SALT MARSH ACCRETION BY ENDOGENOUS CYANOBACTERIA TO REDUCE EROSION IN VENICE LAGOON

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Abstract

Different strains of cyanobacteria were isolated from salt-marsh of Venice Lagoon. One of them was used in the laboratory to colonize artificial substrates to induce a better colonization of eroded sediments. Different materials for cyanobacteria colonization were used from silica, zeolite to sediments. Different tests were made to improve cyanobacteria survival and exo-polysaccharide production under diverse conditions to consolidate sediments.

Keywords: Cyanobacteria, Sediments, Erosion, Lagoons

Fig. 1. Eroded sediments in the Northern Lagoon of Venice

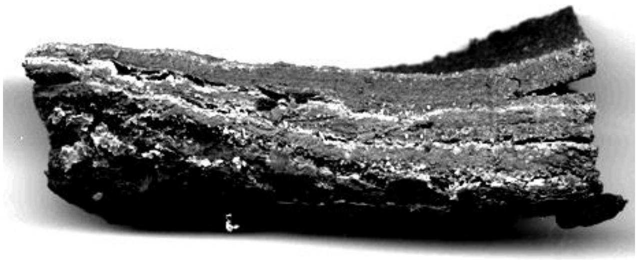

Fig. 2. Natural stratified sediments colonized by filamentous cyanobacteria

During the last century the Venice lagoon wetlands underwent to a severe reduction of intertidal shoals and salt marshes. These geomorphologic components of the lagoon are particularly vulnerable and they have been already affected by intense erosion (Fig. 1) passing from 17.0% to 8.8% [1]. By many observations we know that cyanobacteria in the Venice Lagoon form stratified sediment (Fig. 2). These structures are very stable and consolidate sediments by naturally reducing the erosion. The aim of this work was to mitigate this process by promoting the consolidation of sediment surface with endemic cyanobacteria mat, by growing these autotrophic bacteria on suitable solid substrates to seed and colonize sediments in order to understand the colonization process for facilitating the self-preservation of salt-marsh habitats.

Cyanobacteria were isolated from salt marshes sediment in the northern basin of Venice Lagoon using solid media ASN-III [2]. A filamentous cyanobacteria strain was selected among other isolates. The strain CyV3 was used in colonization experiments on sandy quartz, commercial zeolites grain and natural lagoon sediments. The growth and adhesion of bacteria were followed on these substrates by determining photo pigments, carbohydrates, uronic acids, exopolysaccharides (EPS) and proteins. Adhesion of cyanobacteria on sediments was also studied with epifluorescence microscopy using PNA lectine and other conventional fluorochromes. Experiments were performed also in microcosmos, using lagoon sediments to study cyanobacteria colonization. Four glassware vessels containing each 1 kg of sediments, sampled from the same salt marsh station, were used for the experiment with natural and autoclaved sediments with and without additions of cyanobacteria grown on porous zeolite. These experiment was followed for 15 days and all parameters were determined to understand the colonization process.

The CyV3 strain, belongs to Phormidium sp, grown significantly faster than other isolated strains and so we use this strain to reproduce at the multilayers structure (Fig 2). The strain was grown on coarse silica sand and fine zeolite: the growth was faster in silica but the material consolidation was weak. With finer grains of zeolites, the growth rate was longer but CyV3 produced higher amounts of ESP and total carbohydrates to give a more consolidate structure.

So commercial zeolite grains (0.5 cm diameter) colonized by strain CyV3 were used to seed CyV3 strain in microcosmos with lagoon sediments. The cyanobacteria viability and reproducibility on colonized zeolites was monitored for two months. The same percentage of viability was maintained for two weeks, after a sensitive decrease of viability with an extended lag-phase was observed. Results of experiments in the four microcosms indicated that a strong microbial competition occurred in natural sample so cyanobacterial strain seeded on zeolite did not produce significant augmentation of cyanobacteria population in relation to native autotrophic population. Conversely, the inoculated cyanobacteria zeolite grains in sterilized sediments gave a wide contribution to the formation of consolidated cyanobacterial mat.

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