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Effect of sodium arsenate on chlorophyll content of *Pithophora oedogonia* (Montagne) Wittrock

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Abstract

Chlorophyll content of the alga *Pithophora oedogonia* decreased as the concentration of Sodium arsenate increased from 50ppm to 1000ppm (i.e. at 100, 250, 500 and 1000 ppm) after one day of inoculation. As the day proceed, the chlorophyll content decreased rapidly and this might be because the algal filaments could not survive at higher concentration of sodium arsenate.

Keywords: *Pithophora oedogonia*, Sodium arsenate, chlorophyll content.

Introduction

Arsenic is a well-known carcinogen contaminating the ground water in many countries; majorly in India, Vietnam, Bangladesh and Pakistan. Arsenate is the dominating arsenic species in natural waters while arsenite predominates in interstitial water of sediments. In addition, arsenic may be present as organic compounds or in inorganic complexes. The most significant route of arsenic into aquatic biota is the uptake of arsenate in algae. Algae have a high capacity to transform arsenate to arsenite, methylated arsenic acids, arsenosugars and arsenolipids. Algae are also the main target of arsenate toxicity and the mode of action is through interference with phosphate metabolism, particularly in photosynthesis.

Periphyton and *Fucus* from the Baltic Sea are affected at levels found in large areas of the sea around a smelter discharging into the Gulf of Bothnia. Since *Fucus* is the dominating structural element of Baltic littoral ecosystems, impact on this plant may cause drastic secondary effects on the entire ecosystem. Fresh water algal communities are affected at concentrations similar to or even lower than the back-ground levels of many Swedish lakes (Blanck et al).

The growth rates of *Melosira granulata* var. angustissima *O. Müll*, and *Ochromonas vallesiaca Chodat* were depressed by 1 µM arsenate. *Chlamydomonas reinhardtii* Dang. required 10 µM of arsenate for the same degree of depression, while the growth rates of *Cryptomonas eroasa* Ehr. and *Anabaena variabilis* Kütz. were unaffeted up to 100 µM of arsenate (Planas and Healey, 1978).

Arsenate (1-25µM) reduced the photosynthesis and cell growth in five strains of *Chlorella vulgaris* (Creed et al, 1990).

According to Budd and Craig (1981), more than 200µM arsenate was required to negatively affect the growth of *Synechococcus leopoliensis*.

Materials and Methods

Green filaments of *Pithophora oedogonia* 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 sodium arsenate (from 1000ppm to 0.1ppm). Stock solution (1000ppm) of sodium arsenate was prepared by dissolving desired amount of salt in BBM and further diluting it to make desired concentration. 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

chlorophyll content using spectrophotometer (Mckinney, 1941) with respect to culture grown in control medium (BBM without salt concentration).

Results and Discussion

Chlorophyll content of the alga was decreased as the day proceed and also with the increase in concentration of sodium arsenate with respect to control. After one day of inoculation the alga showed some increase in chlorophyll content upto certain concentration (0.1, 0.5, 1, 10 ppm) but as the concentration of sodium arsenate increases i.e. from above 50 ppm the amount of chlorophyll content decreased as shown in table-I. As the day of inoculation proceed, the chlorophyll content decreased even at lower concentration. At concentration of 1000 ppm and 500 ppm of sodium arsenate (table-I) after 10 day of inoculation the chlorophyll content of the alga became zero.

Planas and Healey (1978) reported that the concentration of 1µM arsenate depressed the growth of *Melosira granulates* and *Ochromonas vallesiaca* whereas concentration greater than 100µM of arsenate were required for similar growth reduction in other strain (*Cryptomonas eroda* and *Anabena variabilis*).

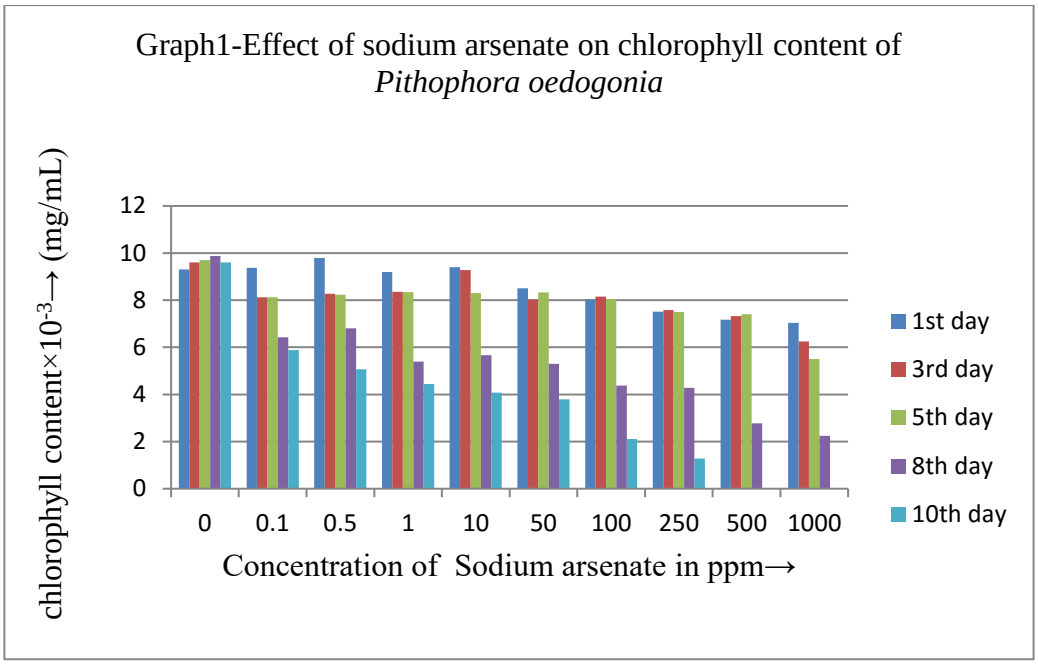
According to Jasrotia et al(2014) *Cladophora* sp. can survive in an arsenic concentration of upto 6mg/L in water and at a concentration of 80mg/L *Cladophora* can biosorb nearly 100% arsenic from water in a contact period of upto 9-10 days after which desorption starts.

Arsenic (III) and Arsenic (V) exerted toxic effects on *Stichococcus bacilaris*, both culture and chlorophyll (a+b) content of the alga decreased over time period with increased arsenic concentrations (Skowronska B.P. et al, 2004).

Table I -Effect of sodium arsenate on chlorophyll content* of *Pithophora oedogonia*

Day of inoculation↓	Concentration of sodium arsenate in ppm →									
	0 Ppm	0.1 ppm	0.5 Ppm	1 ppm	10 Ppm	50 ppm	100 ppm	250 ppm	500 ppm	1000 Ppm
1st day	9.3	9.37	9.8	9.2	9.4	8.5	8.03	7.508	7.179	7.04
3rd day	9.6	8.1205	8.272	8.35025	9.277725	8.0295	8.15725	7.58225	7.32375	6.25
5th day	9.7	8.12625	8.2375	8.337	8.2977	8.3225	8.04	7.5	7.4005	5.5
8th day	9.873	6.4255	6.801	5.4	5.67	5.305	4.375	4.278	2.78	1.374
10th day	9.6	5.89	5.07	4.45	4.082	3.786	2.108	1.28	0	0

*chlorophyll content in $\times 10^{-3}$ mg/mL



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