ISSN 0975 - 6299 Vol 2 / Issue 3 / Jul - Sept 2011

International Journal of Pharma and Bio Sciences

SHORT COMMUNICATION

BIOTECHNOLOG

COMPARATIVE STUDY OF AGITATION RATE AND STATIONARY PHASE FOR THE REMOVAL OF CU^{2+} BY A.LENTULUS

SHIPRA JHA* DR S.N DIKSHIT AND DR G PANDEY

Department of Chemistry, Government Model Science College, Jiwaji University, Gwalior.
Tel : 08860006941, Fax :+ 98 21 22222512 ,

SHIPRA JHA
Department of Chemistry, Government Model Science College, Jiwaji University, Gwalior.

ABSTRACT

The aim of this research work was to find out the effect of agitation rate for the removal of Cu^{2+}.Experiments were performed under shaking and stationary conditions towards optimizing the rate for efficient Cu^{2+} removal by the immobilized fungal strain. Increase in agitation rate from 100-180 rpm resulted into higher copper removal.

KEY WORDS

A.lentulus, Agitation rate, Cu^{2+} removal

INTERDICTION

Heavy metal pollution is one of the most important environmental problems today. One of the processes used for metal removal utilizes natural material[1,2]. In this study, adsorption ability of immobilized A.lentulus was investigated under stationary phase and agitation rate for the removal of metal. The effect of metal toxicity has been largely reflected through decrease in specific growth rates, extended lag phase, and decrease in radial colony expansion and respirations rates in presence of metallic pollutants. Less attention has been paid to concomitant changes in colony and hyphal morphology. In the present study, an interesting observation was made about the change in morphology of the pellets induced by metal stress. The pellets in absence of metal were smaller as compared to those in presence of metal above certain concentration (55mg/l). Size of pellet was found to be 0.4 mm in absence of Cu^{2+}. A gradual increase in pellet size was observed when Cu^{2+} concentrations were increased from 50mg/l to 100mg/l. Above 100mg/g, size of fungal pellets remains almost same. This indicates that change in pellet size may be due to the fact that the pellets get aggregated in response to metal toxicity at higher concentrations. A. niger produces larger pellets in response to nickel toxicity as compared to smaller pellets in control (absence of nickel)[3].

General Procedure:.

1 Biomass preparation Fungal strain was grown in 250 ml Erlenmeyer flasks containing 100 ml of growth media. After exponential phase of growth, cells were harvested by centrifugation at 4000 rpm and 6 C for 10 min. The harvested cells were washed by double distilled water. This biomass was termed as resting biomass. A. lentulus was immobilized by mixing sodium alginate, gelatin with above resting biomass in the ratio of 1:5.This mixture was dropped in the form of beads of sodium alginate, gelatin covering the biomass. These beads were dipped into calcium chloride solution overnight. Finally, beads of calcium alginate, gelatin entrapping the fungal biomass were obtained.

2 Copper removal studies using synthetic solution.

A weigh amount of treated/ untreated fungal biomass (4.5 g/l) was added in an Erlenmeyer flask containing 100 ml solution of known concentration of Cu^{2+}.

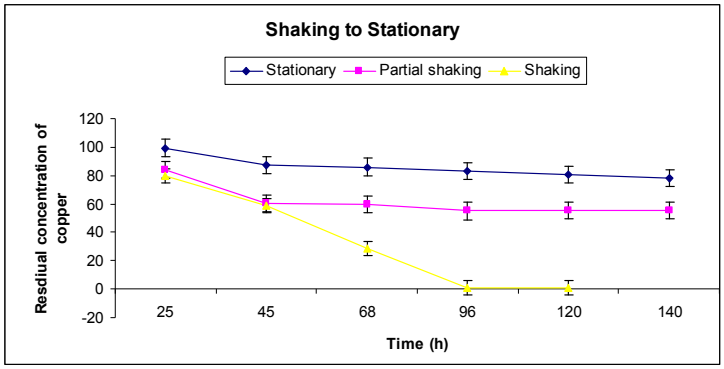
Initially, fungal growth and Cu^{2+} removal studies were conducted under shaking (100rpm) and stationary conditions (Fig 1). As compared to pellet morphology in shaking conditions, the biomass growth in stationary mode was in the form of a thick mat. The growth in stationary conditions was delayed as compared to shaking conditions, even in the absence of any copper stress, which can be attributed to reduced mass transfer and oxygen availability. The presence of Cu^{2+} further reduced the growth rates in stationary condition. It shows that the toxicity of Cu^{2+} was also reduced under stationary mode due to limited contact with the contaminant. For further verification of these results, one of the batches was run in shaking mode till 48 h and then shifted to stationary mode (Fig 2).

It was observed that in the stationary mode leading to the development of thick mat only 40% Cu^{2+} removal was observed .Hence, shaking conditions are necessary to ensure Cu^{2+} removal during growth of A. lentulus. Further experiments were directed towards optimizing the agitation rate for efficient Cu^{2+} removal. Increase in agitation speed (100-180 rpm) resulted into slightly higher biomass production and Cu^{2+} removal changed from 85% to 99.7%. (Fig. 2 and Fig 3)[4]. The oxygen transfer often influences the fungal pellet

growth, and molecular diffusion is assumed to be the determinant mechanism for oxygen transport in pellet if they are larger than a certain size, because of lack of oxygen in the pellet centre[5].

Fig 1

Removal of Cu^{2+} by A.lentulus in shaking and stationary conditions at 100mg/l initial Cu^2 concentration .



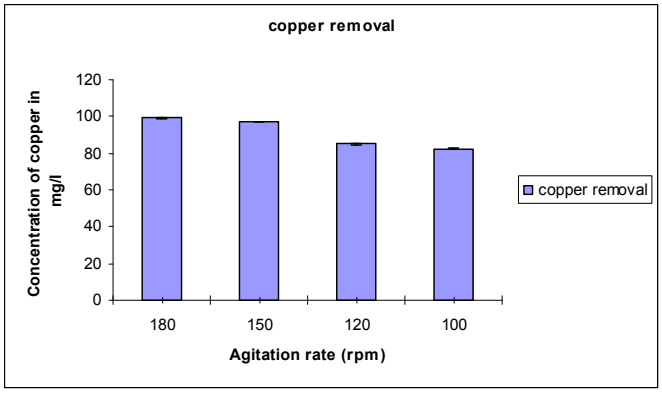


Fig 2

Removal of Cu^{2+} by Alentulus in shaking and stationary conditions at 100mg/l initial Cu^2 concentration

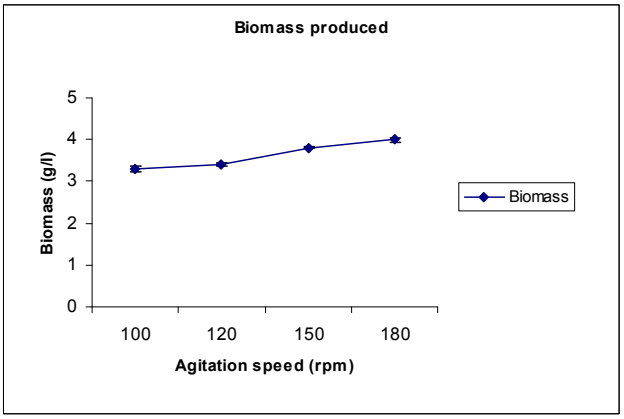


Fig 3

Biomass production in shaking and stationary conditions at 100mg/l initial Cu^2 concentration.

REFERENCE

1 Water Thomas A. Davis, Bohumil Volesky ,A review of the biochemistry of heavy metal biosorption by brown algae Research, Volume 37, Issue 18, November 2003, Pages 4311-4330

2 Vargas-García,Wang J, Chen C, bioremediation of heavy metals with microbial isolatesmc, 2009 .Biotechnology Advances 27, 195-. 226.

3 Magyarosy A, Laidlaw RD,Kilaas R, Echer C. Nickel accumulation and nickel oxalate precipitation by Aspergillus niger. Appl Microb Biotechnol 2002; 59:382-388.

4 Chromium bioremoval from tannery industries effluent by MN Sepehr - 2005 ,Iran J. Enviro.Health Science.Eng,2005,vol-2, no-4pp 273-279

5 Cui YQ, Okkerse WJ, Van derLans RG, Luyben KC. Modeling and measurements of fungal growth and morphology in submerged fermentations. Biotechnol Bioeng 1998;60:216-29.

6 An evaluation of copper biosorption by a brown seaweed under optimized conditions. antunes, Wallace M.; luna, Aderval S; henriques, Cristiane A y da costa, Antonio Carlos A. *Electron. J. Biotechnol.* [online]. 2003, vol.6, n.3, pp. 174-184.

7 Microbial Bioconversion of Palm Oil Mill Effluent to Citric Acid with Optimum Process Conditions. Parveen Jamal, Md. Zahangir Alam and Aisha Bt. Moha B , Biomed 2006 ,Volume 15, 2007, dol: 10.1007/978-3-540-68017-8, 11

8 Effect of growth condition of cadmium and copper. Vaanagnostopoulo 2010.www.gnest.org/journal/Vol12_no3/288-295_725_Symeopoulos_12-3.

9 A review on the use of biopolymers for the *removal* of toxic metals by Virendra Misra 2009 **,**International Journal of Environment and Waste Management Volume 3, Number 3-4 / 2009 Pages: 393 - 410

10 Removal of chromium, lead and copper lons form industrial waste S Ilhan - 2004 ,Turkish Electronic Journal of Biotechnology, Vol-2,P:50-57