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BIOREMOVAL OF Cr (VI) BY DRY BIOMASS OF THE CYANOBACTERIUM *Aulosira fertilissima*: EFFECT OF METAL CONCENTRATION

REKHA SHUKLA[a1], A.K. PANDEY[b] AND K.N. MISHRA[c]

[ab]Biological Research Lab., Department of Botany, Kutir P.G. College, Chakkey, Jaunpur , Uttar Pradesh, India
[c]Department of Botany, T.D.P.G College, Jaunpur, Uttar Pradesh, India

ABSTRACT

Bioremoval of Cr (VI) by *A. fertilissima* was studied from Cr (VI) containing waste water. The present observation suggesting that the externally added dry biomass showed metal sorption like physical sorbents, therefore, it may play an important role as a substitute of physical sorbents in waste water treatment. The extent of sorption was increased rapid in the beginning and became show reaching towards saturation. The overall pattern of Cr (VI) sorption rate seems to be dependent on the concentration of Cr (VI) in the external medium.

KEYWORDS: Bioremoval, Cr (VI), Dry biomass, Concentration, *Aulosira fertilissima.*

Several past episodes of mishaps due to heavy metal contamination in the aquatic environment have increased the awareness about their toxicity due to their biomagnification, accumulation in food chain and persistence in terrestrial and aquatic ecosystem (Chen and Pan 2005). Some of the present methods, to cleanup metal from environment, result the production of harmful byproducts. Therefore, eco-friendly process needs to develop to clean up the environment.

Cyanobacteria are largest and most diverse group of photosynthetic prokaryotes. They are O_2-evolving organisms, those respond to stress condition (Borbely *et al*., 1990) and responding passive accumulation in cells and surface binding to functional groups (Gardea-Torresdey *et al*., 1990; Phoenix *et al*., 2002; Yee *et al*., 2004) and remove harmful metals from the environment by absorbing and taking metal ions (Bender *et al*., 1994).

Not only living biomass but also dead/dry cells/chemically modified biomass accumulate heavy metal ions (Aksu, 1998; Banarjee *et al*., 2008; Munir *et al*., 2010; Singh and Pandey 2011). In the present study, the bioremoval of Cr (VI) by cyanobacterial dry biomass of *Aulosira fertilissima* was investigation in the different mental concentrations.

MATERIALS AND METHODS

Exponentially grown *Aulosira fertilissima* was inoculated in 2L sterilized BG-11 medium at pH 7 and temperature 25±1ºC under illumination of 2700±200 lux cool florescent light with light and dark cycle of 10 and 14 hrs.

Cr (VI) Removal Experiment

Exponentially grown, 8 days old cyanobacterial culture were harvested by centrifugation and repeatedly washed with triple distilled water. Harvested cyanobacterial pellets were dried at 70ºC in a hot air oven till a constant weight and ground in a grinder. Analytical grade of potassium dichromate (Loba chemicals) was used in all experiments related to the bioremoval of Cr (VI). Metal solutions were prepared by dissolving potassium dichromate in sterilized water. The experiments were carried out in sterilized water at pH 6.8±0.2 of the original metal solution. The final volume of cell suspension containing 75 mg/l dry biomass was maintained in 250ml with final concentration of 10, 20, 30, 40 mg/l. Flasks were agitated at 30 rpm and temperature 25±1ºC in an shaker. 10ml metal-cyanobacterial cell suspension was withdrawn from each flask at selected time interval and filtered through Millipore membrane filter. Cr (VI) concentration remaining in the medium was measured with spectrophotometer at 228 nm and concentration level was expressed in mg/g dry wt.

RESULTS AND DISCUSSION

The bioremoval potential of dry biomass of the cyanobacterium *Aulosira fertilissima* was examined with regard to Cr (VI) ions from aqueous solution. The extent of adsorption was increased rapidly in the beginning with 60% within 10 minutes at 10 mg/l initial concentration and become slow in the later stage till saturation (Fig.1). The time required to reach saturation was 50 min. The overall pattern of Cr (VI) sorption rate seems to be dependent on the level of Cr (VI) present in the external medium though sorption of Cr (VI) was rapid during first 10 minutes at all initial concentration (10, 20, 30 and 40 mg/l) of Cr (VI).

In order to simplify the ability of the cyanobacterium *Aulosira fertilissima* for metal removal, the % removal was converted into removal index which facilitated the effect of concentration on the metal removal ability of the cyanobacterium. The highest

[1]Corresponding author

metal removal index was observed at lower concentration of Cr (VI) (Table-1).

The highest metal sorption was very efficient in the early few minutes. This is probably due to the availability of the active sites around and inside the cells of cyanobacteria by absorption followed by metabolism dependent intracellular cations and adsorption on the cell surface (Les and Walker, 1984; Singh and Yadav, 1985; Rangsayatom *et al*., 2002; Singh and Pandey 2011; Mane and Bhosle, 2012) because cyanobacterial cell wall consist of a variety of polysaccharides and proteins which offers active sites to bind metal ions.

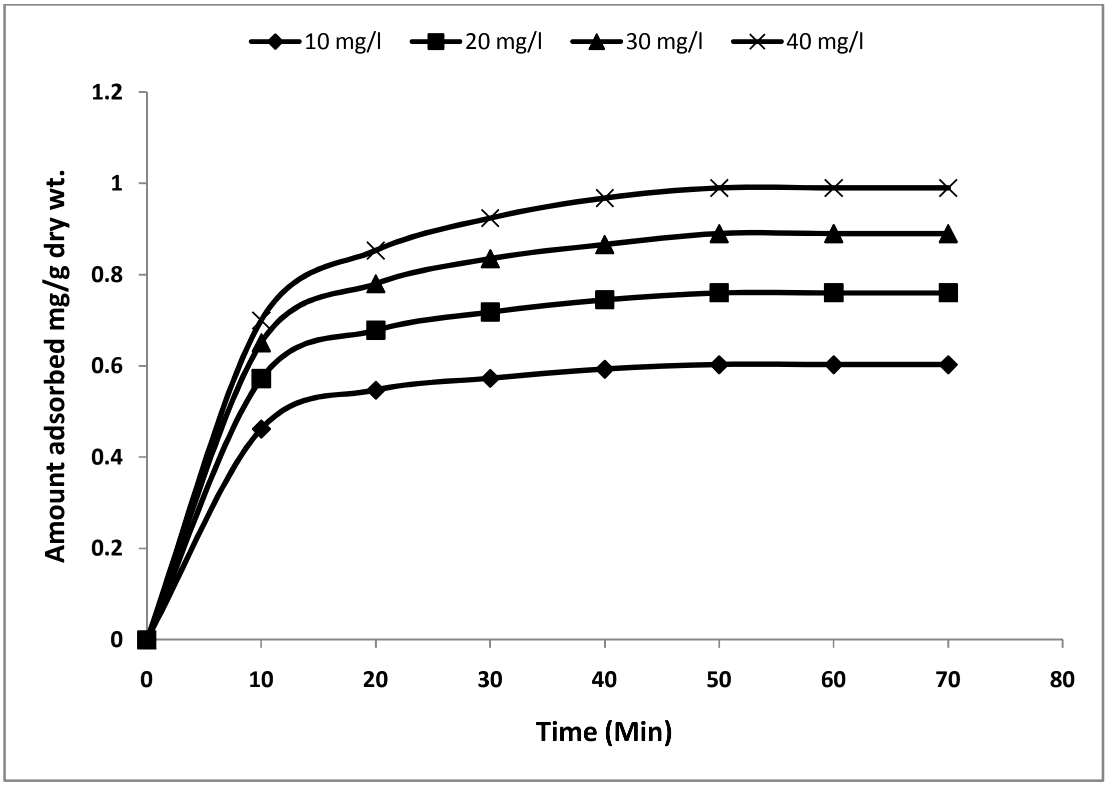

Figure 1: Time variation of adsorption of Cr (VI) by *Aulosira fertilissima* at different initial concentrations

Table 1: Bioremoval efficiency (%) of dry biomass of *Aulosira fertilissima* at 10 mg/l of Cr (VI) concentration in aqueous solution.

Cyanobacteria	Removal index (%) at 10 mg/l			
	Cr (VI) concentration (mg/l)			
	10	20	30	40
Aulosira fertilissima	10	9.45	8.85	8.20

CONCLUSION

On the basis of present observation, it can be concluded the sorption capacity of the cyanobacterium is dependent on metal concentration. Thus, *Aulosira fertilissima* can be efficiently employed for removal of chromium rich waste water.

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