



Effect of Fly Ash on Survival of *Rhizoclonium Hieroglyphicum*

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ABSTRACT

Fly ash is hazardous to organism and had adverse effect on the survival of *Rhizoclonium hieroglyphicum*. The alga could not survive in presence of fly ash, as its chlorophyll content at 1000 ppm became zero on the eleventh day of inoculation of alga. At 500 ppm concentration of fly ash the alga died on eighth day after inoculation. The chlorophyll content of the alga decreased as the concentration of fly ash increased. It also decreased as the day of experimentation proceed.

Keywords: Chlorophyll content; Fly ash; *Rhizoclonium hieroglyphicum* ; Survival.

1. INTRODUCTION

Fly ash is a byproduct obtained from industries where coal or lignite is burnt like thermal power plant, steel, sugar, fertilizer industries etc. Coal based power plants generate a variety of pollutants along with a huge quantity of fly-ash that is usually dumped in nearby areas which affect the environment. Fly ash is a major waste of thermal power plants. Fly ash is hazardous to living organisms because of its minute particle size and the presence of potentially toxic elements like vanadium, antimony, arsenic, boron, aluminum and chromium (Mehra *et al.* 1998), which limits the survival and growth of plants (Wong and Wong, 1986).

2. MATERIAL & METHODS

Green filaments of *Rhizoclonium hieroglyphicum* were collected from a pond water at the garden of Botany Department, University of Allahabad. The unialgal cultures of the alga were isolated and grown in Bold Basal Medium (BBM) (Nichols and Bold, 1965; pH adjust to 7.5 prior to autoclaving) at the temperature 25 ± 1 °C and fluorescent light intensity of *ca.* 40 $\mu\text{mol m}^{-2} \text{s}^{-1}$ for 16 h per day in the culture chamber.

The algal filaments were given stress condition with different concentration of fly ash (from 0.1 ppm to 1000 ppm) by inoculating the algal filaments in culture medium containing different concentration of fly ash. Stock solution (1000 ppm) of fly ash was prepared by dissolving desired amount of salt in BBM and further diluting it to make desired concentrations from 0.1 ppm to 1000 ppm. The inoculated culture tubes were placed in the culture chamber at control culture conditions. Each set of experiment had three replicates. Cultures were

examined periodically to determine the total chlorophyll content using spectrophotometer (Mckinney, 1941) with respect to culture grown in control medium (BBM without fly ash concentration).

The total chlorophyll content of the alga was a criterion chosen to estimate the survival of alga.

2.1 Chemical Composition of Fly Ash

In the present study, the fly ash obtained from the NTPC, Tanda, U.P. was used. The physical and chemical properties are shown in table 1. (Alvin Harison *et al.* 2013).

3. RESULT & DISCUSSION

The total chlorophyll content of *Rhizoclonium hieroglyphicum* increased at lower concentrations of fly ash (0.1 ppm, 0.5 ppm 1 ppm and 10 ppm) during the initial days of experiment but at higher concentration of fly ash it gradually decreased which was evident after one day of inoculation itself. As the day of experimentation proceed the total chlorophyll content decrease at every concentration of fly ash and became zero on eighth day after inoculation at 1000 ppm of fly ash. The total chlorophyll content at 500 ppm became zero on eleventh day after inoculation. At, other concentration, total chlorophyll content decreased as number of days increased from one day to eleven day (Table 2).

Due to the presence of heavy metals in fly ash the chain of *Spirogyra* breaks. Thus, they cannot survive in fly ash discharged water pond. The limit of fly ash for *Spirogyra* was 0.5 gm in 100 ml for 4 days exposure at

30 °C room temperature in hot summer of central India. LD 50 of fly ash for *Spirogyra* was 1.00 gm in 100 ml at 2 days exposure at 30 °C room temperature in hot summer (Shrivastava *et al.* 2012).

In *Ulva lactuca*, DGR (daily growth rate), chlorophyll a, chlorophyll b and carotenoid content

showed decrement over the control at all the concentrations (0.25 to 5.0%) of fly ash. At lower concentrations (0.25, 0.50 and 1.00%) of fly ash, the amount of carbohydrate was found to be more than the control (Sornalakshmi and Venkataraman, 2014).

Table 1. Physical and chemical properties of fly ash.

Chemical Composition (%)	
Silicon dioxide (SiO ₂) + Aluminum oxide (Al ₂ O ₃) + Iron oxide (Fe ₂ O ₃)	95.5
Silicon dioxide (SiO ₂)	60.5
Sulphur trioxide (SO ₃)	0.2
Reactive Silica (SiO ₂)	33.4
Chlorides (Cl)	0.01
Magnesium oxide (MgO)	0.6
Loss on Ignition	1.1
Sodium oxide (Na ₂ O)	0.1
Physical Properties	
Specific gravity	2.30
Mean grain size (µm)	20
Specific area (cm ² /gm)	2680
Colour	Grey to black

Table 2. Effect of fly ash on survival (in terms of total chlorophyll content*) of *Rhizoclonium hieroglyphicum*.

Day of inoculation	Concentration of fly ash in ppm →									
	0 ppm	0.1 ppm	0.5 ppm	1 ppm	10 ppm	50 ppm	100 ppm	250 ppm	500 ppm	1000 ppm
Total chlorophyll content of the alga* →										
1 st day	6.08	6.1679	6.193	6.2048	6.211	5.801	5.8662	4.824	4.197	4.0165
3 rd day	6.2081	6.28	6.203	6.201	6.0933	5.383	4.332	4.0815	3.4255	3.32395
5 th day	5.988	5.892	5.9635	5.3679	5.938	3.6075	3.2118	2.9615	2.5265	1.9135
8 th day	6.03	5.598	5.3815	4.0035	4.756	2.5265	2.5011	1.6565	1.0021	0
11 th day	6.3803	4.824	4.2515	3.2395	2.6655	1.9641	1.7165	1.312	0	0

a. *Chlorophyll content in $\times 10^{-3}$ mg/ml

b. All readings are means of three replicates.

c. 0- Indicates the death of algal filaments (Filaments became hyaline)

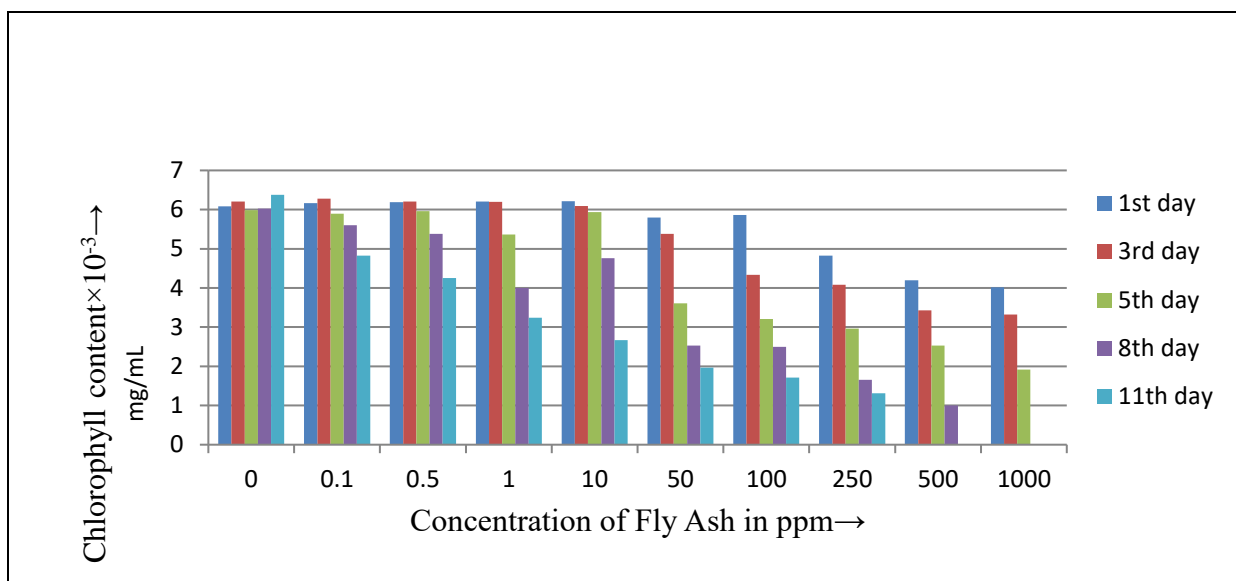


Fig. 1: Effect of Fly Ash on survival of *Rhizoclonium hieroglyphicum*.

4. CONCLUSION

From above study it can be concluded that

- i. The fly ash is harmful for the algal survival.
- ii. At lower concentration fly ash has positive effect on growth of alga as its total chlorophyll content increases.
- iii. Higher concentration does not favour alga and the algal filaments died (became hyaline).

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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