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Biodegradation Potential of the Selected Bacterial Strains Isolated from Sagar Lake

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Abstract : Microbes are well known for their scavenging activity, there is nothing in the universe which are resistant to microbial attack. The present study consist of isolation of different bacterial strains which are capable of removing organic matters like protein, carbohydrate and alter COD and BOD values of lake water. Maximum removal of protein and carbohydrate was brought by Micrococcus luteus-*1*, followed by *Micrococcus luteus-4 and* Micrococcus *sp.*, *Micrococcus luteus-1* and *Micrococcus luteus-4* removed maximum COD, while maximum BOD was removed by *Pasteurella pneumotrop* and *Staphylococcus hyicus*.

Key words : Biodegradation, *Micrococcus luteus*, *Pasteurella pneumotrop*, *Staphylococcus hyicus*.

Introduction

Water, the fluid of life, universal solvent. Water got polluted by human activities and natural calamities. Water pollution can be analysed by the changes in physical, chemical and biological properties like colour, organic/ inorganic contents and microbial load. Water receives micro organisms and other undesirable materials from air, soil, sewage, organic wastes, dead and decayed plants and animals.

For the proper and hygienic use of water it has to be treated for the removal or inactivation of hazardous materials. It involves a number of different physical, chemical and biological processes (Arthur 1981; Shuckrow *et al*., 1981). Heterotrophic bacteria help in recycling of the waste materials. A variety of microorganisms (bacteria, fungi, protozoa, algae and viruses) are found to be present in water. In the beginning aerobic bacteria dominate and decompose organic material and at the end anaerobic bacteria (e.g. methanogens) predominates which produce methane (CH_4), carbon dioxide (CO_2) and hydrogen (H_2) gases. Thus aerobic bacteria that degrade organic materials are usually found near the surface of lakes, where the oxygen content is highest or in there aerated portion of the lakes, where they can act on animals waste and plant or algal that remains in the water. Proteases are degradative enzymes capable of cleaving protein into peptides and amino acids. These enzymes digest protein or participate in the turnover of cellular protein.

Materials and Methods

Collection, Isolation and Maintenance of Microbial Strains

Water samples from Sagar Lake were collected in pre-sterilized plastic bottles and tightly capped. Water sample from three

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selected sites of the Sagar, lake, were collected and heterotrophic bacteria were isolated by dilution plate technique on nutrient agar. The bacterial colonies were isolated by repeated streaking on fresh nutrient agar medium at room temperature and maintained at 4°C on slants of nutrient agar containing 1% gelatin, which act as an inducer for production of proteolytic enzymes.

Identification

Protease producing bacteria were tentatively identified on the basis of morphological, cultural and biochemical characteristics according to Bergey's Manual of Systematic Bacteriology and PIB computer kit (Bryant ,1989).

Biodegradation Studies

The collected water samples were separately inoculated on sterile nutrient agar plates under aseptic condition. The obtained culture is further subcultured by streak plate method. 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. 5 mL 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 d under lab conditions. After desired incubation period the samples were analyzed for their physico-chemical parameters, total carbohydrate and protein using standard methods (APHA, 1985; Adoni, 1985; NEERI, 1988; Dubois *et al*., 1956; Lowry et al., 1951).

Results

The best five selected protease producing bacterial isolates (*Pasteurella pneumotrop*, *Micrococcus luteus*-1, *Micrococcus luteus*-4, *Staphylococcus hyicus* and *Micrococcus* sp.) were tested for their ability to degrade organic matter present in Sagar Lake. All the bacterial isolates were tested for 2-10 days of incubation for different parameters. The present investigation was noticed that pH of the samples remained alkaline (9 to 10) in nature throughout the study period. Biodegradation shown by different microorganisms are given below.

Pasteurella pneumotrop

Maximum removal of protein (35.39%) and carbohydrate (29.91%) on 10 d, while BOD (22.56%) and COD (12.86%) was recorded on 4 d of incubation (Fig. 1). With increase in the incubation period, the carbohydrate and the protein contents decreased in the water sample. It may be due to utilization of readily available nutrients by the Pasteurella pneumotrop population for its establishment to bring about the enzymatic break down.

***Micrococcus luteus*-1**

Maximum carbohydrate (29.0 %) and protein (32.82%) was found to be removed by Micrococcus luteus-1 on 2 d. Maximum removal of COD (27.10%) on 10 d and BOD (18.18%) on 4d (Fig. 2).

***Micrococcus luteus*-4**

Maximum removal of protein (40.49%) and BOD (61.56%) on 2 d, whereas carbohydrate (29.18%) and COD (21.93%) on 4 d (Fig. 3).

Staphylococcus hyicus

Maximum protein (18.24%) and BOD (23.65%) on 2d, while maximum carbohydrate (22.07%) on 6 d and COD (13.38%) on 4 d (Fig. 4).

Fig. 1 : Biodegradation potential of *Pasteurella pneumotrop*

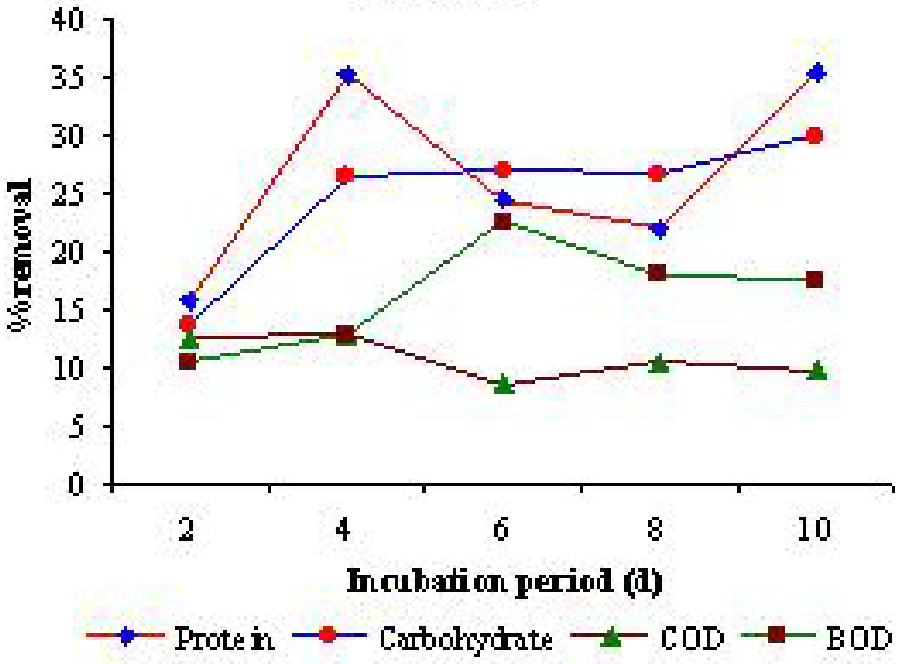


Fig. 2 : Biodegradation potential of *Micrococcus luteus-1*

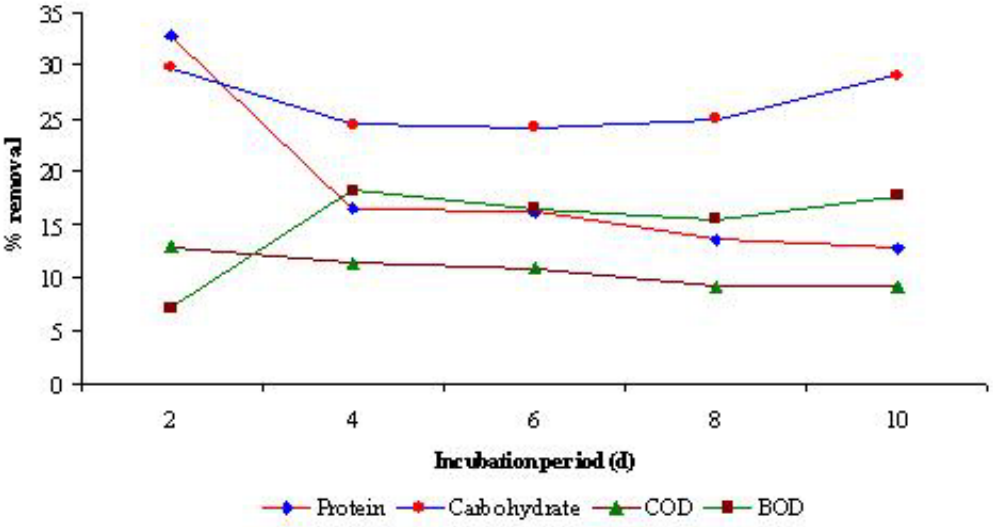


Fig. 3 : Biodegradation potential of *Micrococcus luteus-4*

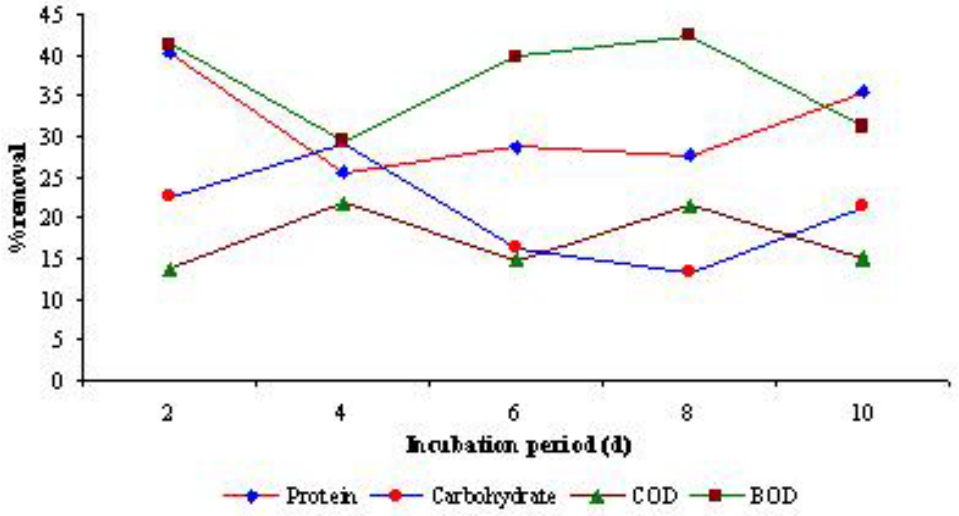
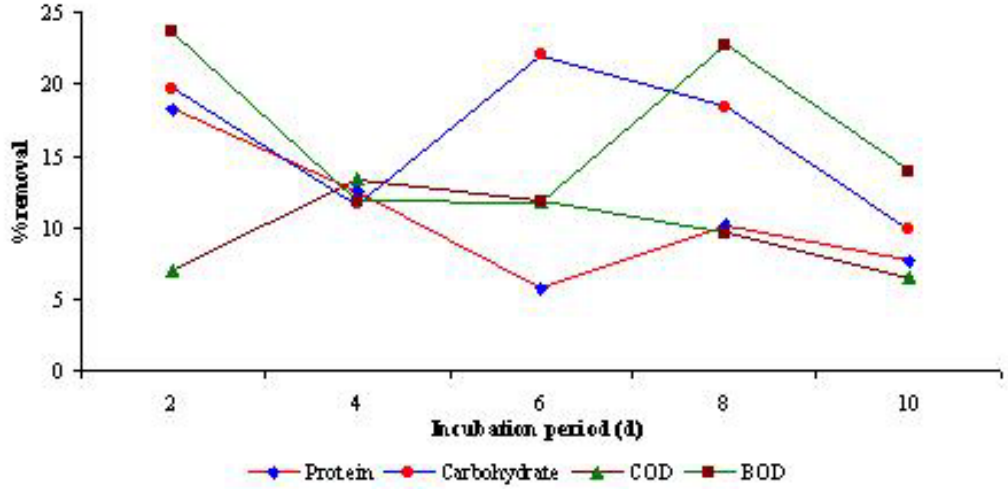
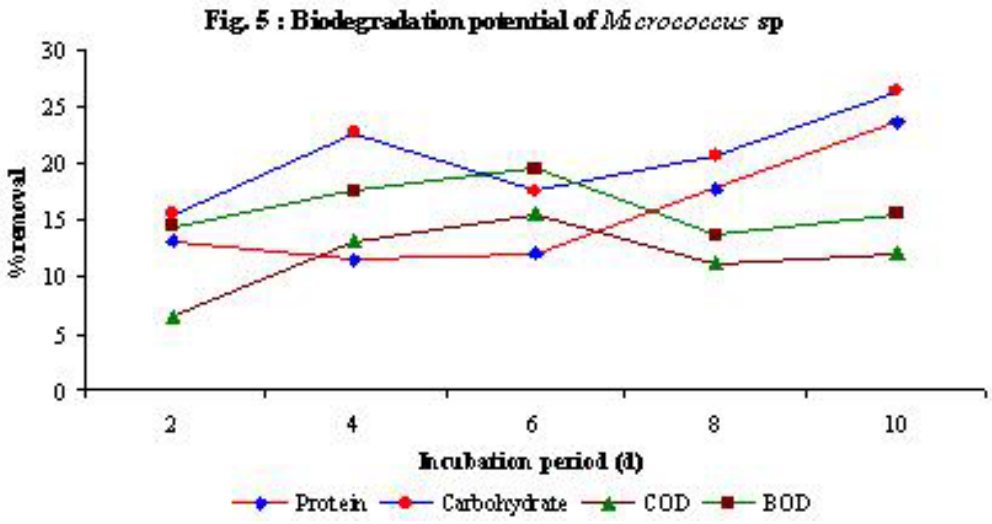


Fig. 4 : Biodegradation potential of *Staphylococcus hyicus*





Micrococcus sp.

Maximum removal of protein (23.62%) and carbohydrate (26.27%) on 10 d while, COD (15.55%) and BOD (19.63%) could be removed by *Micrococcus sp*. on 6d (Fig. 5).

Discussions

Biodegradation involves biological agents, which use organic polymers as a substrate for growth and development. Complete biodegradation converts the organic matter into CO_2 and water. In sewage treatment, the additions of bio enhancer improve the treatment efficiency of BOD, COD, detergent, oil and grease (Chin *et al*., 1995). Bacteria and fungi are capable of producing a wide variety of enzymes that can degrade complex organic compounds. (Claxton and Houx, 1995). The nature of the break down products depends upon both the microorganisms present and the environmental circumstances (Schenk, 1990). There are reports of biodegradation of industrial and domestic waste effluents by microorganisms (Ghosal and Bhowmikm, 1995).

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