Blue biotechnology: enhancement of bioremediation using bacterial biofilms on biodegradable scaffolds

V. Catania[1], F. Lopresti[2], S. Santisi[3], S. Cappello[3], R. Scaffaro[2] and P. Quatrini[1]

1. *Dip.to Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche (STEBICEF), Univeristy of Palermo, Viale delle Scienze edif. 16 90128 Palermo, Italy.*
2. *Department of Civil, Environmental, Aerospace and Materials Engineering University of Palermo,Viale delle Scienze, ed. 6, 90128 Palermo, Italy*
3. *Istituto per l'Ambiente Marino Costiero (IAMC) – CNR U.O.S. of Messina, Italy; Spianata San Raineri, 86 – 98121 Messina, Italy.*

valentina.catania@unipa.it

Petroleum hydrocarbons are still the most threatening environmental pollutants. A promising non invasive and low-cost technology for the treatment of contaminated sites is based on bioremediation by biodegrading microorganism endowed with catabolic ability towards oil and derivatives. New methods are needed to enhance and optimize natural biodegradation, such as the immobilization of hydrocarbons degraders in many types of supports. We developed a scaffold-bacteria bioremediation system to clean up oil contamination based on degradable 3D scaffolds. The polycaprolactone component is biodegradable, produced in the melt, i.e. at low cost and without the use of toxic solvents. The biofilm is made of highly performing HC-degrading bacteria such as the marine hydrocarbonoclastic bacteria (HCB) (1) or solid n-alkane degrading Actinobacteria (2, 3). The bacterial biofilm is observed within the whole structure of scaffold using scanning electron microscopy. The bioremediation efficiency of such systems was tested on crude oil by GC-FID analysis and compared whit planktonic cells. The biofilms formation was a promoting factor for biodegradation showing hydrocarbon removal up to 70% and 15% more in respect to the planktonic cells. Increasing availability of the contaminants and a better interaction between the hydrophobic substrate and the bacterial cells resulted in developing the degradation rate. Biofilm-mediated bioremediation is a new tool to be developed for bioremediation of acquatic system.

1. Yakimov, M.M. et al. (1998) Int J Syst Evol Microbiol 48: 339-348
2. Quatrini, P. et al. (2008) J Appl Microbiol 104: 251–259
3. Lo Piccolo, L. et al. (2011) Appl Environ Microbiol 77(4):1204-13