

# Use of human hair mats for cleaning hydrocarbons in ports

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## Abstract

Human hair mats, produced by needle punching, are capable of recovering hydrocarbons and oil suspended in seawater. In particular, they were able to retain hydrocarbons between 4 and 5 times their weight during 35 days.

## Introduction

The oils and hydrocarbons that reach rivers, lakes and oceans pollute the water and cause damage to aquatic organisms and ecosystems. A single liter of oil is capable of contaminating up to 150,000 liters of water

The main impact of hydrocarbons in water occurs near the coast, where concentrations are high enough to cause death in marine organisms. Oil forms, in fact, a superficial film that affects the exchange of oxygen, compromising the respiration and reproduction of fishes, having a toxic effect on their lungs and liver, affecting birds and leading to the death of many aquatic organisms.

Aquaculture production generates a large number of jobs around the world, which are affected by the worsening of water quality associated with the presence of hydrocarbons, altering the entire aquatic system: biodiversity, fishing, jobs, tourism and the life of the communities.

Ports and beaches are mostly affected by this problem: not only in environmental terms with the loss of marine species, but also with the loss of tourists who will not return due to poor water conditions.

Human hair is transformed into 60x60 cm, 2 cm thick mats with a needle punching method.

Seen:

- the study "Space Act Agreement 97001 (BEPS)" carried out by NASA in 1998 where the hydrocarbon retention properties of human hair are evidenced
- the study "Comparative effectiveness of natural by-products and synthetic sorbents in oil spill booms" from the Technical University of Sydney, which states that the hair has a better hydrocarbon retention capacity than the polypropylene elements normally used to combat spills
- the experiences carried out in the cities of Garland and San Francisco in public sewage systems, with human hair

The hypothesis is that hair mats are capable of recovering hydrocarbons and retaining them in a sustained manner when they are in seawater and particularly in ports.

## Content

### Materials and method

Materials:

- 1 galvanized steel cage 36\*95\*3 cm
- 2 hooks for floating dock
- 5 zip ties
- 1 x hair mat
- 20 inches' tailor scissors
- optical microscope
- glass slides and coverslips, trays and various laboratory materials
- 120 liters tank
- 50 liters of water
- 3 sachet of ENBAC 906

### Method

A galvanized steel cage suitable for housing hair mat is made. The cage is hooked, by 2 units of 201041ss ACC Connector to the floating dock owned by Botes Salvavidas Valparaíso, located in the area called "Muelle Prat" of Puerto Valparaíso



The cage is installed so that hair mats are slightly higher than the tide line.

Installation date May 19, 2022, 11 a.m.

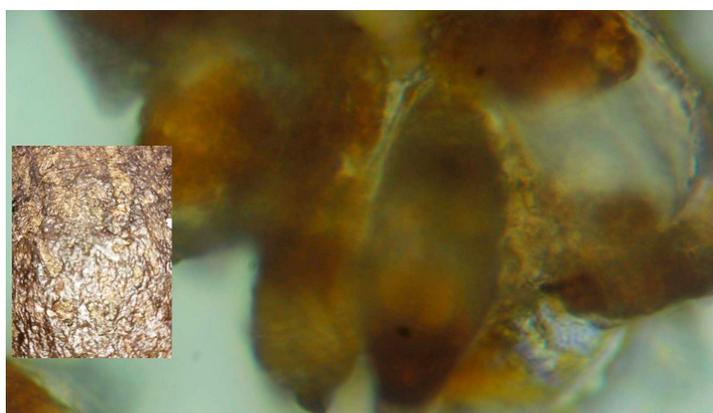
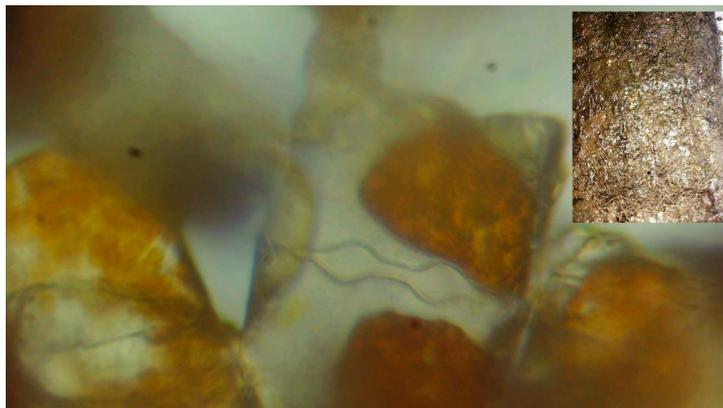
Hair mat is cut to size with tailor's scissors and the cut pieces are introduced into the cage. A 212g mat single is inserted on one side, while a 236g mat (double) is inserted on the other side of the cage

Once the mats are inserted, the cage is closed with plastic ties to prevent the mats from coming out. The plates were withdrawn on June 22, 2022, 11 a.m.



Contaminated hair mats are left on a dry surface for 24 hours before weighing.

Once weighed, random samples are extracted and analyzed under a microscope, demonstrating the presence of adhered hydrocarbons, as on the following photos



After that a water solution with 50 liters of tap water and 3 sachet of ENBAC 906 (approximate price 16 USD per sachet, although bacterias are sold in buckets of 400) is prepared in a 120 liters tank.

Contaminated hair mats are introduced in the tank and the cover is closed. Tank is opened after 30 days and mats are removed

## **Results**

The simple hair mat, once the water has been drained, has a weight of 1,084g, recovering 872g of hydrocarbons

Double hair mat (folded) once the water has been drained, weighs 1,459g, which means recovering 1,223g of hydrocarbons

Oil was not found in the mats after 30-days treatment with ENBAC 906

## **Conclusions**

Hair mats allow the adherence and sustained retention of hydrocarbons in suspension in seawater.

A simple mat device of 236 grams was capable of holding hydrocarbons by more than 5 times its weight

A double mat device of 212 grams was capable of holding hydrocarbons by 4 times its weight.

Microscope photographs allow validating the adherence of substances (oils, greases, hydrocarbons adhered and retained in the mat)

ENBAC 906 are an effective method to clean contaminated hair mats with oil in 30 days period