Phenol Biodegradation by Immobilized Cell of *Pseudomonas* sp

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**INTRODUCTION**

Phenol and phenolic compounds are of general use in many industries such as polymeric resin production and oil refining. As a result, these compounds are commonly encountered in industrial effluents and surface water. Many studies relating to biodegradation process have indicated the effect of the temperature, the pH, the concentration of the effluent, the agitation, the aeration, and the size of bacteria on the treatment efficiency. However, few employ the experimental design method for evaluating the influence of the operation variables on these processes.

Recent literature on the methods of removal of phenol and their compounds from wastewater focuses on adsorption and microbial biodegradation process1-5. Certain species like *Pseudomonas* sp under very controlled conditions of pH, temperature and in the presence of some specific nutrients can degrade phenol. *Pseudomonas* strain, capable of degrading pentachlorophenol has been isolated around tannery soil and characterized as *Pseudomonas aeruginosa*6-9.

An immobilized cell is one of the approaches for incorporating bacterial biomass into an engineering process. The advantages of the process based on immobilized biomass include enhancing microbial cell stability, allowing continuous process operation and avoiding the biomass liquid separation requirement. Physical entrapment of organisms inside a polymeric matrix is one of the most widely used techniques for whole cell immobilization10-11.

**OBJECTIVES OF THE PRESENT INVESTIGATION**

The objective of the present study was to evaluate the ability of *Pseudomonas* sp to degrade phenol. The effect of various cultivation parameters such as temperature, pH, type and concentration of media nutrients glucose & yeast extract on phenol degradation was investigated.

**MATERIALS AND METHODS**

**Microorganism**

Bacteria *Pseudomonas* sp was used to this study and maintained in a mineral salt medium.

**Media composition**

The media was prepared and used for bacterial cultivation with the following composition. Yeast extracts-2 g/l, Glucose-0.5 g/l, (NH4)2 SO4 - 0.5 g/l, NH4 NO3-1.0 g/l, NaCl-0.5 g/l, MgSO4.7H2O-0.5 g/l, K2HPO4-1.5 g/l, KH2PO4-0.5 g/l, CaCl2 -0.01 g/l, FeSO4.7H2O-0.01 g/l, Distilled water-1000 ml, pH-6.8 to 7.0.

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*Pseudomonas* sp, glucose, yeast extract, phenol, biodegradation, immobilization.
Culture conditions
Phenol degradation studies were carried out with 100 ml of the medium in shake flask (Batch Culture) and inoculating with immobilized cells. The shake flasks were incubated in a temperature controlled orbital shaker maintained at 30°C and 240 rpm for free cells growth and 180 rpm for immobilized cells.

Immobilization process
*Pseudomonas* sp cells were immobilized by Encapsulation technique using sodium alginate 4% (w/v).

Estimation of phenol
Phenol was estimated by photometric method 4-amino-antipyrene method as the colouring agent and measuring the absorbance at 510 nm with a Shimadzu UV-Visible spectrophotometer.

RESULTS AND DISCUSSION
The phenol removal efficiency was determined by the addition of different concentration of glucose (range 5 to 30 g/l) and yeast extract (2 to 10 g/l) at neutral pH. 15g/L glucose containing media showed maximum degradation than other concentration. The rate of phenol degradation was also found to decrease with increased concentration of yeast extract as nitrogen source. The results are given in Figure 1 and 2.

*Pseudomonas* sp was able to degrade phenol at temperature ranging from 25°C to 40°C (Figure 3). However, the maximum phenol degradation was observed at 35°C, but the time taken was significantly longer than for cultivation at 35°C. Phenol degradation was greatly influenced by the initial culture pH. The highest phenol degradation was obtained at neutral pH 7. The results are given in Figure 4.
**CONCLUSION**

We have concluded immobilized cells of *Pseudomonas* *sp* was capable to degrade phenol and the performance was greatly influenced by the culture conditions (temperature and pH) as well as concentration of glucose and yeast extract supplied to the culture. The optimum cultural conditions for phenol degradation by *Pseudomonas* *sp* were; 30°C, pH 7, glucose -15g/l and 6 g/L yeast extract.

**REFERENCES**


