Biofilm Matrix Alginate Exopolysaccharides

- Heteropolysaccharides
- Acetyl substituents on *D*-mannuronosyl residues only

Microbial Exopolysaccharides

- **Carbohydrate Composition**
- **Organic and Inorganic substituents**

Bacterial Alginates

- **Carbohydrate Composition**
  - **L-guluronic acid**
  - **D-mannuronic acid**

Bacterial Alginates form a Natural family of Exopolysaccharides

- All contain D-mannuronic acid and L-guluronic acid
- All contain O-acetyl groups on D-mannuronosyl residues only
- All are of High Molecular Weight except a few from plant pathogenic *Pseudomonas* spp.
- None form gels with Ca^{2+} or Sr^{2+}

Pseudomonas aeruginosa alginate

- [-4--D-Man*p*A-(1 4)--D-Man*p*A-(1 4)--D-Man*p*A-(1 4)--D-Man*p*A-(1 4)--D-Man*p*A-(1 4)--D-Man*p*A-(1 4)--L-Gul*p*A (1]
- No GulA-GulA sequences
- O-Acetyl groups are attached to many of the D-mannuronosyl residues

Algal Alginates

- All are of much lower Mol. Weight than *Pseudomonas* or *Azotobacter* alginates
- Wide range of molecular weights, usually less than 1m.
- No Acetyl groups
- Many contiguous Guluronic acid residues
- Wide range of ManA:GulA ratios
- Some are very rigid molecules
- Form heat stable gels with Ca^{2+} or Sr^{2+} ions

Factors affecting gelation of alginates

- Algal alginates possess contiguous Guluronic acid residues
- Pseudomonas alginates lack contiguous Guluronic acid residues
- Azotobacter alginates possess some contiguous Guluronic acid residues but *O*-acetyl groups prevent ion chelation
- Thus only Algal alginates can form these gels!.

Hydration and Solubility of Alginates

- Algal alginates are water soluble due to low mass
- Despite high mass. Bacterial alginates are water soluble
- Deacetylated bacterial alginates are insoluble in water
- Bacterial alginates may adsorb significant quantities of water

Enzyme susceptibility of alginates

- Only alginate lyases have been discovered
- These vary in their substrate specificity
- Algal alginates are readily degraded
- Bacterial alginates are generally highly resistant to enzymic degradation

Specificity of Phages

- Phages have been found for Azotobacter spp. and yield lyases (Davidson et al.,) which act on *Azotobacter* and algal but not *Pseudomonas* alginates
- Phages have been isolated for alginate-producing *P. aeruginosa* (Production and/or specificity of enzymes not fully established) (Hanlon et al., 2001)
- The only enzymes characterised have been polysaccharide lyases (Hanlon enzyme ?)