ABSTRACT

Petroleum hydrocarbons are one of the major pollutants of terrestrial and marine environments. Although evaporation and photo-oxidation play an important role in detoxification, ultimate and complete degradation is accomplished mainly by microorganisms. The general strategies for bioremediation are biostimulation (release of nutrients, biosurfactans and aereation to enhance the metabolic conditions of the native microbial community), and the inoculation of appropriated degradative organisms or bioaugmentation.

Bioaugmentation not always reaches the objective successfully because the selected microorganisms must also be able to overcome biotic and abiotic stresses in the environment in which they are introduced. The use of inoculant formulations involving carrier materials for the delivery of microbial cells to natural ecosystems, is an attractive option. The carrier provides microorganisms favorable conditions for survival as well as functioning of the inoculant cells, resulting in a sufficiently long shelf life as well as improved survival and activity.

In this Thesis the development of inoculants, using chitin and derivates as carriers, to optimize the bioremediation of polluted environments and the biological treatment of hydrocarbons efluents is studied.

Potential of chitin and derivates flakes obtained from shrimp wastes as carrier materials for a hydrocarbon-degrading bacterial strain is examined. The selected microorganism, *Rhodococcus corynebacterioides*, was isolated in

previous research, from coastal soils of Bahía Blanca Estuary. Growing parameters and metabolic activity of the selected strain related to the development of the inoculant are determined: growing temperature range, generation range, use of different hydrocarbon products, hidrophobicity coefficient and crude oil biodegrading activity.

Chitin and derivates, obtained from the exoskeletons of shrimps (*Pleoticus mülleri*) at the Laboratorio de Investigaciones Básicas y Aplicadas en Quitina (L.I.B.A.Q.) of the Departamento de Química at Universidad Nacional del Sur, were studied as carrier material of bacterial strains. Suitable methods for reducing the microbial load of the carrier and the ability to link bacterial cells are determined.

Suitable conditions for the immobilization of microorganisms and formation of an abundant biofilm on the flakes are established.

Once developed the inoculant, the survival of the immobilized strains on the different carrier materials and its biodegrading activity is evaluated.

Also storage conditions and viability assessment of the inoculant are tested.

The effectiveness of inoculant addition in bioremediation process is evaluated. Different microcosms are prepared: an agricultural soil contaminated with crude oil, soil of a local petrochemichal refinery and seawater polluted with crude oil.

In all the cases the developed inoculants improve survival and degrading activity of the immobilized microorganisms. In terms of removal percentaqe of crude oil after the different treatments agricultural soil and seawater microcosms prove to be most successful.

It is important to emphasize that the inoculants formulated with chitin flakes show the best perfomance during storage and bioremediation treatments.

These results allow the use of an abundant residue of the local fishing industry, the exoskeletons of shrimps, that is produced in high amounts in our coasts, meanwhile there is a contribution for the treatment of waters and soils polluted with crude oil that come from the industrial and port activity of Bahía Blanca zone.