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Effect of effluent from Bokaro Steel Plant on chlorophyll content of *Rhizoclonium hieroglyphicum*

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Abstract

Rhizoclonium hieroglyphicum could not survive in effluent from Cold Rolling Mill III (CRM III) of Bokaro Steel Plant as chlorophyll content of the alga decreased with the increase in concentration of effluent from 1% to 100% of effluent concentration. Similarly, the algal chlorophyll content decreased with the increase in day of inoculation of alga in effluent concentration.

Keywords: *Rhizoclonium hieroglyphicum*, Effluent from Bokaro Steel Plant (BSL), chlorophyll content.

Introduction

Steel plant is included in the list of major industry. Steel production at an integrated steel plant involved the three basic steps. In the first step, iron ore blended with coke and lime stone is heated/reduced in blast furnace to form molten metal. In second step, molten metal is further oxidized to make steel. In third step, liquid steel is molded/ casted as slab which is ultimately hot/ cold rolled as per customer demand. The iron and steel industry involves a myriad of operations which generate vast volumes of air emissions, liquid effluents and solid wastes (S.Rajbala and R.Bhaskar, 2012).

The effluent from Bhilai Steel Plant had high concentration of Cobalt, Copper, Lead, Nickel, Zinc, Cadmium and Magnesium in the form of sulphates, phosphate, chloride, carbonate, nitrate and nitrites etc. so the plant *Calocacia* sp.L. present near the effluent channel showed a drastic change in its height(the height increased from 45 cm to 96 cm). In leaves of plant concentration of chlorophyll a, b, total chlorophyll and magnesium increased (B.Pandey et al, 2014).

Materials and Methods

Green filaments of *Rhizoclonium hieroglyphicum* were collected from a pond 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 µmol m^{-2} s^{-1} for 16 h per day in the culture chamber.

The algal filaments were given stress with different concentration of effluent obtained from Cold Rolling Mill III (CRM III) of Bokaro Steel Plant (BSL). The different concentration of effluent used during the experiment were 100%, 50%, 25%, 10%, 5% and 1%. The desired concentration of effluent was obtained by diluting the effluent (100%) with the desired level of BBM. The inoculated culture tubes were placed in the culture chamber at control culture conditions. Each set of experiment has three replicates. Cultures were examined periodically to determine the chlorophyll content of the alga using spectrophotometer (Mckinney, 1941) with respect to culture grown in control medium (BBM without salt concentration).

Table 1 Analysis of the effluent from Bokaro steel plant

Parameters	Value
Emulsion Content (%)	1.3
pH	4.41
Conductivity(µs/cm)	180
Iron (ppm)	45
Chloride(ppm)	34

The data provided by Quaker Chemical Corporation, Bokaro Steel Plant Site Lab.

Results and Discussion

The effluent from CRM III of Bokaro Steel Plant (BSL) has negative effect on the chlorophyll content of the alga *Rhizoclonium hieroglyphicum*. As shown in table I the chlorophyll content of the alga decreased after the one day of inoculation. The chlorophyll content of the alga decreased with the increase in concentration of effluent from 1% to 100% and also with the increase in day of inoculation. After eight days of inoculation the chlorophyll content became zero at 100% of effluent concentration. After 10 days of inoculation even at 50% of effluent concentration the chlorophyll content of the alga became zero and chlorophyll content at other effluent concentration i.e. 1%, 5%, 10%, and 25% it decreases rapidly with respect to the alga grown in control medium.

Table 2 - Effect of effluent from CRM III/ BSL on Chlorophyll content* of *Rhizoclonium hieroglyphicum*

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

Day of inoculation↓	Concentration of effluent from BSL →						
	0% (Control)	1%	5%	10%	25%	50%	100%
	Total chlorophyll content of algae*(mg/ml)→						
1st day	14.25	11.625	11.276	10.6345	9.692	10.627	7.0385
3rd day	14.34	10.89	10.674	10.462	9.087	9.018	5.987
5th day	13.945	8.788	8.65	7.943	6.549	5.669	2.416
8th day	14.586	7.762	7.074	5.680	3.825	2.218	0
10th day	14.07	6.88	5.903	5.426	1.847	0	0

b. All readings are means of three replicates.

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

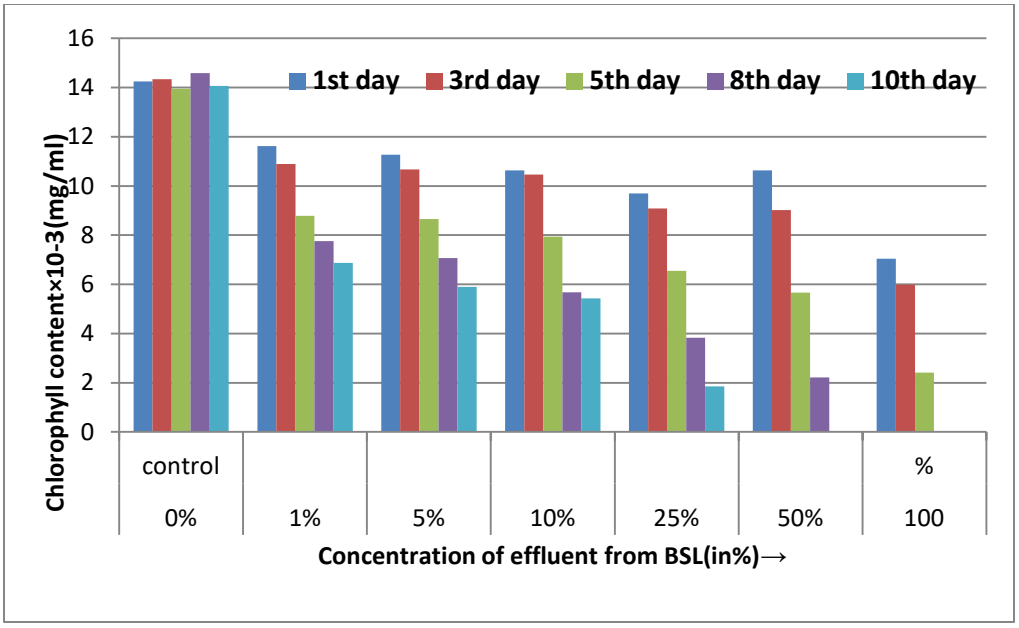

Fig 1 - Effect of effluent from BSL on Chlorophyll content of *Rhizoclonium hieroglyphicum*

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