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BIODEGRADATION STUDIES ON THE SELECTED BACTERIAL STRAINS ISOLATED FROM HOSPITAL DISCHARGE

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ABSTRACT

Three bacterial isolates identified as *Pseudomonas mallei, Micrococcus varians* and *Aeromonas hydrophila* were capable of degrading protein and carbohydrate, and in removing COD and BOD from Sagar lake. Maximum removal of protein (41.68%) and carbohydrate (23.60%) was brought about by *Micrococcus varians,* while maximum COD (10.98%) and BOD (14.75%) could be removed by *Pseudomonas mallei* and *Aeromonas hydrophila* respectively. Amongst these, *Micrococcus varians* has higher degrading potential, thus may be further used in wastewater treatment.

INTRODUCTION

Biodegradation is nature's way of recycling wastes or breaking down organic matter into nutrients that can be used by other organisms. Degradation means decay and the bio-prefix means that the decay is carried out by a huge assortment of bacteria, fungi, insects, worms and other organisms which eat dead material and recycle it into new forms. In nature, there is no waste because everything gets recycled. The waste products from one organism become the food for others, providing nutrients and energy while breaking down the waste organic matter. Some organic materials breakdown much faster than others, but all will eventually decay. Wastewater treatment also accelerates natural forces of biodegradation. In this case the purpose is to breakdown organic matter so that it will not cause pollution problems, when it is discharged into the environment. Through bioremediation, microorganisms are used to clean up oil spills and other types of organic pollution.

MATERIALS AND METHODS

Collection, isolation and maintenance of microbial strains: Water samples from hospital discharge were collected and heterotrophic bacteria were isolated by dilution plate technique on nutrient agar. The bacterial colonies were purified by repeated streaking on fresh medium and maintained at 4°C on slants of nutrient agar containing 1% starch. Three bacterial isolates were selected for biodegradation study.

Identification: Bacterial isolates were identified by morphological and biochemical tests. The isolates were identified with the help of Bergey's Manual of Determinative Bacteriology (9th Edn.) and confirmed with the help of PIB computer kit (Bryant 1989).

Biodegradation studies: Water samples from hospital discharge were collected in clean plastic bottles and tightly capped. The samples were autoclaved at 120°C for 15 min to make them sterile from other microorganisms before inoculating them with the selected bacterial strains. The inoculum was taken from the pure culture grown on nutrient agar slants and inoculated into each test tube containing 5 mL of nutrient broth. The tubes were then incubated at 37 ± 1°C overnight. 5mL of this uniform suspension of each strain was inoculated as initial inoculum into each 1000 mL Erlenmeyer

flask containing 500 mL of sterilized sample. Samples were incubated for 2, 4, 6 and 8 days under lab conditions. The analysis of total protein, carbohydrate, hydrogen ion concentration, biochemical oxygen demand and chemical oxygen demand was done by standard methods (APHA 1985, NEERI 1988, Dubois et al. 1956, Lowry et al. 1951).

RESULTS AND DISCUSSIONS

The best three selected amylase producing bacterial isolates (*Pseudomonas mallei, Micrococcus varians* and *Aeromonas hydrophila*) were tested for their ability to degrade organic matter present in hospital discharge. All the bacterial isolates were tested for 2-10 days of incubation for above pa-

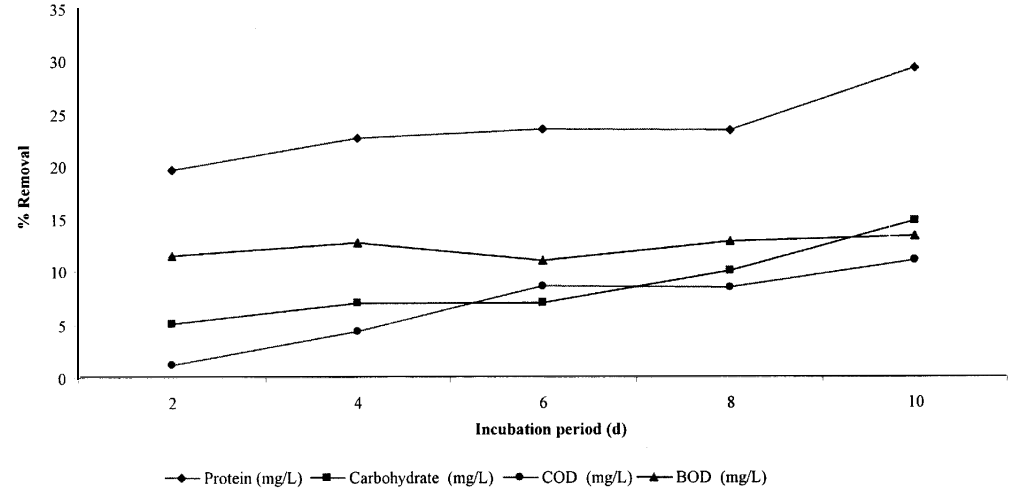

Fig. 1: Biodegradation potential of *Pseudomonas mallei.*

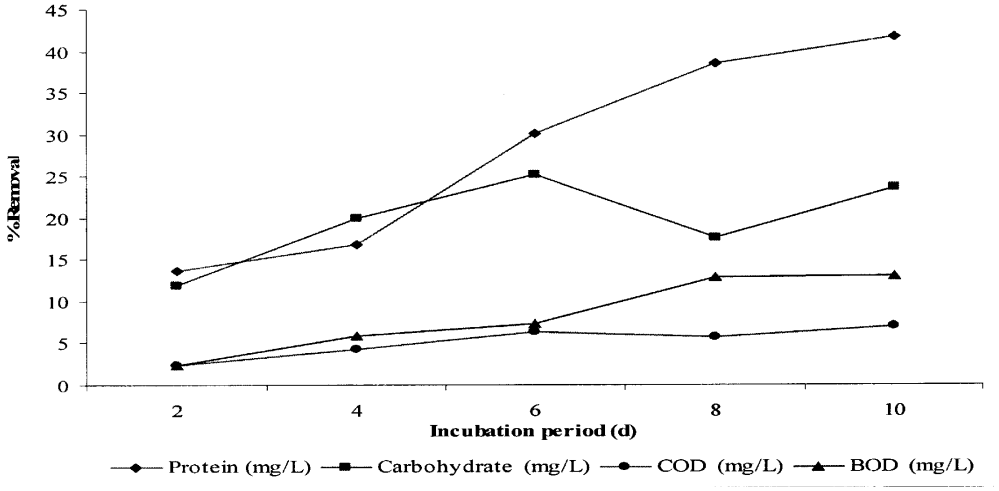

Fig. 2: Biodegradation potential of *Micrococcus varians.*

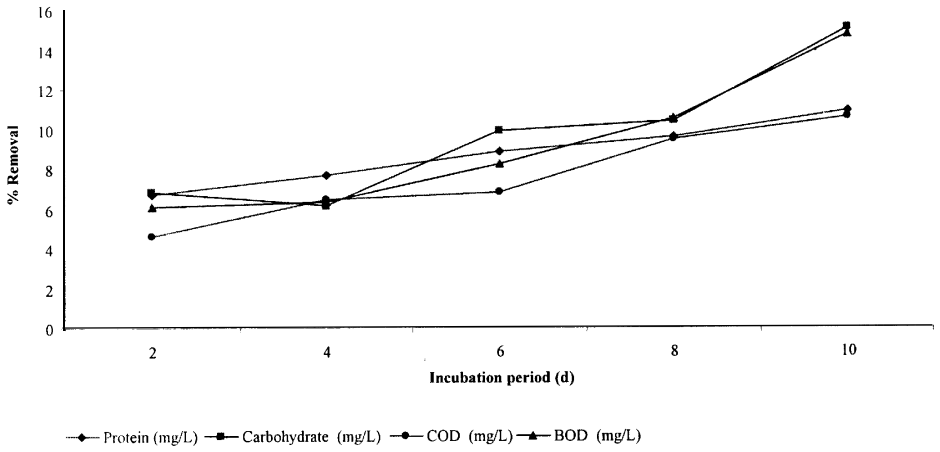

Fig. 3: Biodegradation potential of *Aeromonas hydrophila.*

rameters in the present investigation. It was noticed that pH of the samples remained alkaline (9 to 10) in nature throughout the study period.

Biodegradation Potential of Bacterial Isolates

Pseudomonas mallei: Maximum removal of protein (29.98%), carbohydrate (14.74%), BOD (13.37%) and COD (10.98%) was recorded on 10th day of incubation. The decrease in the amount may be due to utilization of readily available nutrients by the *Pseudomonas mallei* population for its establishment to bring about the enzymatic breakdown (Fig. 1).

Micrococcus varians: Maximum carbohydrate (25.18%) was removed by *Micrococcus varians* on 6th day, whereas maximum removal of protein (41.68%), COD (7.00%) and BOD (13.06%) on 10th day was observed (Fig. 2).

Aeromonas hydrophila: It was noticed that the pH of the sample remained alkaline to neutral (8-7) throughout the study period. Maximum removal of protein (10.88%), BOD (14.75%), carbohydrate (10.57%) and COD (15.06%) on 10th day of incubation was recorded with this isolate (Fig. 3).

Biodegradation can be defined as the degradation and assimilation of organic polymers by the action of living organisms like bacteria and fungi (Potts 1984). Biodegradation involves biological agents which use organic polymers as a substrate for growth and energy. Complete biodegradation convert the organic matter into CO_2 and water. Chin et al. (1995) demonstrated that in sewage treatment, the addition of bioenhancer improves the treatment efficiency of BOD, COD, detergent, oil and grease. Many workers reported biodegradation of industrial and domestic waste effluents by microorganisms. Manoharan & Subramanian (1993) observed significant reduction in BOD and COD from Ossein effluents by *Acinetobacter calcoaceticus* which removed about 70% of COD from pulp mill wastewaters (Jain et al. 1997).

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