WITH THE CONTRIBUTION OF THE LIFE PROGRAMME
OF THE EUROPEAN UNION. LIFE15 ENV/IT/000396

LIFE BIOREST

SOIL BIOREMEDIATION

A NEW OPPORTUNITY FOR HYDROCARBONS REMOVAL

WHAT DO WE KNOW ABOUT SOIL POLLUTION?

"Soil pollution" refers to the presence of a chemical or substance out of place and/ or present at a higher than normal concentration that has adverse effects on any non-targeted organism. Although the majority of pollutants have anthropogenic origins, some contaminants can occur naturally in soils as components of minerals and can be toxic at high concentrations. Soil pollution often cannot be directly assessed or visually perceived, making it a hidden danger.
The diversity of contaminants is constantly evolving due to agrochemical and industrial developments. This diversity, and the transformation of organic compounds in soils by biological activity into diverse metabolites, make soil surveys to identify the contaminants both difficult and expensive. The effects of soil contamination also depend on soil properties since these controls the mobility, bioavailability, and residence time of contaminants.
In the European Union there are 42 potentially contaminated sites and 5.7 contaminated sites per 10,000 inhabitants, with about 340,000 sites that require remediation. Currently only about 15% of contaminated soil have been carried out clean-up operations.

MAIN POLLUTANTS IN SOIL: PAHs and BTEX

The most common soil contaminants are heavy metals in Europe, followed by mineral oil, polycyclic aromatic hydrocarbons (PAHs) and from mixtures of benzene, toluene, ethylbenzene and xylene (BTEX). Polycyclic aromatic hydrocarbons (PAHs) are a group of persistent, semi-volatile organic pollutants.

The most frequent PAHs are anthracene, fluoranthene, naphthalene, pyrene, phenantrene and benzopyrene.
The very low water solubility of PAHs and the slow mass-transfer rates from solid phase may limit their availability to microorganisms, thus hindering natural attenuation by microbial processes.
Polycyclic aromatic hydrocarbons accumulate in soils because of their persistence and hydrophobicity and tend to be retained in the soil for long periods of time.

THE STRATEGY TO BRING GREEN LAND BACK FOR THE COMMUNITY

LIFE BIOREST

LIFE BIOREST aims at demonstrating the economic sustainability and efficiency of a bioremediation method based on the selection and bioaugmentation of autochthonous microbial strains selected for their high degrading capacity.

With the final goal of restoring the ecological functions of the soils, counteract the loss of fertility, biodiversity and resilience and bring new green areas back for the community.

Revegetation of polluted soil and restore its ecological functions, including the elaboration of chemical, microbiological and ecotoxicological indicators and showing the possibility to cultivating different plant species.

Guidelines for an effective bioremediation, sustainable from an environmental and economic point of view, exportable to other EU sites similarly polluted by hydrocarbons.

Increase the engagement of citizens, schools and policy makers about pollution, soil conservation, enhancing local resources through communication activities, training courses, events, international workshops.

Optimized bioremediation protocol with selection of microbial consortia with improved degradation abilities towards alkanes, polycyclic aromatic hydrocarbons and BTEX, with enhancement of agro-industry by-products.

Microorganisms production at industrial scale and bioremediation of a demonstration area of 400 m^3 compatible with the public and residential use in the site of Fidenza (Emilia-Romagna region, Italy).

POLICY AND REGULATION

The Revised World Soil Charter (FAO, 2015b) recommends that national governments implement regulations on soil pollution and limit the accumulation of contaminants beyond established levels in order to guarantee human health and well-being. Governments are also urged to facilitate remediation of contaminated soils that exceed levels established to protect the health of humans and the environment. Recently, the United Nations Environmental Assembly (UNEA-3) adopted a resolution calling for accelerated actions and collaboration to address and manage soil pollution in the framework of Sustainable Development.
This consensus achieved by more than 170 countries, is a clear sign of the global relevance of pollution and of the willingness of these countries to develop concrete solutions to address pollution problems (UNEP, 2018).

REMEDIATING POLLUTED SOIL

Remediation techniques can be divided in two main groups: in situ (on the site) and ex situ (removal of contaminated soil for treatment off the site) remediation. Available remediation options include physical, chemical and biological treatments, and these options offer potential technical solutions to most soil pollution. For both in situ and ex situ, the net effect on the contaminants can be categorized as reducing the concentration, reducing the bioavailability without reducing the concentration, encapsulating in an inert matrix, containment, and removal.

The management of polluted sites is a site-specific approach that includes characterization, risk assessment and remediation technologies selection, and therefore is mainly focused on local or point-source contamination. Bioremediation is a technology that destroys or renders harmless various contaminants, using the biological activity of certain microorganisms. Bioremediation actually relies on the microbial growth and activity; its effectiveness is highly dependent on the applied environmental parameters that influence the microbial growth and the degradation rate.

LIFE BIOREST

COORDINATORE:
Consorzio Italbiotec

CONTATTI:
ilaria.re@italbiotec.it | www.lifebiorest.com