

Using human hair filters in small scale fishing boats to capture hydrocarbon residue in “achique” maneuvers 2nd Stage.

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- **Abstract**

Oil spills can cause serious damage to resources in the fisheries and aquaculture sector through physical contamination, toxic effects on fish and shellfish stocks and business interruption. In some cases, effective protection measures and cleanup can prevent or minimize damage. As a result of this, the ideas of looking for possible solutions arise. This is how our research tries to contribute to the ecosystem, capturing the hydrocarbons present on the Caldera coast, with the use of human hair filters (F.C.H.) in artisanal fishing boats.

- **Executive Summary**

In the fishing sector (capture of natural species) and Aquaculture (culture of species in captivity) it encompasses important industries that can be seriously affected in various ways by oil spills, animals and plants could suffer damage as a result of the toxicity and suffocation. Fish and shellfish could become physically contaminated or tarnished, acquiring an unpleasant taste derived from hydrocarbons. Fishing gear and farming equipment could be impregnated with these, which would cause the risk of contamination of the catches of the populations until the process of cleaning or replacing the gear is finished.

Hydrocarbons are as dangerous, the overturning or rupture of the ships that transport crude oil, as the washing of the ponds that still contain hydrocarbon residues. Oil slicks float in the sea, because that product is lighter, and "drowns" all kinds of life, including birds and fish that die sadly and slowly.

After the fishing maneuvers used by artisanal boats, they carry out the so-called "bilge" action that has as its objective the cleaning of the holds of the boat where they are found with the liquids spilled by both the engine and the residues of the fishing obtained, such Dirt is dumped directly into the sea without going through any filtering process to capture polluting particles that directly affect the biodiversity present in the area.

Due to this problem, we believe that it is necessary to find possible solutions to help reverse this situation. For this we will use a prototype of a filter made with human hair that will capture the hydrocarbons in the "bilge" action in artisanal boats, before being thrown into the sea. These filters are made up of a basket covered with a micron mesh, a cotton sleeve and human hair as a filter material for hydrocarbon retention, since hair is a natural bioabsorbent, which can absorb three to nine times its weight in Petroleum.

The present investigation is of an experimental type, it focuses on delivering a product that can contribute to the care of the ecosystem through the control, capture of hydrocarbons and fuel residues with the use of F.C.H filters, installed in the artisanal fishing boats of the commune.

The purpose of this research is to create a cultural ecological awareness of care and preservation of our animal and plant biodiversity, with the installation of F.C.H. in artisanal fishing boats in the Caldera Bay, with the purpose of cleaning and purifying our coastal waters, and thus be able to provide a more favorable environment for our biodiversity.

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GENERAL BACKGROUND

One of the main causes of the deterioration suffered in the marine environment is the waste produced by ships in their daily activity, consisting of oily mixtures, dirty water, garbage and cargo residues. Due to the great damage caused to the marine environment by the discharge of this waste, numerous agreements and conventions have been developed, which prohibit the discharge of said waste into the sea, in addition to requiring ports and terminals to have facilities or systems that allow vessels to discharge their bilge waste for subsequent treatment. Due to the current legal framework in our country regarding bilge waste, it has been necessary to implement systems and facilities that allow the discharge of this waste to the port for its subsequent treatment.

Considering the great damage caused by the discharge of bilge waste into the sea and other nautical operations, in 1973 the international agreement to prevent maritime pollution called Marpol (Marine Pollution) was created, which underwent major modifications in 1978 so that currently is called Marpol 73/78, this agreement endorsed by the International Maritime Organization (IMO) dedicates its Annex 1 to the discharge of hydrocarbons, which specifies, among other things, that ships must have hydrocarbon discharge control systems, quantities and places in which it is possible to discharge this waste into the sea, the use of a book for monitoring bilge waste, in addition to forcing the ports belonging to the agreement to have reception facilities for waste whose discharge is not possible by regulations at sea. Chile, as a country belonging to the Marpol agreement, must ensure compliance with its regulations, controlling discharges into the sea in its jurisdiction and equipping its ports with the necessary facilities for the discharge of bilge waste.

Given the geographical location of Chile, its ports are generally the final destination of merchant ships and cruise ships, which is why it must have appropriate facilities to be able to efficiently provide the bilge unloading service.

• INTRODUCTION

There is only one World Ocean, which covers 72% of the Earth's surface and is essential for humanity. All human beings depend on the sea, even if they live far away or inland. It plays a role in the social, economic and environmental balance of all countries in the world.

The ocean releases more oxygen into the atmosphere than all the world's forests combined thanks to marine vegetation (phytoplankton). In addition, the ocean is a vital source of animal protein for one billion people around the world.

The maintenance of marine biodiversity and the living resources of the sea is essential for man: it provides people with food, jobs and income. Fishing and aquaculture provide direct employment, but also many indirect jobs in the distribution and processing of seafood. It is of great economic importance for many families, but also for the countries that export its production. Thus, for societies heavily dependent on fish, these resources represent food security, but also economic and social security.

Hence, pollution of the marine environment is of such fundamental importance to all. When the human being introduces into the marine environment (directly or indirectly) substances or energies that produce or may produce harmful effects, he is polluting. This damages living resources and marine life, as well as being a risk to human health.

Due to the immensity and depth of these bodies of water, pollution has been barely visible, however, studies indicate that the degradation of the marine ecosystem, especially in coastal areas, has increased significantly in the last three centuries.

Sea freight transport accounts for 90% of the world's international traded goods. However, such activities cause pollution, since in their work maneuvers, hydrocarbons are discharged directly into the sea, and cause great damage to the ecosystem. This layer of pollution affects marine biodiversity, even causing the mortality of these animals.

The existence of maritime pollution due to hydrocarbons produces great damage to aquatic ecosystems. In some cases, these hydrocarbons are discharged into the sea due to accidents in oil tankers, but this corresponds to 10-15% of the total discharge of hydrocarbons. The remaining percentage corresponds to small spills in loading and unloading operations, minor accidents, tank ruptures, tank cleaning and bilge waste discharge.

The bilge of a ship is the lower cavity located above the keel, where water from different sources accumulates, filtering through the sides, deck, tunnel of the ship's propeller and where leaks and residues of lubricants, fuels and waters also converge. engine room washing. Liquid waste from this sector of the ship is known as bilge residue.

These residues are a mixture of water - hydrocarbons, where generally 40% corresponds to water and 60% to hydrocarbons, these parameters being variable in a wide range, in addition there are sedimentable solids which do not exceed 0.1[mg/l].

Caldera, is a commune that is located in the third region of Atacama, belonging to the Province of Copiapó. It is a mining, fishing and aquaculture port.

Playa Mansa is the main beach in Caldera with about 250 meters of fine sand and very calm waters. But each year the pollution has increased. The proximity of this beach to the fishermen's cove and the shipping pier has caused a problem that is hydrocarbon contamination. This contamination is the result of a habitual maneuver used by artisanal fishermen on their boats called "bilge", an action that aims to clean the holds of the boat where they meet the liquids spilled by both the engine and the waste. of the fish obtained, such dirt is dumped directly into the sea without going through any filtering process to capture polluting particles that directly affect the biodiversity present in the area. Process that is repeated every time the boats dock and set sail at the dock.

- **RESEARCH QUESTION**

Can human hair be used as filters (F.C.H. system) in artisanal fishing vessels to capture hydrocarbons present in bilge maneuvers?

- **RESEARCH OBJECTIVES**

General Objective: Use human hair filters (F.C.H. system) in artisanal fishing vessels for the capture of hydrocarbons present in bilge maneuvers.

Specific objectives:

- Install F.C.H. filters. in high and low tonnage vessels in the Caldera Bay
- Install floating filters on boats when they dock at the dock.
- Determine the hydrocarbon capture capacity of the F.C.H. in "bilge" maneuvers.

- **SOCIOECONOMIC AND ENVIRONMENTAL IMPACT**

Possibility of using F.C.H. filters. in the boats for their "bilge" maneuvers.

- Manufacture and positioning of F.C.H. filters. for vessels of the Caldera commune: 50 TRG motorboat with a capacity of 50 tons, 18 meters in length and artisanal vessels smaller than 10 to 25 tons, 11.5 meters in length.
- Replicate the project in different boarding areas, within the commune.

The purpose of this work is to create a cultural ecological awareness of care and preservation of our animal and plant biodiversity, with the installation of F.C.H. in artisanal fishing boats in the Caldera Bay, with the purpose of cleaning and purifying our coastal waters and thus being able to provide a more favorable environment for our biodiversity.

• PRESENTATION OF THE PROBLEM

Caldera Bay has a total of 262 artisanal boats registered in the commune, the vast majority of which sail daily, with the clear objective of obtaining their highly valued product (fish).

The fishing industry in Chile, both industrial and artisanal, generates a strong impact on the populations of marine species existing in the country. The extraction of hydrobiological resources is developed through industrial extraction, artisanal exploitation, and exploitation of management areas. Different fishing industries discharge their effluents directly into the sea, into the bay, which mainly contribute oils and fats, phosphorus, nitrogen, suspended solids, and their waste has high levels of BOD5 (Biochemical Oxygen Demand). Meanwhile, in artisanal fishing, the environmental impacts begin when the nets are collected and the enormous quantities of fish are stored on the high seas, due to the accumulation of organic waste in the water in the holds of the ships. If an adequate transfer of fishing from ships to industry on land is not carried out, the sea experiences contamination by organic matter. In this case, the waste deposited into the sea by the artisanal fishing boats is made up of hydrocarbons, oils, bilge water, fat particles, meat and blood, which is why it is important to carry out a treatment of the waters that are discharged into the sea.

Hundreds of liters of polluted water are thrown into the sea daily by these boats, which can be seen with the naked eye when approaching the sea, appreciating the multicolored spots found on the surface, as well as the marine fauna present in the area with hydrocarbon residues on their shells, legs and shells, a black layer covers them.

It is essential to conserve a clean ocean to preserve the living resources of the sea, human health (avoid disease problems linked to bathing or the consumption of sea food), and preserving them has economic and social value (living resources for consumption, advantages linked to tourism and other hobbies, contain the costs linked to health problems).

Added to this is the staining that is usually defined as an odor or taste foreign to a food product. Contamination in fish and shellfish can usually be detected immediately as a petroleum odor or taste. Bivalve molluscs and other sedentary filter-feeding animals are particularly vulnerable to tainting, as they filter considerable amounts of water and are therefore at risk of the entry of dispersed oil droplets and contaminated particles suspended in the plume. of water.

Other factors that influence the presence and persistence of slickness include the type of oil, the species affected, the extent and duration of exposure, hydrographic conditions and water temperature. The staining of living tissues is reversible but, although the absorption of the stain by hydrocarbons is rapid (minutes or hours), the purification process is much slower (weeks) depending even more if the temperatures are low.

"Are we aware of the importance of water and its contamination? What do we do to reverse this situation?"

- **RESEARCH HYPOTHESIS**

- Human hair filters are efficient for use on boats.
- Replicate the project in different boarding areas, within the commune.

- **METHODOLOGY**

Currently there are several methods of capturing hydrocarbons, whether they are removed by pumps, vacuum trucks and skimmers, mechanical collection, manual collection, pressure washing, among others, but a filtering system in the sea or preventing hydrocarbons from reaching the sea it is a novel system.

Despite the fact that there is a CURRENT NATIONAL REGULATION ON MARITIME HYDROCARBON POLLUTION, in our area it seems that such regulations are not complied with or controlled.

The F.C.H. They are a system for capturing hydrocarbons that were installed in an artisanal fishing vessel of the Caldera commune "Don José Miguel" with a capacity to capture fish of 50 tons (jack mackerel, anchovies, anchovies, etc.). Such a boat was the one selected to carry out the experimentation of filtering tests in "bilge" activity.

For this, a simple cartridge was used, with a mesh opening filtering capacity of 2 microns, which was wrapped by a meter of cotton mesh (used for medical treatments) inside which ½ kilo of human hair was placed. .

The filter was installed at the outlet of the bilge system, whose outlet is the water conduit that comes from: the bow hold, bilge and racel of the vessel. 5 tests were carried out before the filter was put into operation, evidencing its capture capacity.

Water samples were taken before the position of the filter and later with the use of it. During the month of April of this year, the hydrocarbon samples taken from the F.C.H. Such samples were obtained once the filter had been removed, after having cleaned the holds, after each docking.

The filter was replaced by another with the same characteristics, an activity that was repeated during the 15 sailings carried out in the month of April. In total, in the month of the experience, 2 F.C.H filters were used, used alternately.

Once removed, the filter was taken to the establishment's hatchery for cleaning. These were disassembled and washed in a jar, by shaking the filter, to achieve the release of hydrocarbons. Subsequently, the filter is dried at room temperature (cotton and hair). Once the materials of our filters were dry, they were assembled for reuse.

To calculate the amount of hydrocarbons captured by the filter, the "contaminant" overflow technique is used. This was deposited in 1,000 ml precipitated glass vessels, thus calculating the total obtained for each departure.

- **RESULTS**

The results obtained during the 8 months of research were highly favorable, achieving positive results to our expectations.

Table n° 1: Capture of hydrocarbons, first experience with F.C.H.

Month April																
Día	3	4	5	9	10	12	13	15	17	19	20	23	25	26	27	TOTAL
																Its
mL	450	630	590	720	690	650	770	820	630	690	740	630	670	700	680	10.060

Table n° 2: Capture of hydrocarbons, total period of 8 months of experimentation.

	Month	N° of sailings	Total Its	
total	April	15	10,060	The
	May	18	10,240	
	June	17	8,980	
	July	12	8,250	
	August	15	10,290	
	September	13	7,720	
	October	17	11,150	
	November	8	5,640	
	TOTAL	115	72,330 liters	

amount of hydrocarbons collected (72,330 liters) was allocated to the municipality of the Caldera commune, since it could not be collected in the establishment.

• CONCLUSIÓN

The catchment systems used today have provided a solution to minimize hydrocarbon pollution, thus being a viable alternative for cleaning and purifying marine environments.

The work carried out in this investigation shows that it is feasible to use filters with human hair to capture hydrocarbons before they are discharged into the sea, in the bilge maneuvers by artisanal vessels in the Caldera Bay.

Although mortality is common due to the normal life cycle of marine biological species, providing a clean and contaminant-free environment will greatly increase their life extension and facilitate adequate reproduction.

The small-scale experimental work carried out yielded excellent results, which greatly increased our expectations of giving continuity to the use of F.C.H filters, not only in high-tonnage vessels, but also in small vessels where the bilge maneuver is carried out manually. . But we are still a long way from fully solving this problem, although there are large-scale projects to capture waste in the oceans, it is extremely important to start with small projects that contribute to a system for cleaning and capturing pollutants in our waters. coastal areas, so as not to increase the damage and provide a favorable environment for our biodiversity present in the area.

There is no doubt that the hydrocarbon capture system with the use of human hair is highly efficient to be used in artisanal vessels.

Notwithstanding the foregoing, it is necessary to continue with this research, to increase the number of F.C.H filters in artisanal boats with continuous departures, to massify this initiative of caring for the environment, thus creating a cultural ecological awareness of preservation of endemic resources.

It is also worrying to see the results of the samples obtained by vessel, since if we multiply these results by the total number of vessels registered in the port, the figures are alarming.

• DISCUSSION

It was possible to demonstrate the small-scale experimental work carried out, which produced excellent results, which greatly increased our expectations of giving continuity to the use of F.C.H filters, not only in high-tonnage vessels, but also in small vessels where the bilge maneuver is done manually. However, we are far from fully solving this problem, although there are large-scale projects to capture waste in the oceans, it is extremely important to start with small projects that contribute to a system for cleaning and capturing pollutants in our coastal waters, so as not to increase the damage and provide a favorable environment for our biodiversity present in the area that has caused a problem that is hydrocarbon pollution. This contamination is the result of a habitual maneuver used by artisanal fishermen on their boats called "bilge", an action that aims to clean the holds of the boat where they meet the liquids spilled by both the engine and the waste. of the fishing obtained, such dirt is poured directly into the sea without going through any process of filtered to capture polluting particles that directly affect the biodiversity present in the area. Process that is repeated every time the boats dock and set sail at the dock.

- **PROJECTIONS**

Finally, indicate that the study takes the first step for future research in both high schools and universities considering the population of animals that are in serious danger of contaminating coastal waters due to bad maneuvers and the little cultural ecological awareness that we have.

In addition, it is necessary to determine that, with the increase in additional cartridges in the bilge maneuvers, the amount of hydrocarbon capture of each vessel would increase.

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- “DESIGN OF THE BILGE WASTE TREATMENT PLANT IN THE OXIQUM QUINTERO CHEMICAL TERMINAL”

ANNEXES

Image N° 1 Vessel selected for placement of human hair filters (F.C.H.)



**Using human hair filters in small scale fishing boats to capture hydrocarbon residue in “achique” maneuvers 2nd Stage.
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Image N°2 Motor boat

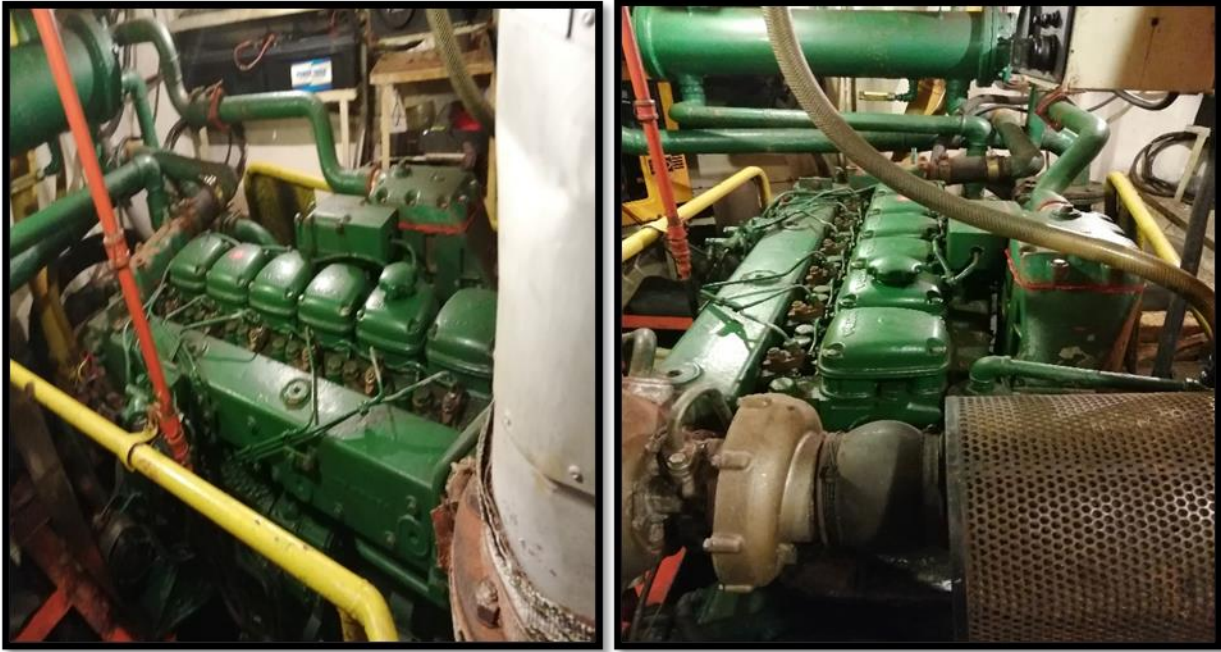


Image N°3 Filter and bilge system



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Image N°4 “Bailing” maneuvering system



(1)



(2)



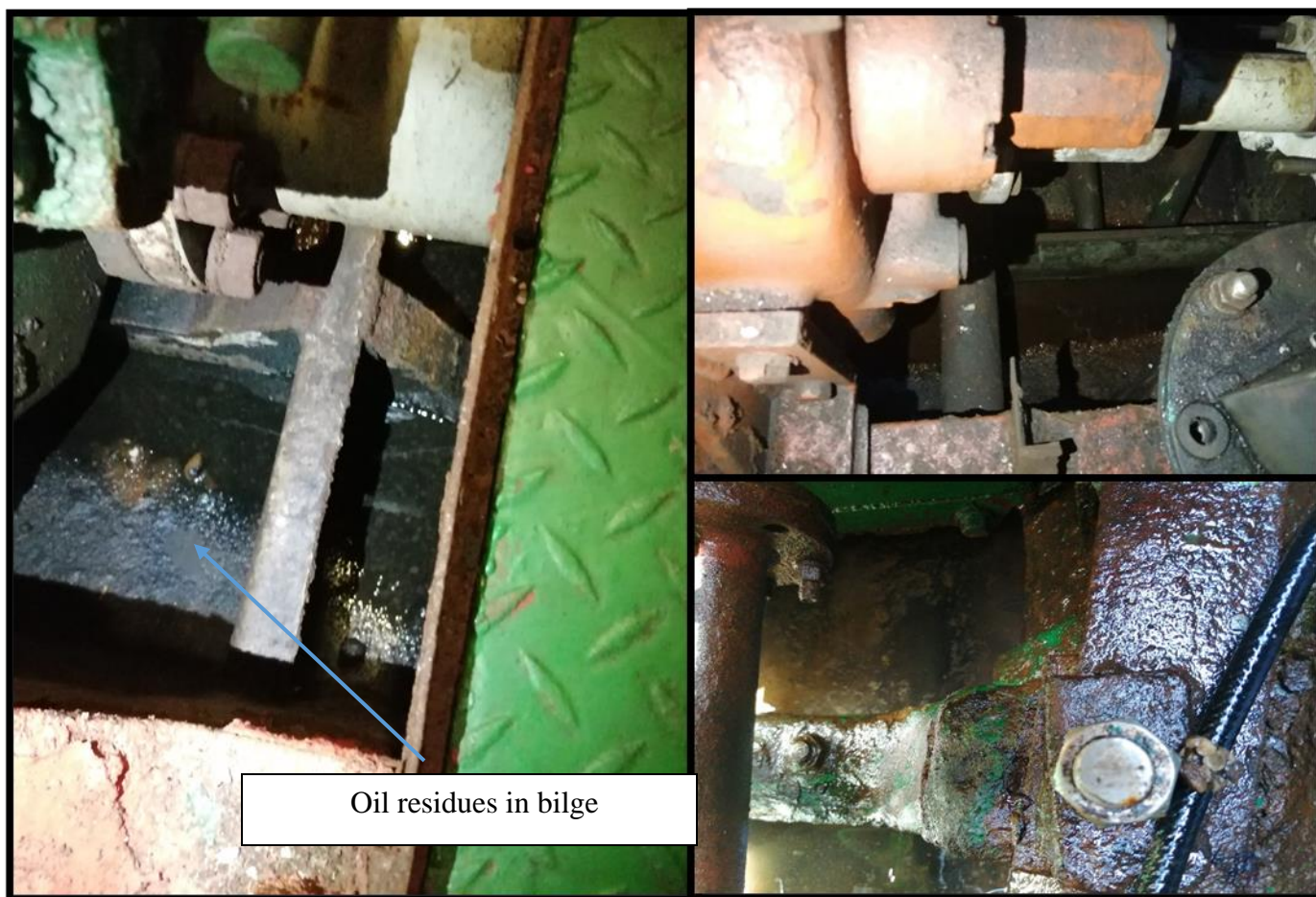
(3)



(4)

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Image N° 5 Bilge and oil spills



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Image N°6 Preparation of human hair filters (F.C.H).



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Image N°7 Filters with human hair



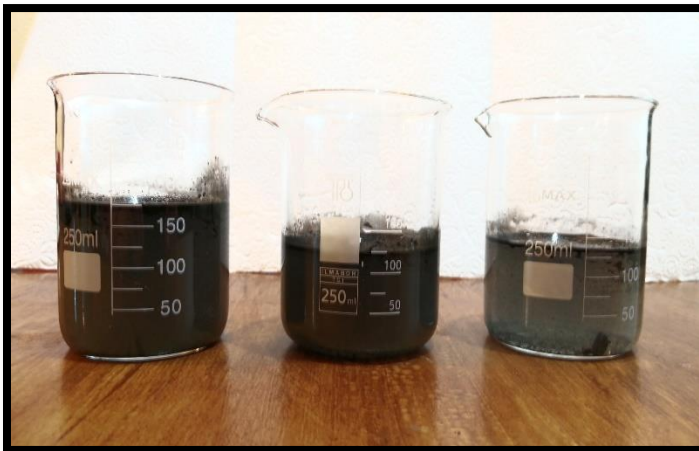
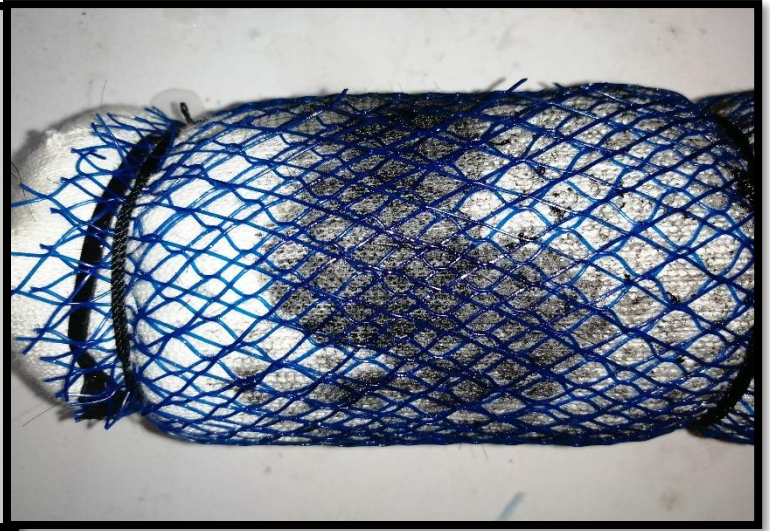
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Image N°8 Posture of human hair filters (F.C.H.) at the outlet of the "Bilge" pump



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Image N° 9 results and capture of hydrocarbons



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Image N° 10 hydrocarbon residues captured by filters

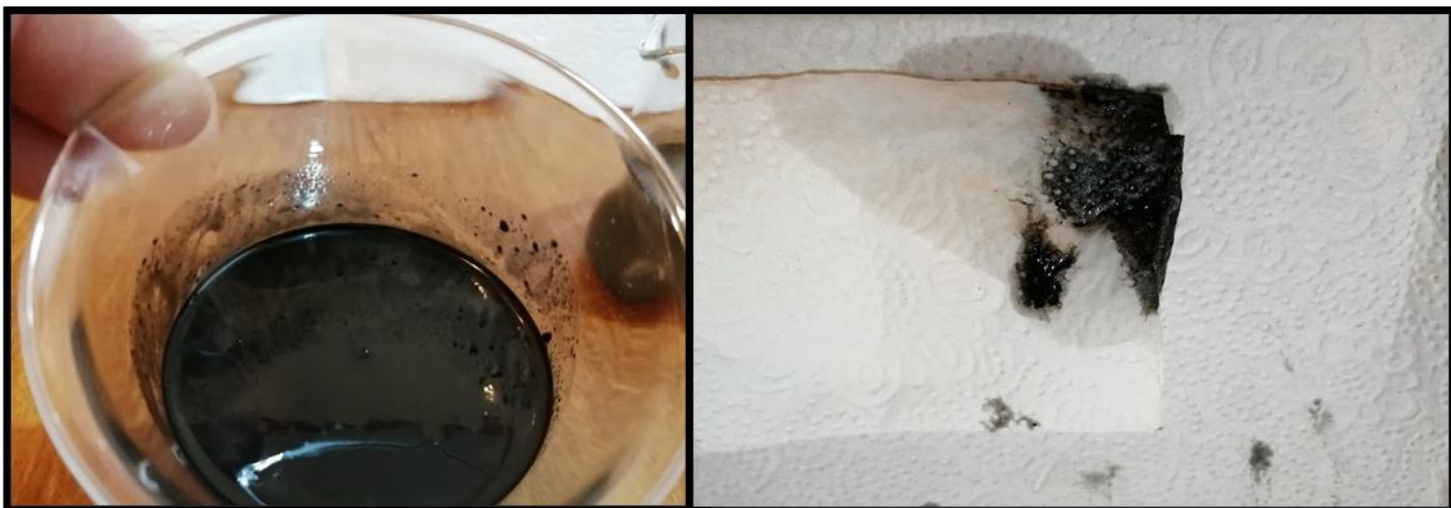
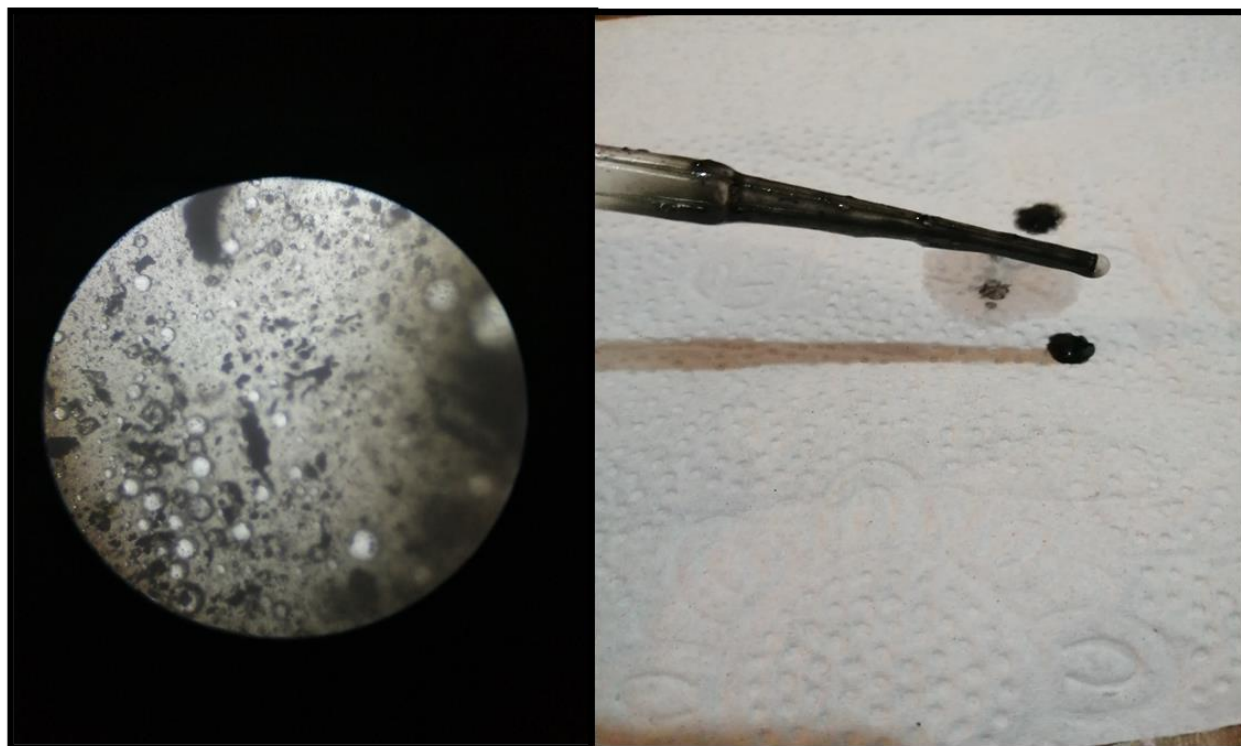


Image N° 11 photo drop of hydrocarbon under microscope and taken by pipette



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Image N° 12 Samples collected in test tubes



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