Environmental Engineering and Management Journal *March 2012, Vol.11, No. 3, Supplement, S162*
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

P102

EXOPOLYSACCHARIDIC MATRIX OF BIOLOGICAL SOIL CRUSTS FROM ARTIC ENVIRONMENTS

Federico Rossi[1], Gianmarco Mugnai[1], Giovanni Colica[1], Stefano Ventura[2], Claudio Sili[2], Cristina Mascalchi[2], Roberto De Philippis[1]

[1]Department of Agricultural Biotechnology, University of Florence, Florence, Italy; [2]Institute for Ecosystem Studies, CNR, Florence, Italy

Abstract

Biological soil crusts (BSC) are soil-surface communities that represent a typical example of microbial adaptability to harsh environmental conditions. They improve soil fertility and promote plant growth, representing a valid putative tool to fight desertification processes. Various mechanisms allow them to withstand constraints such as drought, high solar irradiation and wind erosion.

These organisms produce extracellular polymeric substances (EPS), excreted in response to the environmental characteristics, which are known to primarily contribute in many ways to the increase of constraint tolerance. While various features of these excreted molecules have been investigated in axenic bacterial cultures, a not definitive and relatively low number of studies come from the direct study of the entire matrix of microbial aggregates, with limitative information on how they contribute to microbial survival in extreme environments.

The aim of this study was to investigate the microbial composition and the characteristics, both qualitative and quantitative, of the EPS extracted from BSC collected by several sites in Ny-Ålesund, Svalbard Island, Norway, in a landscape mostly characterized by the high arctic tundra, where environmental conditions are extreme and where BSC play a key role in creating a favorable habitat for plant growth after deglaciation processes.

A proper method for extracting EPS directly from the crust samples was optimized. Exopolysaccharidic fractions were quantified and analyzed using ion-exchange chromatography (IEC) to determine the monosaccharidic composition. Size exclusion chromatography (SEC) was also used to determine the size distribution of the EPS fractions. Abundance of phototrophic microorganisms, which are known to primarily contribute to EPS excretion, was also evaluated in all the samples.

Results underlined the complexity of the polysaccharidic fractions, displaying a high number of constituent sugars; the matrix was found to be constituted by two main fractions, a higher molecular weight (MW) fraction (apparent MW around 2 10^6 Da) and a lower molecular weight fraction (MW < 100 10^3 Da). Fluctuations of these results were observed along the sampling sites suggesting the influence of environmental factors and substrate characteristics on the formation of EPS matrix.

This study presents novel data concerning EPS of BSCs matrix in cold environments and the results represent a starting point to deepen the knowledge on the mechanisms at the basis of the high tolerance showed by BSC microorganisms to extreme conditions. The knowledge of these mechanisms in different extreme environments (both hot and cold) can improve the outcome of the exploitation of these communities to increase the fertility and the stability of soils in constrained environments.