

# ISOLATION AND CHARACTERIZATION OF BACTERIAL STRAINS FOR TREATMENT OF DAIRY WASTE WATER

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## Abstract

Wastewater from the dairy processing industry contains high concentration of organic material like proteins, dissolved sugars, lipids, suspended solids, high biological oxygen demand (BOD) and chemical oxygen demand (COD), nitrogen content, oil and grease content and large variations in pH. Due to the high pollution load of dairy waste water, the milk-processing industries discharging untreated waste water can cause serious health problems. The bacterial strains were isolated from the wastewater and the efficient strains were screened in terms of maximum reduction in COD, protein and carbohydrate content. These strains were further biochemically and morphologically characterized for use in bioremediation of dairy waste.

**Keywords:** Bioremediation, Dairy effluent, COD, organic content, biochemical characterization.

## Introduction

The dairy industry is the largest source of food processing wastewater in many countries. All steps in the dairy chain, including production, processing, packaging, transportation, storage, distribution, and marketing, impact the environment (Strydom *et al.*, 1993). Dairy effluent contains soluble organics and suspended solids, causing growth of algae and bacteria that consume oxygen in the water and eventually suffocate the rivers leading to the gradual disappearance of aquatic life (Kumar and Desai, 2011).

## Material and method

### Initial characterization of Dairy wastewater

Parameters like COD (APHA, 2005), protein content (Lowry *et al.*, 1951) and carbohydrate content (Trevelyan *et al.*, 1952) were analyzed for dairy wastewater.

### Isolation and Characterization of isolated efficient bacterial strains:

Dairy wastewater was diluted in 90 ml of sterile distilled water and added to an enrichment cultural medium like nutrient broth and placed on shaker for 24 - 48 hrs at 30°C. Milk broth was used as specific cultural media, which contains peptone, yeast extract and milk. After complete growth of the microorganisms, transferred to the sterilized solid cultures such as agar and incubated at 37°C (Harrigan, 1998). Each of the

effective isolates was characterized for their size, shape, colour, elevation, opacity and Gram nature. Biochemical characterization was done for enzymatic activities and carbohydrate utilization.

#### Bioremoval studies:

The dairy effluent was treated with bacterial isolate to see the effect of incubation time and amount of inoculum on % reduction in COD, protein and carbohydrate content. The operating conditions were pH 7.0, shaking speed of 250rpm, percentage inoculum 1% and 5% at a temperature of 37°C.

#### Results and Discussion

From the dairy effluent, six bacterial strains were isolated named BP1, BP2, BP3, BP4, BP5, BP6 respectively by spreading on nutrient agar plates by incubating for 24 to 48 hrs (Fig.1). A total of six bacterial isolates were obtained and examined for their ability to reduce the chemical oxygen demand and the other chemical tests. The initial COD of wastewater was 760 mg/l and the wastewater was treated to determine the reduction in COD during 7 days of incubation. The strain BP4 was found to be more efficient than all other strains for COD reduction of 68% and 65.3% with 1% and 5% inoculum (Fig.2 and Fig. 3) and was further used for the reduction of protein and carbohydrate content along with BP2 and BP5 strain the second and third most effective strains in COD reduction. Similar studies for COD and protein was done by Priyadharshini and Kumar, (2016) showing 57% and 71% removal respectively. The maximum reduction in protein (0.32mg/l) was also done by BP4 with a value of 66% and 68% for 1% and 5% inoculum respectively (Fig.4 and Fig.5) and 69% and 71% reduction of carbohydrates for 1% and 5% inoculum respectively (Fig.6 and Fig.7). Livingston *et al.*, (2013) observed protein removal in dairy wastewater in range of 60-90% with Bacillus strain because of high enzymatic proteolytic activity. Keffala *et al.*, (2017) studied 82% and 87% reduction of sugar content by yeast and 78% and 76% reduction of protein content by bacteria with 5 and 10% inoculum rate.



Fig.1: Effective bacterial strains isolated from the dairy effluent by plating on nutrient agar plate named BP2(A), , BP4(B), BP5(C).

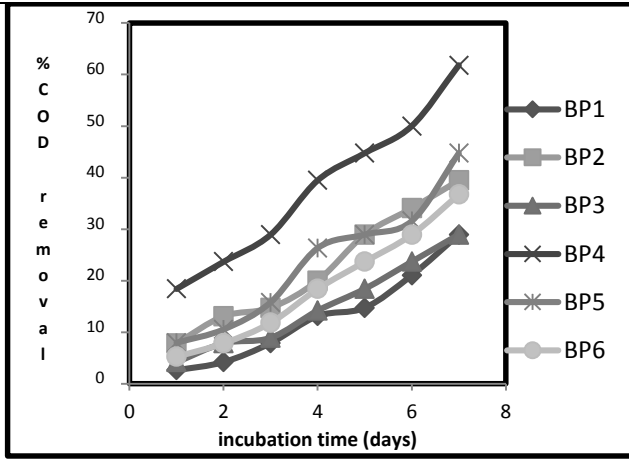


Fig. 2: % COD removal with 1% inoculum of isolated bacterial strains

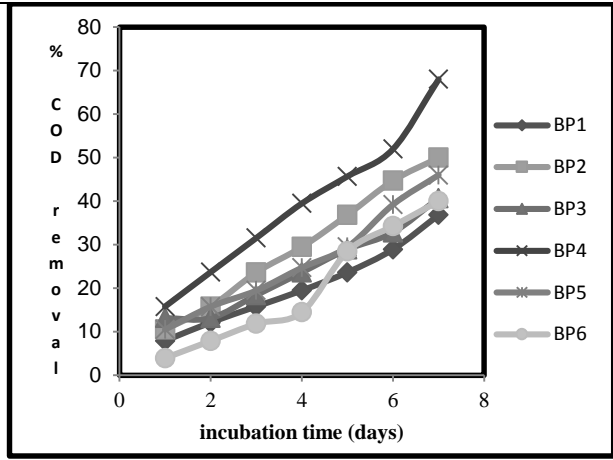


Fig. 3 : %COD removal with 5% inoculum of isolated bacterial strains

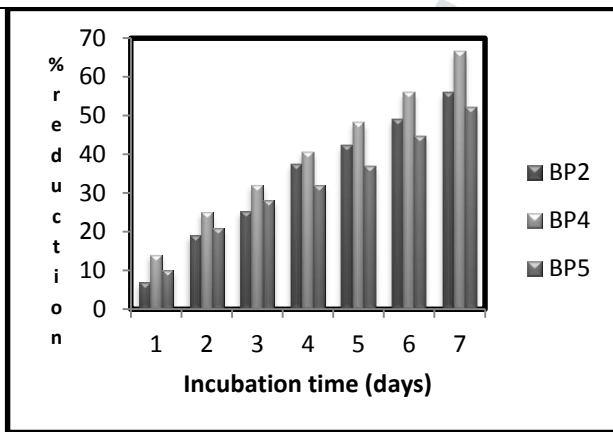


Fig. 4: Reduction in protein content with 1% inoculum of isolated bacterial strains

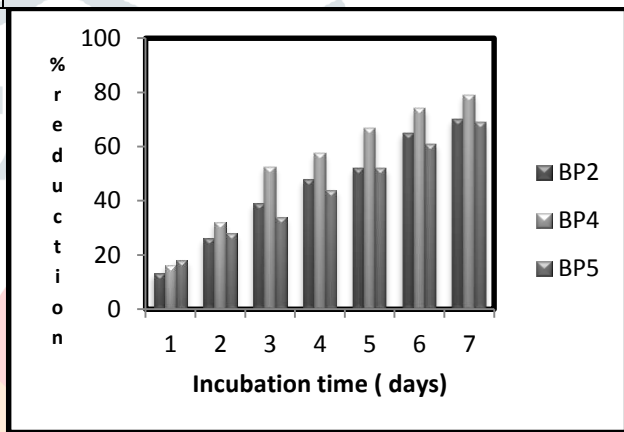


Fig.5: Reduction in protein content with 5% inoculum of isolated bacterial strains

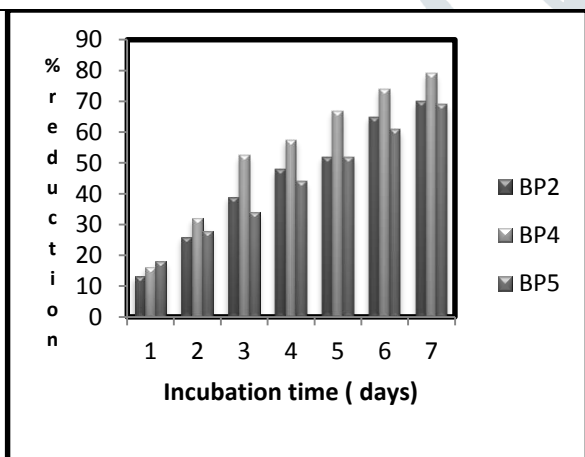


Fig.6: Reduction in carbohydrate content with 1% inoculum

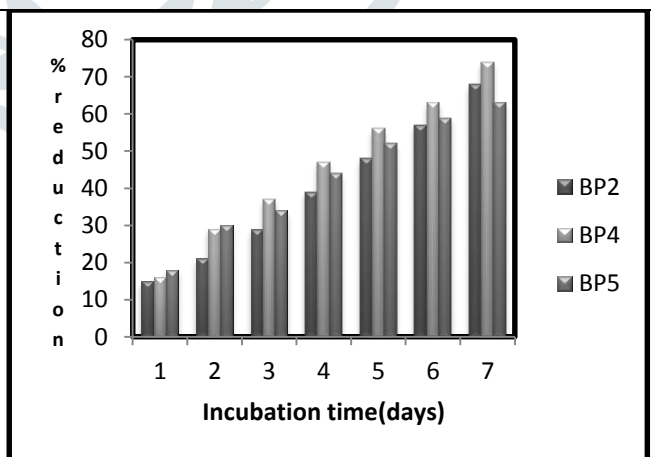


Fig.7:Reduction in carbohydrate content with 5% inoculum

Table1 : Morphological and Biochemical characterization of effective bacterial isolates

S.No	Morphological & Biochemical characteristics	Bacterial strains		
		BP2	BP4	BP5
1.	Shape	circular	circular	Circular
2.	Surface	smooth	Smooth	Rough
3.	Arrangement	Single	Grouped	Single
4.	Optical property	Opaque	Opaque	Opaque
5.	Color	Off white	Off white	Off white
6.	Gram nature	+ve	-ve	-ve
7.	Starch hydrolysis	+ ve	+ve	-ve
8.	Catalase activity	-ve	+ve	-ve
9.	Indole production	-ve	-ve	-ve
10.	Methyl red test	+ve	-ve	+ve
11.	. Voges Proskauer	-ve	-ve	+ve

## Conclusion

From results, BP4 was the most effective strain which reduces maximum COD concentration to 68% with 1% inoculum and protein and carbohydrate reduction upto 68% and 71% with 5% inoculum respectively. So, from the research work it has been concluded that the isolated strain can be efficiently used to treat the dairy wastewater.

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