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Research for Oil-Absorbing carpets using hair materials

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ABSTRACT

The issue of marine pollution in general, as well as pollution brought on by oil spills into the sea, in rivers and lakes, or wastewater from factories, businesses, mechanical repair shops, gas stations, universities, and auto repair shops, is one that the world is currently facing, particularly since when it does, it invariably results in harm to the environment and people. Oil spills result in oil plaques on the ground, in rock crevices, washed up on the coast, a foul smell, a loss of tourism beauty, harm to the ocean's ecosystem, and even equipment damage. equipment, supplies, water transportation, etc... Expensive oil spill blotting papers had to be used at the time, resulting in high costs. The amount of hair that individuals discard each day is not little, and even when it is burned, it emits unpleasant scents and polluting gases that are harmful to human health. Furthermore, it is very easy to make a hair mat at vehicle wash facilities, school restaurants with big parking lots, and car repair shops. To prevent the majority of the oil from being spilled into the environment, handmade oil-absorbing carpets made of hair materials are laid over the drains in these locations. In this study, the authors used hair as the main raw material to create a product that absorbs oil scum in wastewater. The study used an experimental method with the results sent for analysis from a professional analysis center. Research results show that the water sample after treatment with the hair mat meets QCVN 40:2011/BTNMT (Column A).

Keywords: *environmental pollution, Scum oil, hair, products*

1. Introduction

There are many different materials used to treat oil spills in rivers, at sea, composites, especially polypropylene and other polymeric plastics, but their use of water surface cleaning and then treating them can also affect the environment. Meanwhile, hair is a natural processable material and is readily available due to its constant constant supply. Many studies have shown that hair absorbs 3 to 9 times its weight in oil. If it is oily hair, the hair will be greasy because the oil sticks to the hair shaft. A long haircut is still valid when used to make wigs, false eyelashes, and accessories in the toy industry such as dolls... However, with short or extremely short curls, they often cannot be used for anything but can only be thrown in the trash. Hair is proven to be an effective and sustainable way to absorb large oil spills and help keep storm drains and waterways clear of oil slicks. Instead of using expensive products to deal with oil spills like today, we can use cheap natural products like hair to clean up the scum oil.

The goal of this study was to demonstrate that hair can scum oil and from there we can make products that scum oil from the hair.

2. Material and methods

To make a complete hair oil absorbent pad, the ingredients are detailed as follows

TABLE 1. Statistics of materials

STT	Material	Quantity
1	Hair	1 bag 5 kg
2	Storage bins	1 pc
3	Brush	1 pc
4	Sand and dust filter tray	2 things
5	Mesh fabric	1 kg
6	Lubricants	2 bottles
7	Nailed board	1 pc
8	Glove	20 pairs
9	Face mask	1 box
10	Tank used to mix oil	2 things
11	Needle	2
12	Sewing only	1 roll
13	The tarp is used to filter trash and dry hair	1 sheet
14	Candle wax	600 grams
15	Water cans	4 cans 1 liter

2.1 Sample processing methods

The ingredients were collected from barber shops in Thu Dau Mot city

The time required to complete a hair pad (product): 5 hours / 3 products (not counting the time to collect hair)

Process and materials recycle hair

Method 1: Press your hair into pieces with a nail table

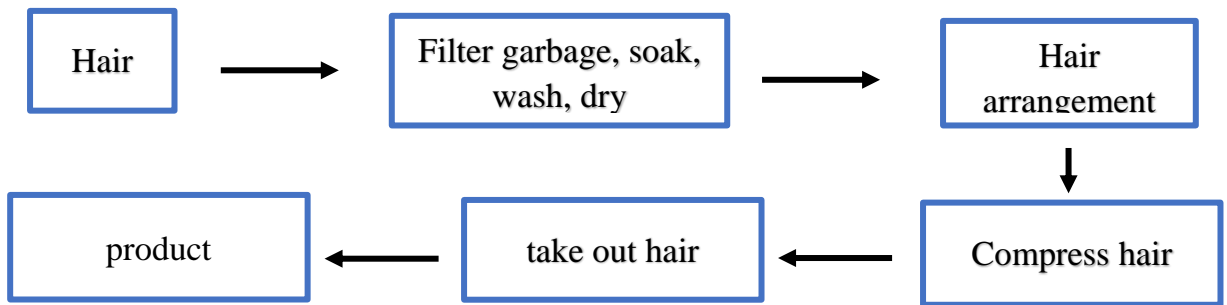


Diagram 1. The process of making a hair mat from a nail table

The process of making hair products: 6 steps

Time to apply for hair: 7 days to apply for hair

Implementation steps:

✓ **Step 1:** Gather the ingredients

We collect hair at barbershop locations in areas in Thu Dau Mot City. Ask for hair within 7 days

✓ **Step 2:** Filter the garbage, soak, wash, and dry

We collect materials to an agreed place and conduct a garbage filter to remove all kinds of impurities in the hair when collecting such as paper, hairpins, plastic bags, sand... Filtering garbage like this is very time-consuming, if not filtered, it can cause the hair to be mixed with impurities, then it is difficult to determine the hair's ability to absorb oil. This stage is also one of the most important stages of this entire study.

Clean the hair with dirt on the hair, wash and dry it for about 2 hours to dry the hair (We proceed to dry the product for 1-2 hours, the drying time may be less or more depending on the hair color). weather, sunshine), to straighten the hair to hold them together.

✓ **Step 3:** Fold your hair

Take out your hair and spread it all over the surface of the nail so that it can be pinned together into a carpet.

✓ **Step 4:** Compress the hair tightly on the nail table

When the hair is spread evenly, use the nail plate to fix it into pieces, press it down the nail table and take another small nail table and press it to make it close together.

✓ **Step 5:** Remove the hair from the nail plate

Remove the hair in the straightener from the nail plate, and arrange with the scissors to trim the excess curls out.

✓ **Step 6:** Products

The scum absorbent product has a size of 22x29 cm when removing the oil scum absorbent mat in the water it is sprinkled and cannot adhere well, because it is handmade

without using machines and additives, and the hair is very short in size, so it is difficult to intertwine and stick.

Method 2: Fix hair with Paraffin wax

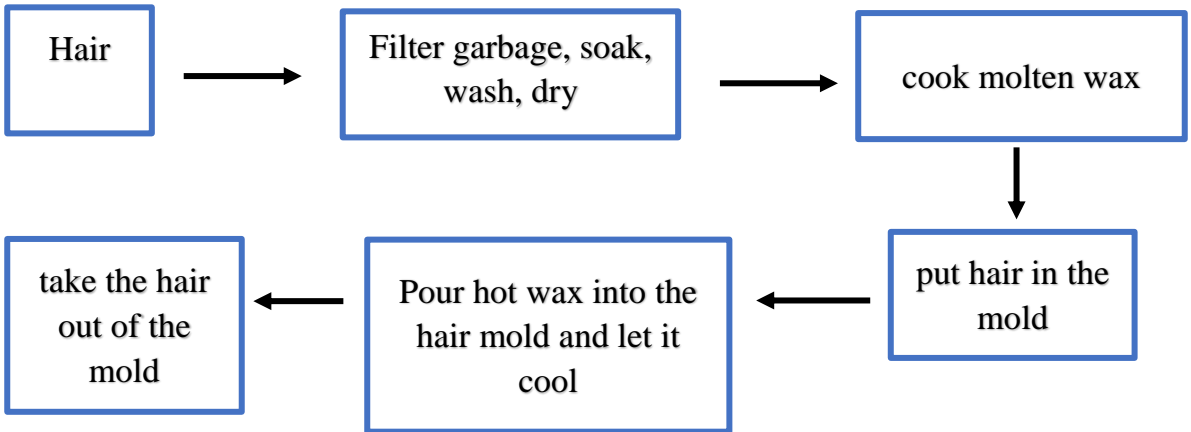


Diagram 2. Process of making hair mats from Paraffin wax

The process of making hair products: 6 steps

Time to apply for hair: 7 days to apply for hair

Implementation steps:

✓ **Step 1:** Gather the ingredients

We mobilized and collected hair at barbershop locations in areas in Binh Duong. Ask for hair within 7 days

✓ **Step 2:** Filter the garbage, soak, wash, and dry

We collect materials to an agreed place and conduct a garbage filter to remove all kinds of impurities in the hair when collecting such as paper, hairpins, plastic bags, sand... Filtering garbage like this is very time-consuming, if not filtered, it can cause the hair to be mixed with impurities, then it is difficult to determine the hair's ability to absorb oil. This stage is also one of the most important stages of this entire study.

Clean the hair with dirt on the hair, wash and dry it for about 2 hours to dry the hair (we proceed to dry the product for 1-2 hours, the drying time may be less or more depending on the hair color, weather, and sunshine), to straighten the hair to hold them together.

✓ **Step 3:** Cook 300 grams of wax in water

Cut the wax into small pieces, then make the stove put the pot on the dry side, and let the pot heat up, put the wax in and heat it until it melts into water and then pour it down.

✓ **Step 4:** Put 100 grams of hair in the mold

Take out the hair to spread evenly over the surface of the mold so that when making wax, the wax water flows out to the surface.

✓ **Step 5:** Pour the hot wax into the mold and let it cool

When the wax is cooked, pour it down, prepare a small mold, spread the hair out on a thin surface to fill the mold, and make hot wax spread over the pre-molded hair, let it cool.

✓ **Step 6:** Take the hair out of the mold

Remove the hair from the mold when the hair has cooled, when left for a long time, it will break and melt when exposed to hot outdoor temperatures causing clumping.

Method 3: Fix the hair with a mesh bag and sew

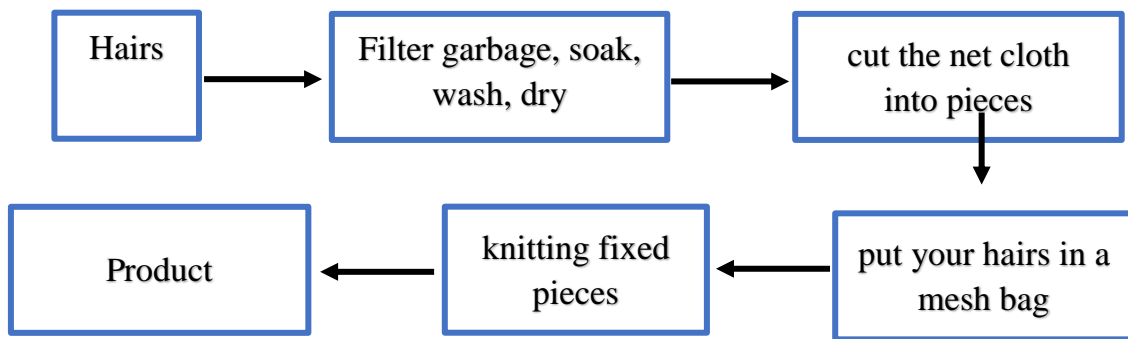


Diagram 3. The process of making a hair mat from a fixed mesh bag

To complete the absorbent mat with sizes 15×22 and 22×29, the ingredients are specifically called as follows:

TABLE 2. Statistics of materials for making hair mats

STT	MATERIAL	QUANTITY	UNIT
first	Hair	200	g
2	Mesh fabric	44x29	cm
3	Needle	1	Piece
4	Sewing only	1	Roll

The process of making hair products: 6 steps

Time to apply for hair: 7 days to apply for hair

Implementation steps:

✓ **Step 1:** Gather the ingredients

We mobilized and collected hair at barbershop locations in areas in Binh Duong. Ask for hair within 7 days

✓ **Step 2:** Filter the garbage, soak, wash, and dry

We collect materials to an agreed place and conduct a garbage filter to remove all kinds of impurities in the hair when collecting such as paper, hairpins, plastic bags, sand... Filtering garbage like this is very time-consuming, if not filtered, it can cause the hair to be mixed with impurities, then it is difficult to determine the hair's ability to absorb oil. This stage is also one of the most important stages of this entire study.

Clean the hair with dirt on the hair, wash and dry it for about 2 hours to dry the hair (we proceed to dry the product for 1-2 hours, the drying time may be less or more depending on the hair color, weather, and sunshine), to straighten the hair to hold them together.

✓ **Step 3:** Cut the mosquito nets into pieces

Cut the net fabric to a length of 44cm and width of 29cm, and sew it into a bag with a diameter of 22cmx29cm

✓ **Step 4:** Put the hair in the mesh bag and fix it

When the hair has been processed, it will lead to the stage of putting the hair into the mosquito net, before putting the hair in, the amount of hair must be weighed. Weighing the amount of hair removed is for specific quantification so that it can be based on that to determine the amount of oil to be treated scientifically.

Put in a mesh bag of 200 grams of hair, start sewing the mouth of the bag, and take down the wooden stick to fix it into pieces.

✓ **Step 5:** Knit the fixed piece

Fixed mesh bag, use a needle to sew it into pieces, and sew to fix it firmly so that the piece of hair does not clump when dipped in water when filtering oil.

✓ **Step 6:** Products

The hair mat is sewn to fix the finished product through a mesh bag that can absorb the oily oils discharged down the drain from motorbikes and public vehicles and from parking lots.

➤ **In the 3 processes of making oil absorbent mats above, the 3rd process achieves certain success :**

Method 1: When the pin is fixed, because the hair is too short, it cannot be fixed, so the hair dropped into the water is sprinkled, falling out into small pieces.

Method 2: Because candle wax is fragile when left to cool for a long time, it will be bent and broken, easy to melt when exposed to hot temperatures.

Method 3: This is a way to achieve good results when fixed with a mesh and sewn through, the hair is fixed firmly without falling out, and the mesh bag containing the hair inside can absorb the oil on the surface. The wide surface area of the hairpiece.

2.2 Experimental method for products from mesh bags (mesh cloth)

TABLE 3. Statistics of materials for sewing mesh bags

STT	MATERIAL	QUANTITY	UNIT
first	Cloth to sew the inside of the bag	200	gram
2	Cloth for sewing covers	44x29	cm
3	Needle	1	Piece
4	Sewing only	1	Roll

Real process show:

✓ **Step 1:** Sew a piece of mesh bag fixed with mesh fabric

200 grams of net fabric is arranged into pieces with the size of 44cm x 29cm, then fixed with a sewing needle into horizontal and vertical lines. This helps prevent the mesh bag from clumping and shifting during transport and when oil-contaminated water flows through.

✓ **Step 2:** Sew a mesh bag

Cut the net fabric and sew it into a bag with a size of 22cm x 29cm, this mesh bag is wrapped outside a fixed mesh bag. This is to simulate the weight and size of the hair mat wrapped in a mesh bag.

✓ **Step 3:** Products

Insert the mesh bag inside the mesh bag to form a mesh cloth bag with 2 components: the intestine weighs 200 grams and the shell.

2.3 Method of sampling oil-contaminated water before and after treatment

The authors have contacted car wash shops to collect oil-contaminated car wash wastewater for testing and analysis. However, the salons refused because of concerns related to environmental pollution and current laws. Therefore, the authors have to mix water and oil as described in the study to facilitate the experiment and analysis.

2.3.1 Method of taking a water sample before treating with a hair mat

Prepare a basin, in which 900ml of well water is poured into the basin, 100ml is the used car waste oil and is replaced, we mix it. Then use a little water through the PE bottle and discard, then pour the rest into a 1-liter PE bottle through a funnel to analyze the water sample before treating the hair mat.

2.3.2 Method of taking water samples after hair mat treatment

Prepare a basin, in which 900ml of water is poured into the bowl, 100ml is used car waste oil and is replaced and mixed. Then let this amount of water flow through the oil absorbent pad with the hair underneath there is a basin to not catch water after passing through the hair. Take the amount of water that has been absorbed by the hair mat, pour water into the funnel through a 1-liter PE plastic bottle, and analyze the treated water sample.

2.3.3 Method of sampling water before treatment with a mesh bag (mesh cloth)

Prepare a basin, in which 900ml of well water is poured into the basin, 100ml is the used car waste oil and is replaced, we mix it. Then use a little water to wash through the PE bottle and then throw it away, then pour the rest into a 1-liter PE bottle through a funnel to analyze the water sample before treating it with a mosquito net.

2.3.4 Water sampling method after treatment with mesh bags (mesh cloth)

Prepare a basin, in which 900ml of water is poured into the bowl, 100ml is used car waste oil and is replaced and mixed. Then let this amount of water flow through the oil absorbent

pad with a mesh cloth bag, underneath there is a basin to prevent water from going through the mosquito net. Take the amount of water that has been absorbed by a cloth, pour water into the funnel through a 1-liter PE plastic bottle, and analyze the treated water sample.

2.4 Sample analysis

Samples are analyzed at the company's laboratory, we bring samples to the Center for Environmental Technology Consulting and Occupational Safety and Health for analysis.

This method is for the determination of n-hexane extract material (total grease) and n-hexane extract material not adsorbed by silica gel (mineral grease) in surface water, seawater, industrial wastewater... domestic wastewater.

This method is capable of measuring total greases and mineral oils up to 1,000 mg/L

2.5 Integrated Approach

Synthesis of documents collected, field survey thereby evaluating and analyzing the study area. Combining experimental methods and product evaluation to conclude product quality. Finally, give unbiased reviews about hair recycling and market accessibility.

3. Results and discussion

3.1. Application products

3.1.1. The hair mat absorbs the oil from the nail plate

When you put your hair in the nail plate to fix it, the hair mat, the hair can't stick well, so when taking the fixed piece of hair out of the nail plate, the piece of hair mat does not have good cohesion because when giving pieces of hair mat In the water, it disintegrated, did not stick together, easily separated by hand because the hair was too short and the product did not use additives, so it did not guarantee adhesion. Products made this way are not effective at absorbing oil.

3.1.2. Candle wax absorbent pad

Absorbent mat is made from Paraffin wax, when the hair mat comes out of the mold when the hair has cooled down when hair is left for a long time, it will break and melt when exposed to hot outdoor temperatures causing clumping, easily broken when impacted. strong on the carpet, the adhesion of the hair mat Not sure can break easily.

3.1.3. Types of hair mats absorb oil from mesh bags

- *The type of hair mat that absorbs oil with a mesh bag that has not been sewn in place*

The mesh bag absorbent mat, when not fixed to the edge, can clump into a long bun that can't absorb much oil inside the bun core, but it can be left around the manholes at washes. car or parking place to clean, through the naked eye observation of we, when using a hair piece to absorb oil, the amount of oil in the water is removed by about 75% by the visual

perception method, the research team found that When The bun goes through the oily water, the water will be clear and less oily than at the beginning, and the bun will be blackened by the oil scum. However, there is still oil scum in the water, but most of the oil has been removed. From there, it proves that the oil-absorbing hair mat when not sewn in place can be applied in sewers or wastewater treatment places such as car washes, etc.

- Oil-absorbing hair mat type fixed with seams

The hair absorbent pad has a fixed mesh pocket, has a large surface area that can absorb at the surface and absorb all the oily residue left on the water.

Discussion:

In absorbing oil scum and removing oily residues on drains, parking lots, and car washes. The scum absorbent hair mat can be used for oil spill problems in rivers and the sea because the scum pad is highly effective and easy to apply.

3.1.4. The mat absorbs oil from the mesh bag (mesh cloth)

sewing and inserted into the bag before being put into the oil-contaminated water basin.



Figure: The water tank has oil scum before being treated with a mesh bag (mesh cloth) and After being treated with a mesh bag (mesh cloth)

3.2. Collect samples of wastewater before and after treatment with absorbent hair mats and mesh bags (mesh cloth)

3.2.1 Collect pre- and post-treatment wastewater samples with absorbent hair pads

Take water samples before treating oily water

Prepare a basin, in which 900ml of well water is poured into the basin, 100ml is the used car waste oil and is replaced, we mix it. After that, a little water is poured through the PE bottle and then discarded, then the rest is poured into a 1-liter PE bottle through a funnel to be analyzed for water samples before treatment.

Take water samples before treating oily water

Prepare a basin, in which 900ml of water is poured into the bowl, 100ml is used car waste oil and is replaced and mixed. Then let this amount of water flow through the oil absorbent pad with the hair underneath there is a basin to not catch water after passing through the hair. Take the amount of water that has been absorbed by the hair mat, pour water into the funnel through a 1-liter PE plastic bottle, and analyze the treated water sample.

3.2.2 Sampling of wastewater before and after treatment with absorbent mesh bags

Take water samples before treating oily water

Prepare a basin, in which 900ml of well water is poured into the basin, 100ml is the used car waste oil and is replaced, we mix it. Then use a little water to wash through the PE bottle and then throw it away, then pour the rest into a 1-liter PE bottle through a funnel to analyze the water sample before treating it with a mosquito net.

Sampling water after treating oil-contaminated water

Prepare a basin, in which 900ml of water is poured into the bowl, 100ml is used car waste oil and is replaced and mixed. Then let this amount of water flow through the oil absorbent pad with a mesh cloth bag, underneath there is a basin to prevent water from going through the mosquito net. Take the amount of water that has been absorbed by a cloth, pour water into the funnel through a 1-liter PE plastic bottle, and analyze the treated water sample.

3.3. Analysis of water samples before and after treatment with oil-absorbing hair mats and mesh bags (mesh cloth)

Analysis of wastewater samples was taken according to the process of the Center for Environmental Technology Consulting and Occupational Safety and Health. Sampling can be analyzed according to the following procedure:

- Sample preparation
- Separation, extraction of samples
- Solvent distillation
- Determination of total grease
- Determination of mineral oil and grease
- Determination of total weight of mineral grease
- Determination of animal and vegetable fats and oils
- Quality control

And take a sample of water contaminated with processed oil according to the company's ratio of 900ml of well water: 100ml of lubricating oil

3.4.4. Analysis results of wastewater before and after treatment with absorbent hair pads



Figure: The results of water analysis before and after treatment are made by the Center for Environmental Technology and Occupational Safety and Health.

Water analysis results:

According to the analysis results of water containing oil scum, before treatment, the concentration of total mineral oil in the water was still quite high (135-02/23-3.4NT1. Before treatment was 894 mg/l), When the oil board was absorbed by the hair mat, it was (135-02/23-3.4NT2. After treatment, it was **4.9mg/l**). In the regulation of QCVN 40:2011/BTNMT (Column A) of **5mg/l** or less, the result of oil-contaminated water after treatment with oil absorbent hair pad achieves QCVN 40:2011/BTNMT (Column A).

Discussion: With the above analysis results of the water sample, basically the oil absorbent pad of the research team is effective in treating oily wastewater according to QCVN40: 2011/BTNMT column A. Wastewater when reaching the standard column A can be discharged. from rivers to streams without having to go through the receiving and treatment system.

3.5. Wastewater analysis results before and after treatment with a mesh cloth

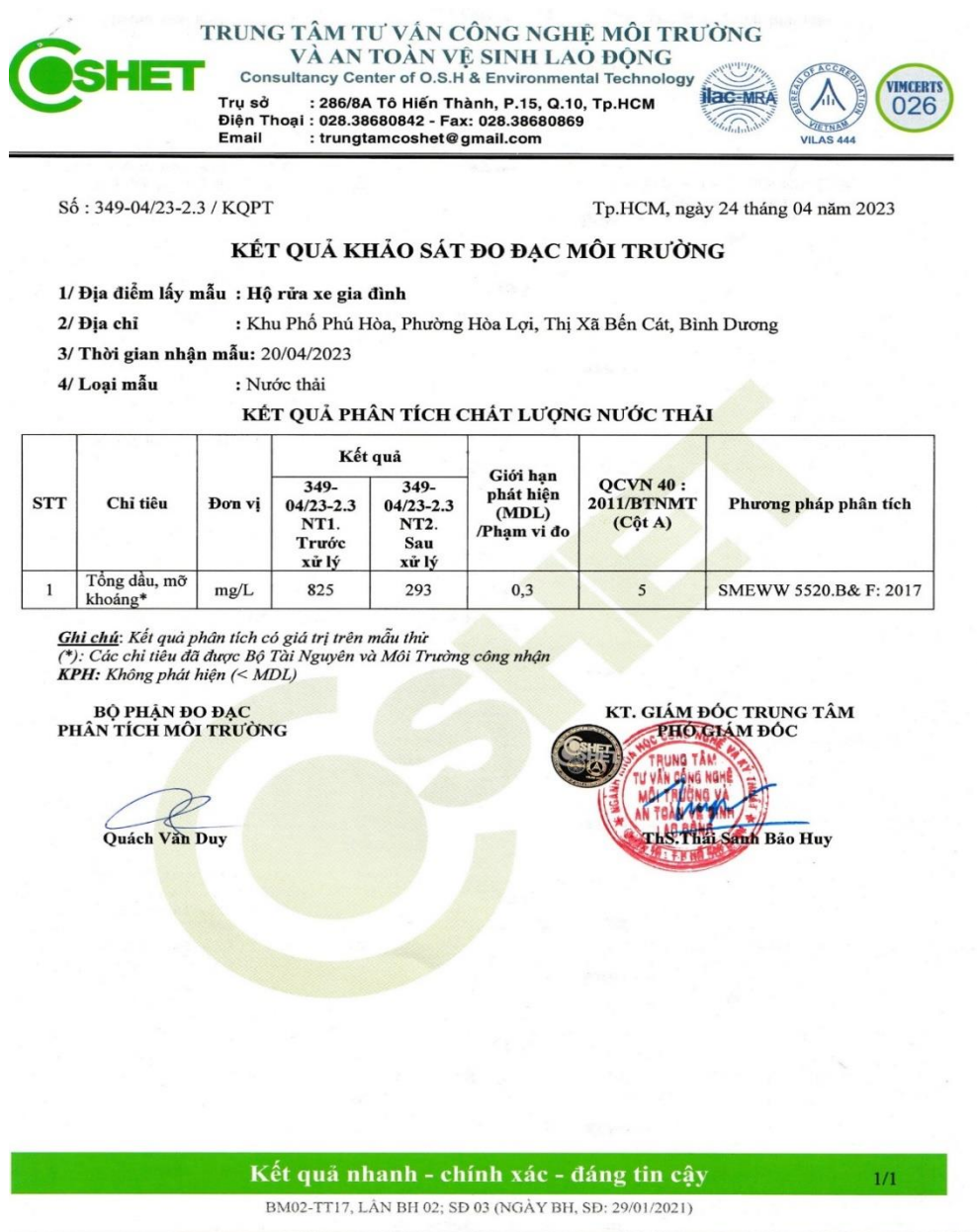


Figure: Result of water analysis before and after treatment with a mesh cloth made by the Center for Environmental Technology Consulting and Occupational Safety and Health.

Water analysis results:

According to the analysis results of water containing oil scum, before treatment, the concentration of total mineral oil in the water was still quite high (135-02/23-3.4NT1. Before treatment was **825mg/l**), when the mesh cloth is available, it is (135-02/23-3.4NT2. After treatment is **293mg/l**). In the regulation of QCVN 40:2011/BTNMT (Column A) **5mg/l** or less, the result is satisfactory, but the oil-contaminated water after treatment with a mesh cloth is higher, so it does not meet QCVN 40:2011/BTNMT (Column A).

Discussion: With the above water sample analysis results, the oil-repellent mesh cloth meets the Vietnamese standard column A QCVN40: 2011/BTNMT. Wastewater samples that do not meet column A must be collected and treated through a wastewater treatment system before being discharged into the natural river and stream environment.

4. Conclusions and recommendations

4.1. Conclusion

Research on oil-absorbent pads using hair materials has been successfully carried out according to the research objectives. The aim is to recycle it into an eco-friendly oil absorbent pad from waste hair material. While reducing the amount of daily waste and protecting the resources of the country, on the other hand, the cost of producing a hair absorbent pad is quite low. After 3 implementation methods, we have found a way to form an oil absorbent pad capable of absorbing oil quite well to meet the requirements of the research objective. Besides, the research team also practiced how to mix and take water samples before and after treatment with oil scum pads for analysis. The results of analysis of water containing oil scum, before treatment, the concentration of total mineral oil in the water was still quite high (135-02/23-3.4NT1. Before treatment was **894mg/l**), when If the oil is absorbed by the hair mat, it is (135-02/23-3.4NT2. After treatment, it is **4.9mg/l**). In the regulation of QCVN 40:2011/BTNMT (Column A) of **5mg/l** or less, the result of oil-contaminated water after treatment with oil absorbent hair pad is QCVN 40:2011/BTNMT (Column A).

In addition, to compare the oil scum pad with mosquito net in the treatment of oil scum in wastewater. Our research team also created a product that is an oil-absorbent pad made of mosquito netting of the same weight and size as the oil-absorbent pad made of hair. We also mixed the water in the correct proportions with the hair piece and gave the oil-absorbing pad with a mosquito net a test treatment. Then we take the results of the water before and after the treatment with a mosquito net for analysis as we did with the oil absorbent pad. Results of analysis of water containing oil scum, before treatment, the concentration of total mineral oil in the water was still quite high (135-02/23-3.4NT1. Before treatment was **825mg/l**), when the net bag is made of mesh cloth to absorb oil, it

is (135-02/23-3.4NT2. After treatment is **293mg/l**). In the regulation of QCVN 40:2011/BTNMT (Column A), **5mg/l** or less, the result of oil-contaminated water after treatment with a mesh cloth bag to absorb oil scum does not achieve QCVN 40:2011/BTNMT (Column A). The total amount of mineral oil in the water after treatment is still quite high, so it cannot meet the output wastewater to be discharged directly into canals, rivers, and streams, but must be collected into the wastewater treatment system for treatment to meet new standards. discharged into the environment.

This is the result that shows that the use of oil-absorbent hair pads can effectively treat oily water. Absorbent pads This oil can be widely used in car repair shops, car washes, large parking lots of apartments, schools, supermarkets, restaurants, etc. And can be applied to absorb oil spilled on rivers and at sea.

4.2 Recommendations

This study has not analyzed wastewater themselves because they have not studied it through the environmental analysis module. In addition, if possible for further research, the team wishes to recycle the discarded hair into an oil-absorbent pad with 100% hair composition without wrapping it in a mesh bag. The team will try to find the substance that binds the hairs together to form patches as large as a carpet.

Products from the research can be used for useful development applications outside the market such as hair mats that absorb the drains of car washes, parking lots, etc. have high applicability in life. Small business units can apply this way to remove the remaining oil. Both reduce costs because they are made from waste materials and reduce the amount of waste significantly if using polymer oil absorbent pads. In addition, it also protects resources that are dwindling.

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