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An Urban Freshwater Lake Revitalised with the Aid of Chitinolytic Bacteria

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ABSTRACT

A wide range of bacterial diversity is found in aquatic ecosystems. Among them, the heterotrophic bacteria play an important role in the cycling of substances directly or indirectly thereby helping in lake restoration. Anasagar lake, an important freshwater lake in Ajmer, Rajasthan is located in the heart of the city. This lake being the chief recreational centre and a place of tourist attraction, receives an influx of many pollutants in the form of agricultural runoff and human interferences due to restaurants and hotels nearby. A study was undertaken of heterotrophic bacteria utilizing chitin. Chitin being an important substance in exoskeleton of coelentrates, molluscs, protozoans, cell wall of various algae and fungi etc. is present in large amounts in the sediments of the lake. A variety of chitinolytic bacteria were isolated from Anasagar lake water thereby helping in degrading the chitin and thus adding to the self-purification process of the freshwater lake.

Keywords: Aquatic Ecosystem, Anasagar Lake, Chitinolytic Bacteria, Chitin

INTRODUCTION

Heterotrophic bacteria utilizing the organic matter are the prevailing bacterial groups in any aquatic ecosystem. These bacteria are mainly responsible for the natural cleansing process of lakes. The present study deals with the study of chitinolytic bacteria present in an urban freshwater lake. Anasagar lake is an important lake of tourist attraction situated in the heart of Ajmer city, Rajasthan. As Ajmer is famous for the shrine of Khwaja Moinuddin Chishti and also for a holy Pushkar lake that is situated about 11 kms. from Ajmer city, thousands of people

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come for pilgrimage the year round. Hence, this lake is visited round the year by thousands of people.

Chitin is one of the most important polysaccharide in nature and is one of the main component of cell walls of aquatic fungi, exoskeleton of crustaceans, insects, molluscs, diatoms etc. (Goodday, 1990). Chitin is abundant in many types of environments .Some enzymes functioning to degrade chitin are found in many organisms chiefly the heterotrophic bacteria. In aquatic ecosystems bacteria are the main mediators of chitin degradation. (Aumen, 1980; Goodday, 1990)

MATERIALS AND METHODS

Chitinolytic bacteria were studied from the water of Anasagar lake. This lake is an important site of tourist attraction in Ajmer. The lake is located in the heart of Ajmer city and is surrounded by residential buildings, hotels, guest houses and from one side by agricultural fields. This Lake also harbors many migratory birds in winter season at one of the site. Four sites was selected for the bacterial studies. Water was collected in sterilized water bottles from these four sites.

Site 1 - This was quite undisturbed site, it did not have direct human interference. This site receives sewage water from nearby hotels and guest houses.

Site 2 - This is the most disturbed site, as thousands of people visit this site daily, as a chaupati is made and many people are present here viewing the lake. Though prohibited, this site also receives somehow sewage water from the nearby residential colonies.

Site 3 - This is quite undisturbed site as it is near to the agriculture fields, thus receiving run off in rainy season from the nearby agriculture fields.

Site 4 - This site is the main site where migratory birds visit every year. Near the boundary of the lake at this site, some old dismantled remains of buildings are there, which serves as home for the migratory birds.

Water was collected from these sites in different seasons. Bacteria isolated from the lake water after serial dilution techniques on nutrient agar slants and plates. After several tests, 33 bacterial forms were isolated and identified. These forms were then subjected to various tests for studying their enzymatic activity. The chitinase activity was detected by using CM-3 medium containing colloidal chitin. Colloidal chitin was prepared according to the method of Stainer (1946). Chitin

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flakes were dissolved in 50% cold water and subsequently precipitated with two volumes of water. The above colloidal chitin was washed three times with water and was incorporated into agar media. The chitinase activity of the bacterial isolates was demonstrated by the formation of clear zone surrounding the bacterial growth.

RESULTS AND DISCUSSION

Out of the 33 bacterial forms isolated and identified by the help of Bergey's Manual of Systematic Bacteriology, 19 bacterial forms were found to degrade chitin. The chitin degrading bacteria are listed in Table 1 according to the occurrence at the four sites.

Chitin as a nutrient is quite wide spread among the aquatic microbes. The first report on chitin degradation was made by Benecke (1905). Rheinhemmer (1985) and Campbell (1983) have also reported *Pseudomonas* and *Vibrio* species as helpful in chitin degradation.

In the present study it was found that maximum chitinolytic bacteria were reported at site 2 and site 4. Side 2 being the most polluted site receiving influx of organic matter and site 4 being the site which harbors many migratory birds and abundant of micro and macro flora and fauna. This served as food for birds. Site 2 was also rich in diatoms and phytoplanktons.

Thus, it was concluded that though all the sites of Aanasagar lake were rich in the heterotrophic microflora, Site 2 and Site 4 were the sites where maximum chitinolytic bacteria were found. These bacteria help in decomposition or degrading of chitin present in the sites in the form of waste of insects, phytoplanktons, fungi, molluscs etc., thus aiding in cleaning process of freshwater lakes at some level. Our study was in accordance with studies done by Tran et. al. (2018). Chun Jen Chen et. al. (1996) also reported several species of bacteria from the site receiving organic matter in eutrophic lakes.

Table 1. Occurrence of Chitinolytic bacterial species at different sites of Anasagar Lake.

Name of Bacteria	Site 1	Site 2	Site 3	Site 4

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 1, 2022

1. Pseudomonas putida	+	++++	+	+++
2. Pseudomonas sp. 1				
3. Pseudomonas sp. 2	+	+++	++	+++
4 Pseudomonas sp. 4	++	+++	+	+++
5.Xanthomonas sp. 1	++	++++	++	+++
6. Zooglea sp. 1	+	+++	++	++++
7. Zooglea sp. 3	+	++	+	++++
8. Vibrio sp. 1	+	+++	+	++++
9. Vibrio sp. 3	++	++++	++	++++
10. Vibrio sp. 4	+	++++	+	++++
11. Bacillus mycoides	+	+++	-	++++
12. Bacillus sp. 2	+++	++++	++	++++
13. Bacillus sp. 3	++	++++	+	++++
14. Aeromonas sp. 1	+	+++	+	++++
15. Aeromonas sp. 2	++++	++++	++	++++
16.Flavobacterium	++++	++++	+	++++
acquatile.	+	++++	+	++++
17. Alcaligens sp.1	+	+++	++	++++
18. Cellulomonas sp.1	+	++	+	++++
19. Cellulomonas sp.2	+	+++	+	+++

+ shows strength of bacterial occurrence

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