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Abstract

design effective bioremediation strategy in the tropics, efýcient strains having fast degradation capacity and high

Biodegradation; Surfactants; SDS; MBAS assay; *Pseudomonas sp*

Surfactants are synthetic organic chemicals that are formulated to have cleansing or solubilisation properties with the development of the industrial economy and increase in population density, surfactants have become one of the most widely disseminated xenobiotics to enter the aquatic environment, creating a serious environmental problem. Principal criterion for the ecological behavior of surfactants is their biodegradability [1]. Anionic surfactants are groups of xenobiotic compounds that contain either sulfonated or ester sulfate groups [2] which are widely used ingredients in several industrial products such as detergents and cosmetics [3]. Because of their large consumption worldwide, anionic surfactants have the potential for wide disposal in to aquatic and terrestrial environments [4].

Anionic surfactants are present in monomeric form in both apolar and polar solvents at low concentration. At a higher concentration (Critical Micelle Concentration- CMC), they form regular aggregates polarity of the solvent, on the structural characteristics of the surfactant molecule [5,6] and on the ion concentration of the solution [7]. Use of detergents containing synthetic surfactants that commonly possess strongly anionic groups such as sulfonate (C-So_3-) or ester sulfate C-O-So_3-) has increased dramatically, in terms of volume and range of applications [1], since their introduction on a commercial scale over 40 years ago. At the concentrations used, the surfactants did not a ect bacterial growth, so that toxicity was eliminated as the mode of action in favour of disruption of hydrophobic interactions more recently, the cationic surfactant cetyl pyridinium chloride was shown to enhance microbial adhesion to hexadecane by diminishing surface charge and increasing cell surface hydrophobicity [8].

One of the major xenobiotic anionic surfactants that have large scale industrial applications and thus wide environmental release is Sodium Dodecyl Sulphate (SDS); it is mainly used in industrial cleaners and household detergents. It is also widely used in other industries as emulsi ers, dissertators, synergists in the pharmaceutical eld, as auxiliaries in textile and bre production as well as in the plastic, paint, leather, photographic and metal industries [9]. is surfactant is mostly discarded through domestic or industrial waste water. Surfactants, due to their favorable physicochemical properties are extensively used in many elds of technology and research i.e in pharmacy, in cosmetics, textile industry, agriculture, biotechnology. e use large quantities of surfactants and their derivatives are released to aquatic and or terrestrial environment. ese compounds can act on biological wastewater treatment processes and cause problems in sewage aeration and treatment facilities due to their high foaming, lower oxygenation potentials and making death of waterborne organisms [10].

Biodegradation was initiated by primary or secondary alkyl sulfatases enzymes, followed by the oxidation of the liberated primary or secondary alcohols by appropriate alcohol dehydrogenases. *Pseudomonas* sp are capable of producing a multiplicity of alkyl sulfatases. *Pseudomonas* can produce ve such enzymes [11], *Pseudomonas* putida FLA six [12] and *Pseudomonas* DESI four [13] of the ve alkyl sulfatases produced by *Pseudomonas* C12B, two (designated PI and PII) are active towards primary alkyl sulfates, where as the other three (S1, S2 and S3) act on secondary alkyl sulfates [14]. e latter enzyme exhibits positional and Stero-speci city, S1 being active towards D-2-alkyl sulfates, S2 towards symmetrical and near symmetrical secondary alkyl sulfates. Interestingly, now there are reports of several bacteria, which are able to degrade and metabolize SDS as a carbon source. e work on SDS biodegradation was rst initiated by Payne and Feisal (1963). ey did a detailed study on SDS biodegradation by *Pseudomonas* sp, including enzymes and kinetics of degradation. Biodegradation of SDS was

***Corresponding author:**

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also reported by consortia of *Acinetobacter calcoaceticus* and *Pantoea agglomerans*. Notably biodegradation of SDS by facultative anaerobic bacteria is rare occurrence [15]. Several authors have investigated the e ects of surfactants on the adhesion of bacteria at water-oil and water-solid interfaces. In the present study was attempted to study the isolation, characterization and degradation of Sodium Dodecyl Sulphate by bacteria from detergent contaminated soil from di erent environmental samples. And also study the SDS degrading by using MBAS.

In this present study the isolation of SDS degrading bacteria from detergent contaminating soil. e samples were collected from in and around Kanchipuram. e samples were collected in a sterile polythene bag with wetness sealed and transfer to laboratory.

e ve gram of soil sample was taken and added to the ask containing 500 ml of basal medium (consisting of 1 gram/100 ml of SDS) for enrichment of bacteria. e conical ask was kept in shaker for incubation at 28ºC for “24 h” [16].

e enriched samples were taken for the isolation of bacteria. 0.1 ml of enrichment sample was spread on to basal medium agar plate containing (consisting of 1 gram per 100 ml) SDS as the only source of carbon energy. e plate was incubated at 28ºC [16]. e incubated plates were observed for SDS degrading bacteria. e morphologically di erent colony was selected and streaked on fresh nutrient agar plate and incubated at 28ºC for “24 h”. All the strains were preserved at 4ºC until further studies.

All the selected bacterial strains were further screened for con rmation of SDS degrading activity. e bacterial strains were spotted on Bacto agar incorporated with (consisting of 1 gram per 100 ml) SDS. e plates were incubated at 28ºC for “24 h”. A er incubation, the plate were ooded with Lugol's iodine and observed for the zone of clearance around the bacterial growth. Strain which showed maximum zone of clearance on their preliminary screening that selected potential strain used for further studies.

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e concentration of residual SDS was determined by measuring the intensity of Methylene blue in a chloroform extraction process [17]. All the strains were inoculated with Basal medium and incubated at 28°C for “24 h”. A er incubation all the samples were studied for SDS degradation by using MBAS /AMC9 BDC /T12 1 0EachMC9 Bl) f5lMC9 Balf5lMC9 Balf5lMC9 Balspotted on Bacto

Agar (incorporated with 1 gram per of SDS 100 ml). Totally 40 bacteria were studied for the degrading activity (Table 1). Among the 40 strains 4 strains showed zone of clearance around the well. e best degrading activity of all the 4 strains was given in the Figure 1. Hence 4 strains selected for MBAS assay.

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HS18 showed 80%, 53%, 24%, and 23%, HS21 drf3.55utifacr9activit c th/ArfD[(4)7/O /Layout[0%,oayouth0 17%DC /F9.u1%,oayouLW38oayou1

that anionic surfactants signi cantly biodegraded by bacteria.

e obtained results concluded that anionic surfactants signi cantly biodegraded by bacteria. e results of this study suggest that growth of simple bacteria in household and industrial sewage can be a cost-e ective method of anionic surfactant elimination. In conclusion, we have isolated an SDS-degrading bacterium from an SDS-polluted water sample from Kanchipuram. HS18 showed 80%, 53%, 24%, and 23% of degrading activity in 1 g, 2 g, 3 g and 4 g of SDS in 100 ml respectively.

e relatively high optimum temperature for growth on SDS exhibited by this bacterium is suitable to be used for the bioremediation of SDS polluted sites in Kanchipuram. Based on the phenotypic characteristics the potential strain was identi ed as *Pseudomonas* sp (HS18). e results of this study suggest that growth of simple bacteria such as *Pseudomonas* sp in household and industrial sewage can be a cost-e ective method of anionic surfactant elimination.

Acknowledgement

References