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DEGRADATION OF CELLULOSE CONTAINING EFFLUENT BY *TRICHODERMA*

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ABSTRACT

Water pollution due to paper and pulp industry is becoming more and more hazardous, the industrial effluent contains cellulose which is depositing in the water bodies currently there are two pathways for converting cellulose into glucose they are, chemical verses enzymatic. *Trichoderma* a fungus produces an enzyme cellulase complex which can hydrolyse cellulose to glucose thus reducing the water pollution to some extent. In the present investigations the purified cellulase enzyme complex was immobilized and used also the enzymatic degradation was compared with the chemical degradation. It was found that enzymatic degradation was more efficient and the enzyme retained its efficiency till 72 hours and then declined. Thus cellulose a major pollutant can be converted to glucose which can be used as an energy source.

Keywords:- Degradation, cellulose, effluent, Trichoderma.

INTRODUCTION

Currently there are two major ways of converting cellulose into glucose, chemical verses enzymatic cellulose from various sources are the same at the molecular level, however the differ in the crystalline structures and bindings by other biochemicals. It is this difference that make possible a persistent research on cellulose. There are two types of hydrogen bonds in cellulose molecules that form between the C3OH group and the oxygen in the pyranose ring within the same molecule and those that form between the C6OH group of one molecule and the oxygen of the glycosidic bond of another molecule. Ordinarily beta 1 for glycosidic bonds themselves are not difficult to break. However because of these hydrogen bonds cellulose can form very tight crystallites. These crystals are so strong that sometimes neither water nor enzymes can penetrate them, only exoglucanase, a subgroup of cellulase that attacks the terminal glycosidic bond is effective in degrading it. Divine Etal (1994). It has become interestingly clear that microbial interaction may play an essential role in the degradation of recalcitrant compounds in nature. The performance of any waste water treatment process depends on the activities of the living organisms, present in the process. Ohtonen.et.al.(1994)

The development of immobilisation of microbial cells and its applications in the degradation of organic pollutants occurred in the past few years. Various cellulolytic compounds were found to be degraded by the immobilised cells of Trichoderma but one of the potential disadvantage of immobilisation is the increased resistance of substances and the products to diffuse through immobilised matrices, oxygen transfer often becomes the rate limiting factor in the performance of immobilised cell systems, thus when aerobic cells are used aeration becomes a very important factor in the bioreactor design. Kamakura.et.al.(2000)

In the present study an attempt was made to treat cellulose containing effulent by using the earlier extracted cellulose enzyme complex from Trichoderma and this biodegradation was compared with chemical degradation of cellulose.

MATERIALS AND METHODS

- **Enzymatic hydrolysis of cellulose:** 50 ml of untreated effluent of paper pulp industry was inoculated with 5 ml of sodium alginate immobilized cellulase enzyme beads the flask was incubated at 30 degree Celsius. After every 12 hours, 5 ml of the mixture was removed and the enzymatic hydrolysis of cellulose was checked and the amount of glucose formed was determined by 3,5, dinitrosalicylic acid method. This procedure was carried for 72 hours results are shown in table 1.

- **Chemical hydrolysis of cellulose:** 50 ml of untreated effluent of paper pulp industry was inoculated with 5 ml of 5% of H_2SO_4.

  After every 1 hour interval 5 ml of mixture was removed the hydrolysis reaction was terminated by neutralizing the acid with the help of 0.1% of NaOH the amount of glucose formed was again determined by 3,5, dinitrosalicylic acid method. This procedure was carried for 5 hours results are shown in table 2.

RESULTS AND DISCUSSION

Table 1: enzymatic degradation of cellulose using immobilized whole cells of *Trichoderma.*

Time of incubation in hours	Amount of glucose formed. (mg/ml)
12	0.04

24	0.08
36	0.08
48	0.11
72	0.06

Table 2: chemical hydrolysis of cellulose.

Time of incubation in hours	***Amount of glucose formed. (mg/ml)***
1	0.210
2	0.316
3	0.330
4	0.310
5	0.200

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