



BIOLOGICAL REMEDIATION OF PETROLEUM HYDROCARBONS FROM A **REFINERY'S SOIL** COMPARISON OF DIFFERENT TECHNOLOGIES

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Presentation Outlines

> I - INTRODUCTION > II - PROJECT DESIGN > III - FIELD WORK > IV - FIRST RESULTS > V - DISCUSSION > VI - COMPARISON WITH LITERATURE > VII - PRELIMINARY CONCLUSIONS

I - INTRODUCTION

Jeum Hydrocarbons

Environmental contaminants

Different sources



Source: http://earthsci.org/mineral/energy/gasexpl/refine.html

Different physical and chemical properties

Some molecules can be tightly sorbed to soil particles

I - INTRODUCTION

The Refinery

High distillation capacity

Units - Lubricants, aromatics, fuels, utilities, base oils "Environmental soul"



Source: http://www.drakogroup.com/oil.htm

Project Goals

RESEARCH OPPORTUNITIES

Development of a methodology for restoring contaminated sites using different biological remediation technologies:

➢ Rhizoremediation

➢ Bioaugmentation

TO ACHIEVE THE TARGET

Cost

Development –

Investigation goal 🧹 Technical

Regulatory

I I-PROJECT DESIGN

Cortaderia selloana Scirpus maritimus Juncus maritimus S. maritimus ass. J. maritimus



Bioaugmentation product

Commercial

I I- PROJECT DESIGN

SITE LAYOUT



Contaminated soil



I I I - FIELD WORK

(Re) Contamination





Soil's Homogenization



III - FIELD WORK

Container's Preparation





Container's Preparation



III - FIELD WORK

Container's Preparation





Plant's transplantation

sk up and transplant of plants

from Douro's Estuary – Scirpus maritimus & Juncus maritimus

rom the Refinery – *Cortaderia selloana* **Study's place**



Plants picking up

I I I - FIELD WORK

Douro Estuary



I I I - FIELD WORK

Refinery





Transplant & general aspect of the place





Í I I - FIELD WORK









"WITHOUT" MICROORGANISMS



COMMERCIAL BIOAUGMENTATION PRODUCT





NUTRIENTS

COMMERCIAL BIOAUGMENTATION PRODUCT

PLANT

NUTRIENTS/SURFACTANT

COMMERCIAL BIOAUGMENTATION PRODUCT









PLANT

NUTRIENTS



NUTRIENTS SURFACTANT



PLANT NUTRIENTS SURFACTANT







PLANT NUTRIENTS SURFACTANT COMMERCIAL BIOAUGMENTATION PRODUCT



Plant's evolution - DAY 0



Plant's evolution - DAY 0



I'I I - FIELD WORK

Plant's evolution - DAY 22 nd





Plant's evolution - DAY 26 th



Plant's evolution - DAY 56 th



IV - FIRST RESULTS

Plant's evolution - DAY 64 th













































IV - FIRST RESULTS





FIRST RESULTS



BT – Basic Treatment

WM - "Without" Microorganisms

N – Nutrients

N+S - Nutrients + Surfactant

N+CBP - Nutrients + Commercial Bioaugmentation Product

N+CBP+S - Nutrients + Commercial Bioaugmentation Product + Surfactant

% Nonadecáne Loss

DISCUSSION

Signals

GC/MS *vs* FTIR

Extension of degradation Results



COMPARISON WITH LITERATURE

Very quicklyInexpensive

Some limitations



Source: http://www.geat.iastate.edu/fangresearch2.shtml



Figure 6 Comparison of TPH losses obtained using Solv-II compost, as determined by GC-FID and FTIR. The error bars indicate ± 1 SD. The large errors are attributed to a change in consistency and increased heterogeneity of the compost mass, which made it difficult to take representative samples.

Source: "Removal of Heavy Oil Sludge Contamination by Composting", Headley J. V. et al, (Wise, D.L. (2000) "Bioremediation of Contaminated Soils", New York: Marcel Dekker, pp 537-560.

REMEDIATION CONCLUSIONS

Effects of the addition of:

Commercial bioaugmentation product

Surfactant

> Nutrients

VII- PRELIMÍNARY CONCLUSIONS

GENERAL CONCLUSIONS

This study will provide further knowledge in terms of biological remediation technologies.

Costs and schedules – This technology is cheaper than some physico-chemical alternative methods of treatment (soil's removal, transport and treatment).

V II- PRELIMÍNARY CONCLUSIONS

THANK YOU

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