

## Microbial Alginate Production: Does Nature of Alginate Relate to Source Microorganism

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### EDITORIAL

Alginate is formed of the mannuronate (M-block) and residues of guluronate (G-block) organized in intermittent blocks in linear chain. Currently, the source of alginate is the cell wall of the brown seaweeds (Saude and Junter, 2002), where they are found as mixed salts of Ca, Na and K with alginic acid (Clementi *et al.*, 1995). Alginate obtained from various algae sp. or among several sections in the same algae has different amount of these salts (Sabra, 1998). Alginate can be produced from the brown seaweeds and from bacteria (Donati and Paoletti, 2009).

At present the giant brown kelp *M. pyrifera* is the origin for commercial production of alginate. As commercial production of alginate is limited to few species of brown algae regarding abundance, location and uniform quality, the search for alternative bacterial alginate is need of the hour. Some prokaryotic microbes of two genera like *Azotobacter* sp. (Gorin and Spencer, 1966) and *Pseudomonas* (Cote and Krull, 1988; Moral and Yildiz, 2016) have ability to produce alginate. The alginate produced by *Azotobacter vinelandii* has similar blocks of monomer residues to that of alginate produced by seaweeds (Steinbuchel *et al.*, 2001).

Various bacterial species are capable to produce alginate and most important among them are *Pseudomonas* sp. and *Azotobacter* sp. Many studies on molecular mechanisms of alginate biosynthesis by bacteria have been done on *Pseudomonas aeruginosa* which is the opportunistic human pathogen and *Azotobacter* which is the soil dwelling bacteria. Even though these two bacteria (*Pseudomonas* and *Azotobacter*), secrete alginate in nature by using the same molecular mechanism. Both bacterial species *Azotobacter* and *Pseudomonas*

synthesize the alginate in vegetatively growing cells as an extracellular polysaccharide (EPS) (Steinbuchel *et al.*, 2001). It has been documented that alginate obtained from *Pseudomonas* lack G blocks (Skjak-Braek *et al.*, 1986) whereas alginate obtained from *Azotobacter* may have these blocks. There are reports about the development of thick highly structured biofilms from alginate produced by mucoid strains of *P. aeruginosa* (Hay *et al.*, 2009), whereas *Azotobacter* produce the stiffer alginate with usually a greater amounts of G residues. These G residues remains closely linked with the cell permitting the development of desiccation resistant cysts (Sabra and Zeng, 2009). The monomer composition and molecular weight of alginates are known to have effects on their properties (Urtuvia *et al.*, 2017).

There have been investigations about biosynthesis of bacterial alginate, their potential uses in applications requiring distinct substantial possessions (Hay *et al.*, 2013). There are various characteristics including high molecular mass and the negative charge of bacterial alginate that confirm its hydrated and viscous nature. The broad distribution of *Azotobacter* and *Azospirillum* in various surroundings, such as water, soil and residues make it ecologically important. The broad metabolic diversity of *Azotobacter* spp. and *Azospirillum* spp. has made it capable of degrading different highly resistant substrates for increase in plant yield by increasing fixed nitrogen in the soil (Ashraf, 2016). There has been a partial association of alginate biosynthesis with the growth of bacteria.

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