Biomass Conv. Bioref. (2017) 7:51–58
DOI 10.1007/s13399-016-0212-z

ORIGINAL ARTICLE

Isolation and characterization of alginate-degrading bacteria *Sinomicrobium oceani*

A. Jegatheesan[1] · **M. P. Sudhakar**[2] · **C. Poonam**[1] · **K. Perumal**[2] · **K. Arunkumar**[3]

Received: 30 January 2016 / Revised: 2 July 2016 / Accepted: 6 July 2016 / Published online: 15 July 2016

Abstract This research work is focused on identifying alginate-degrading bacteria from various marine as well as alginate industrial substrates using basal salt medium with alginate as sole source of carbon. In the present study, alginate-degrading colonies formed soft pits on the surface of the medium with clear haloes around them gradually degrading the solid medium into liquid on day 7. The isolate positive for alginolytic activity formed a circular pale yellow zone around the colony. Out of the 23 isolates studied, 11 exclusively isolated from the alginate industrial wastes were chosen for the degradation study. On the basis of bacterial growth, total sugar, reducing sugar and total protein in the culture medium, isolates AAl 01, AAl 02, AAl 03 and AAl 04 were selected of which consortium AAl 02 + AAl 04 was found promising for maximum alginate lyase activity on day 4 of inoculation at 28 °C with pH 7.5. Batch culture studies showed that fresh biomass of *Sargassum wightii* produced 37.88 ± 1.37 % of reducing sugar by direct saccharification using bacterial consortium, whereas by acid pretreatment + bacterial consortium, the yield was 62.69 ± 2.90 %. In the case of pigment-phycocolloid spent, 82.41 ± 4.50 % of reducing sugar was released using bacterial consortium, whereas by mild acid pretreatment + bacterial consortium, 86.68 ± 7.11 % was achieved. Results of morphology, biochemical tests and 16S rRNA sequence confirmed the two promising isolates as *Sinomicrobium oceani* (AAl 02 and AAl 04) belonging to *Flavobacteriaceae.* Seaweed biomass degradation using biological methods is non-toxic and considered environmentally safe.

Keywords Seaweeds · Seaweed industrial spent · Alginolytic activity · Alginate lyase · *Sinomicrobium oceani*

1 Introduction

Some marine macroalgae belonging to the members of *Phaeophyceae* (brown seaweed) are composed of polysaccharides in their cell wall to avoid desiccation. These cell wall hydrocolloids (polysaccharides) are alginate, laminarins, fucoidans, cellulose, etc. [1]. Besides cell wall polymers, proteins, free mannitol, minerals, polyphenols, peptides, fatty acids, terpenoids and various pigments are also found in brown seaweeds [2, 3]. Quantitatively, the major polysaccharide in the cell wall of the brown algae is alginate constituting 45 % of the dry weight of biomass [4] and it varies depending on species [5, 6]. Structurally, alginate consists of unbranched chains comprising blocks of continuous β-l,4-linked D-mannuronic acid and blocks of continuous α-l,4-linked L-guluronic acid [7]. The average length of the blocks is about 20 units and these are interspersed with a statistical mixture of the two acids [8]. The proportions of the two acids vary from species to species and differ in parts of the same plant [9].

Electronic supplementary material The online version of this article (doi:10.1007/s13399-016-0212-z) contains supplementary material, which is available to authorized users.

✉ K. Arunkumar
arunnir@yahoo.co.in

[1] Marine Algae Research Division, Post Graduate and Research Department of Botany, Alagappa Government Arts and Science College (Alagappa University), Karaikudi, Tamil Nadu 630003, India

[2] Shri AMM Murugappa Chettiar Research Centre (MCRC), Taramani, Chennai, Tamil Nadu 600113, India

[3] Department of Plant Science, Central University of Kerala, Riverside Transit Campus, Padanakkad, Nileshwar, Kerala 671314, India