Arctic marine bacteria for bioplastic production

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Oil-based plastic production now exceeds 330 Mt annually[1] and poses a major environmental problem. Polyhydroxyalkanoates (PHA) is a group of bioplastic polyesters that can replace oil-based plastics in many applications, but economic costs are higher and industrial-scale production still limited. PHA is produced naturally by diverse groups of bacteria and stored intracellularly as hydrophobic granules, carbonosomes, when carbon is in excess relative to other nutrients. PHA polymerase enzymes located peripherically on the carbonosome with regulatory proteins and PHA de-polymerases, synthesize the carbonosome which can occupy more than 90% of the cell volume for some species.

We screen a collection of arctic marine bacteria to find novel PHA producers with the potential of utilizing low-value marine biomass as feedstock in production. PHA producers are selected based on fluorescence microscopy, Fourier-Transform Infra-Red (FTIR) spectral analysis and Gas Chromatography–Mass Spectrometry (GC/MS). Structural conformation of PHA monomers will be characterized using Nuclear Magnetic Resonance-spectroscopy (NMR). Growth conditions for selected bacteria is optimized to increase natural PHA production. Metabolic modelling using transcriptomic data will provide targets for metabolic engineering, eg. by knock-out or knock-down of PHA de-polymerases, to further increase PHA production.

We present here results from 16s rDNA analysis of bacteria isolated from a Norwegian fish-landing facility and preliminary results of possible PHA producers from our arctic marine bacterial collection.

1. Statista 2018, https://www.statista.com/statistics/282732/global-production-of-plastics-since-1950/ 29.04.2018