Extracellular polymeric substances produced by a marine bacterium, *Hahella chejuensis*

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Abstract

A bacterial strain producing a large amount of EPS was isolated from marine sediment sample collected from the Cheju Island, Republic of Korea. In the present study, the isolation and identification of this isolate, which is named *Hahella chejuensis* gen. nov., sp. nov., the effects of nutrients on the production of EPS, and some properties of this EPS are reported.

Introduction

Extracellular polysaccharide (EPS) secreted by microorganisms plays important roles involved in their existence such as protecting from other organisms or antigens, neutralizing environmental toxic materials, and preventing loss of intracellular water in dry environment. This microbial EPS has been used in a wide range of industry through its functions such as gel formation, emulsifying, absorption, cohesion, and film formation. Furthermore, heavy-metal ion accumulating, anti-tumor active and anti-ulcer active EPSs have been reported. Such EPSs have industrial potential as new biomaterials through these activities. EPS from marine microorganisms such as *Zoogloea* sp. *Pseudomonas* sp., *Vibrio fischeri*, *Cyanothece* sp., and *Alteromonas macleodii* were produced and their properties were investigated. Microbial EPS have advantage over EPS from other sources as they can be produced in large quantity using relatively simple purification step. However, EPSs from marine microorganisms isolated from Korean coasts were not studied enough with the exception of EPS from marine bacterium *Zoogloea* sp. KCCM 10036.

Isolation and identification of EPS-producing isolate

A bacterial strain, designed 96CJ10356, producing abundant extracellular polysaccharides and red pigment, was isolated from marine sediment collected from the Cheju Island, Republic of Korea. The organism is Gram negative, aerobic, rod shaped and motile. The color of colonies changed from pale organge to pinkish red, and the colonial shape from small circular to large vocanic form after 3 days. The shape of the isolate was long rod in the young stage, which became short rod in old cultures. The orgainsm was motile by means of single polar flagellum. Growth occurred between 20 to 45℃, though extended incubation time (up to one month) was required at 10 and 15℃. The growth was not observed in the absence of NaCl, and optimal concentration of NaCl was 2%. The strain had oxidase and catalase, and was able to utilize esculin and gelatin. The major cellular fatty acids were saturated or monounsaturated straight-chain fatty acids. The G plus C ratio of DNA of our isolate was 55%. Almost complete sequence of 16S rDNA of test strain was determined. It is clear from polyphasic evidence that the isolate merits the generic status in the gamma subgroup of *Proteobacteria* and the name *Hahella chejuensis* gen. nov., sp. nov. was proposed to harbor marine isolate 96CJ10356 (=KCTC 2395T).

Production of EPS-R by *Hahella chejuensis*

Hahella chejuensis 96CJ10356 produced a novel exopolysaccharide, designated as EPS-R. It was produced optimally in a sucrose/tryptone ratio of 2:1 (w/w). Although the growth of the strain was maximal at the concentration of 2% NaCl, 1% of NaCl provided the highest yield of EPS-R. This strain also required magnesium and calcium ions for growth and production of EPS-R. At the aeration rate of 1.5 vvm in 5 L jar fermenter, about 12 g/l EPS-R could be produced at pH 7.0, 25℃ after 72 h culture.

The average molecular weight was determined to be larger than 2×10^6 Da. EPS-R was mainly composed of galactose and glucose in a molar ratio of 6.8:1 with minor amounts of ribose and xylose.

The EPS-R has emulsifying stability, flocculation activity, viscosity, and the large amount of EPS-R could be obtained. So this EPS-R exhibited such a potential industrial purpose.