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"Gheorghe Asachi" Technical University of Iasi, Romania

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BIOAUGMENTATION POTENTIAL OF *Novosphingobium* SP. PP1Y IN NATURAL AND ARTIFICIAL SOILS CONTAMINATED BY PAHS AND HEAVY METALS

V. Cafaro, E. Notomista, V. Izzo, L.Troncone, G. Donadio, P. Tedesco, A. Di Donato

Université de Caen Basse-Normandie - UR ABTE - F-14032 Caen, France

Abstract

Polycyclic Aromatic Hydrocarbons (PAHs) are among the most widespread organic pollutants in the environment. PAHs are of great concern because some of them show strong mutagenicity and carcinogenity. Bioremediation, which involves the use of microorganisms to reduce the concentration of various chemical pollutants, has become nowadays one of the most promising approach for environmental clean-up. Unfortunately, the presence of heavy metals in environments contaminated by organic compounds often hamper the environmental restoration. Several species of bacteria have been isolated from polluted environments able to degrade recalcitrant compounds. We have recently characterized a novel Sphingomonadales, *Novosphingobium* sp. PP1Y, isolated from surface seawater samples collected inside the harbour of Pozzuoli (Naples, Italy). The strain PP1Y not only uses a surprisingly large number of mono and polycyclic aromatic compounds as the sole carbon and energy sources but it shows a very interesting and effective adaptation to grow on complex mixtures of aromatic compounds dissolved in oil phases like diesel-oil and gasoline. *Novosphingobium* sp. PP1Y showed the ability to form "biofilm" on several types of hydrophobic surfaces and, in water/oil systems. It is well known that biofilm formation make bacteria able to adhere to growing substrates and to confer the resistance towards heavy metals and organic pollutants. We investigated the biodegradation abilities of *Novosphingobium* sp. PP1Y in natural soil and compost, artificially contaminated by PAHs and heavy metals such as nickel, copper and zinc, in small-scale experiments. *N.* sp. PP1Y showed the ability to quickly remove phenanthrene from the compost after addition of the organic compound in crystal form or dissolved in oil phase. The bacterium was also able to metabolize phenanthrene in the presence of heavy metals, showing the most significant delay in phenanthrene removal only at high nickel concentration. When a mixture of PAHs in paraffin containing naphthalene, phenanthrene and pyrene, was added to the compost, the bacterium was able to remove all the three compounds, although with different rates. Furthermore, the addition of *N.* sp. PP1Y to a natural soil contaminated by heavy metals and PAHs, already endowed with a microbial community adapted to use PAHs in the presence of heavy metals, halved the time of natural self-purifying of the soil, thus suggesting the ability of *N.* sp. PP1Y to compete with the adapted endogenous microbial community.In conclusion *Novosphingobium* sp. PP1Y is a good candidate for the bioremediation of organic compound contaminated soils in the presence of heavy metals.