20% had the shoot length of 12.2cm and 7 leaves, 30% had the shoot length of 10.2cm and 7 leaves, 40% had 9.6 cm shoot length and 8 leaves and 50% had the 7.3 cm shoot length and the 6 leaves.

In fourth week the control set had the shoot length of 18.2cm and 13 leaves, 10% had the shoot length of 17.5cm and 11 leaves, 20% had the shoot length of 14.1cm and 9 leaves, 30% had the shoot length of 12.9cm and 8 leaves, 40% had 12.5 cm shoot length and 9 leaves and 50% had the 9.8 cm shoot length and the 8 leaves. After the final treatment of fifth week it was observed that the control set had the shoot length of 21.7cm and 15 leaves, 10% had the shoot length of 20cm and 13 leaves, 20% had the shoot length of 18cm and 12 leaves, 30% had the shoot length of 17.8cm and 10 leaves, 40% had 15cm shoot length and 10 leaves and 50% has the 17.3 cm shoot length and the 9 leaves. From the above results, it was observed that, after the five weeks of effluent treatment at concentrations of 10%, 20%, 30%, 40% and 50%, the control set of plants showed the highest growth with a shoot length of 21.7cm 15 leaves and the lowest growth rate was observed in the plant set of 50% effluent treatment with a shoot length of 17.3cm and 9 leaves.

Katepogu Raju *et al.,* 2015[4] also observed that the addition of industrial effluent is capable to cause desired changes to the growth rate o the plant. As the treatment period increases the growth rate of the plant gets decreases with decreased shoot length. And also he observed that the higher concentrations of effluent were found to inhibit the germination and growth of paddy. M.O. Islam *et al.*, 2006[5] observed that plant height of rice was decreased in the contaminated soils as compared with the normal agricultural soils. The reduction of plant height by different treatments over normal agricultural soil (Reduction Over Control) ranged between 7 to 19, 25 to 37 and 50 to 65% during 30, 60 and 85 days of treatment.

Hence, the present results are highly significant. The rate of reduction was found to increase with time and increase in concentration of effluent. The distinguishable change to the morphology (shoot length and number of leaves) may be due to the effect of effluent added. The highest no of leaves is observed in the control set of plants and it got reduced as the effluent concentration increases from 10% to 50%, the no of leaves present in the control set is 15 and it got reduced by 9 in the 50% set. M.O. Islam *et al.*, 2006[5] observed that the number of leaves in rice was reduced by the contaminated soil and the effects were more pronounced with the advent of plant growth. After 60 days of effluent influence, the reduction of tiller numbers as compared to normal agricultural soil (Reduction over Control) ranged between 33 and 40%. After 85 days the Reduction over Control was 50% to 74% and these values are highly significant. The rottening of several tillers in contaminated soils were also observed at the later stage of plant growth. Similar observations were also noticed in case of rottening of leaves in the present study.

Conclusion

From the observations for the 5 weeks of treatment showed that the industrial effluents are capable to cause desirable changes in the morphology of plant species. At the final stage of treatment, the sample set which showed the highest shoot length and leaf number was the control set with 21.7 cm shoot length and 15 leaves and the lowest shoot length was recorded in the 50% sample set 17.3 shoot length and 9 leaves. So from this it was very clear that the shoot length and the number of leaves were less in the sample sets as the treatment concentration increased from 10%, 20%, 30%, 40% and 50%. So it is very important to treat the effluent before it is disposed out from the industries, other ways it is capable to cause serious issues to the sensitive plant varieties and change its morphology. The observations showed that as the treatment concentrations increased,

the growth rate of the plant got reduced and noticeable reduction in the number of leaves was also there.

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