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OIL SEPARATOR FROM SEA WATER

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Abstract: Our project's major goal is to protect marine life without causing pollution. It is a very straightforward but crucial idea. Oil rises on top of water because water has a higher density than oil. This feature of an oil separator is based on how oil and water interact. The viscosity difference idea underlies the majority of this endeavor . Because oil has a higher viscosity than water, it flows over the aluminium discover a much slower rate than water does while the project is being worked on. Because of this, separating oil from water is simple. The four metal discs in this project are connected to a motor shaft to speed up the separation of oil from water. The engine is powered.

I. INTRODUCTION

It has long been noted that massive amounts of crude oil are spilled, which harms the ecosystem, threatens aquatic life, and pollutes the air and water .Due to its low density, oil that spills into the ocean or the sea owing to numerous incidents floats above the water's surface.

Sunlight is thus prohibited from entering water, which is necessary for ocean life.

Because oil has a higher viscosity, birds flying over the ocean drown when they become entrapped in it. So, in order to reduce the impact of oil spills, we have developed the idea of individually collecting the oil that is present on the ocean's surface.

1) TYPE OF OIL SPILL

Oil spills happen when petroleum-based, plant- or animal-based oils mistakenly get into the environment. On land and in the sea, oil spills occur every day; the majority of the oil eventually finds its way into the water through runoff. Customers who spill oil when filling up their automobiles with petrol are one cause, while high- profile incidents in the oil industry that release millions of gallons are another. Several types of oil spills have varying consequences on wildlife and human evironments, and cleanup procedures vary depending on the type of oil that has leaked. Responders to an oil spill take into account things like the toxicity of the oil, how quickly it spreads, and how long it takes for the oil to degrade. The spill's location and the weather are two other crucial factors.

1.1 Oil Class A

When spilled, Class A oil spreads swiftly and has a potent odour. It is also light and fluid in nature. The least lasting and most poisonous oil is class A. The effects will continue a long time if the oil seeps into the soil.

Class A oils quickly spread in water but have an impact on aquatic life in the upper water column. Class A oils include processed goods like gasoline and jet fuel as well as premium light crude oils. Benzene, a proven carcinogen, and hexane, which can harm both human and animal neurological systems, are toxic components of gasoline.

1.2 Class B Oil

"Non-sticky" oils are referred to as Class B oils. They are more prone to stick to surfaces but are less hazardous than class A oils. The U.S. Fish and Wildlife Service claims that they have the potential to contaminate water over time. Class B includes low-grade light crude oils and refined goods like kerosene and other heating oils.

Class B oils leave a film on surfaces, but if the area is vigorously washed with water, the film will weaken and dissolve. Class B oils are more combustible than class A oils and will burn for a longer time.

1.3 Class C Oil

Class C oils are viscous and cumbersome. Class C oils have a high adhesion to surfaces but do not spread or penetrate sand and soil as quickly as lighter oils.

Because Class C oil is difficult to diluted and scatter, it is extremely harmful to wildlife, including waterfowl and marine mammals with fur.

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A class C oil spill can seriously contaminate intertidal zones due to the sticky film it leaves behind, necessitating costly, lengthy cleanups. The majority of crude oil varieties and bunker B and C fuel oils are classified as class C oils. These oils are prone to creating emulsions or lumps of oil.

1.4 Class D Oil

The least harmful crude oil is class D, which is solid. Class D oil poses the greatest environmental risk if it isheated and solidifies on a surface, making cleanup all but impossible. As some oils' volatile components evaporate, the U.S. Environmental Protection Agency notes that they can leave behind class D residues.

1.5 Alternative Fuel

The EPA regulates synthetic oils because they can contaminate the environment if they are released into the environment, much as oils made from plant or animal fats. Non-petroleum oils coat wildlife and can result in suffocation or dehydration, which can result in death.

Non-petroleum oils damage an area for a long time since they are slow to decompose and easily permeate soil. Products made without petroleum oil include culinary fats and synthetic oils, for instance.

2) DESIGN OF OIL SEPARATOR

2.1 Components of oil collector:

- BATTERY: 12V/2.5AH
- MOTOR: 12V/10RPM
- MOTOR: 12V/18000RPM
- ALUMINIUM PLATE: dia. - 20 cm (4 plates)
- SHAFT
- ACRYLIC (3mm) AND ALLUMINIUM MATERIAL
- PROPELER FAN
- ELECTRIC SWITCH
- MOTOR STAND

DISC

Fig.2.1.Aluminum disc

Specifications:- size 200 mm

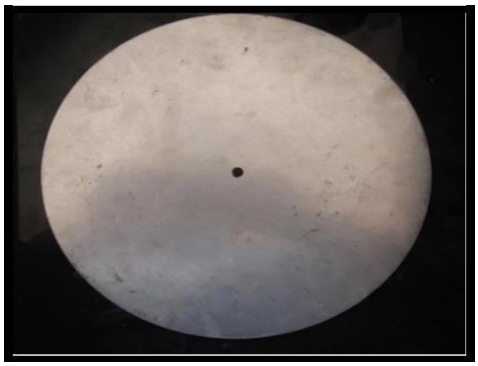

Fig.2.1.Aluminum disc

Thickness: 1mm. Hole Diameter: 5mm

Material used: Aluminum.

Description:-

The aluminum material for disc is used for the following advantages:

1) Strong and light

2.7 (g/cm3) = 1/3 the weight of steel

Low weight means reduced energy consumption in transportation.

2) Easy to form

Aluminum is ductile and has a low melting point

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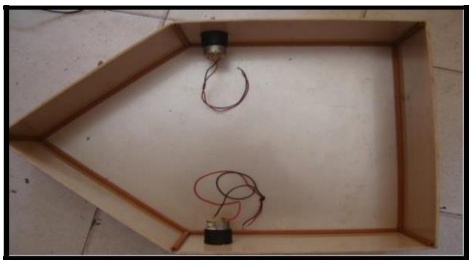
Easy to process in cold and hot condition.
This allows design flexibility and integration in advanced transport and building industries

3) Long life – low maintenance
This prolongs the life of aluminum in cars and buildings
Reduces need for maintenance
Reduces environmental impacts due to replacements and maintenance

BODY
Fig.2.2.Body of oil collector Specifications:-



Size - length: 570 mm.
Width: 410 mm.
Fig.2.2.Body of oil collector Height: 135.0 mm.

- Material used: Acrylic.

We chose acrylic because it has the following benefits: Durability : Durability is the primary benefit. Basic shop fixtures will need to be durable for at least a year, if not longer. Also, they must be protected from an unintentional elbow strike or a young child who is drawn to a vibrant display. In reality, when compared to lacquered or varnished hardwood, acrylic is significantly more durable and lasts a lot longer.

Lifetime Guarantee: A lifetime guarantee is offered with many acrylic products, which lowers your costs. Also, you won't need to store a lot of extras just in case something breaks.

Strength: Acrylic has a deceptively delicate appearance yet is quite strong. The majority of retailers do not always scale products according to weight. Both large and heavy objects may be displayed on the same acrylic stands that held little or light objects. Moreover, acrylic material is highly impact resistant. Flexibility: is incredibly flexible, which makes it ideal for any type of display stand. Its corners can be square or rounded, and it can be shaped into any shape.

Lightness: Acrylic is lightweight, making it simple to transport display cases from place to place. They will also just slightly increase the weight of the shelves holding the product.

MOTOR

Fig.2.3.Motor Specifications:-

Voltage: 12V Fig.2.3.Motor
Speed: 10RPM Length: 80mm Torque: 1.5kg-cm Shaft diameter: 6mm Weight: 130g
The 12V DC geared motor is utilised in this project since it is simple to obtain DC power using batteries and that it can be stored for an extended period of time. As toy motors only need 12V of power, while AC voltage is 240V, this voltage cannot be used because doing so would entail stepping down the AC current, which would be difficult and more expensive in terms of components.

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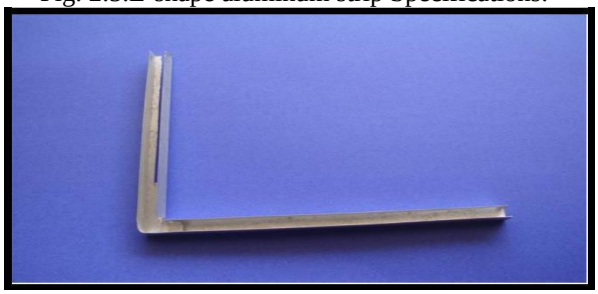
ALUMINUM STRIP

Fig.2.4. Aluminum strip Specifications:-

Size - Length: 20 mm Fig.2.4. Aluminum strip Thickness: 4mm
Width: 25mm
Material used: Aluminum
Low weight means reduced energy consumption in transportation.
Aluminum is ductile and has a low melting point.
Reduces environmental impacts due to replacements and maintenance.

L SHAPE ALUMINUM STRIP

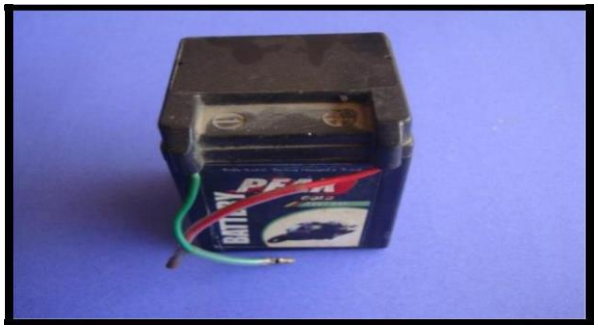
Fig. 2.5.L-shape aluminum strip Specifications:-



Size -Length: 200 mm*180 mm Fig. 2.5.L-shape aluminum strip Width: 1mm
Angle: 90 degree
Material used: Aluminum.

BATTERY

Fig.2.6.12V DC Battery Specifications:-



Volts : 12V Fig.2.6.12V DC Battery
Amperes: 2.5 amp. Type : lead acid battery Charging voltage : 27V

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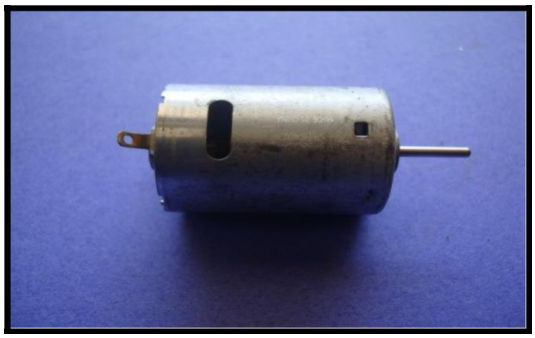
PROPELLER BLADE

Fig.2.7. Propeller blade Specifications:-

Description:-
Aluminum material is used because:
Size: 17.50 cm Fig.2.7. Propeller blade
Material: Hard plastic

HIGH SPEED MOTOR
Fig.2.8.High speed motor
Specifications:-



Speed: 18000 rpm.
Fig.2.8.High speed motor Volt: 12V

The boat is propelled forward by this motor, which rotates the propeller blade at 18000 rpm. The 12V DC motor is employed because DC power can be obtained quickly by using batteries and may also be stored for a long time. As toy motors only need 12V of power, while AC voltage is 240V, this voltage cannot be used because doing so would entail stepping down the AC current, which would be difficult and more expensive in terms of components .

3) Calculations:
By assuming following dimensions of
1) Acrylic body :
Length - 57 cm= 0.57 m
Breadth - 41 cm= 0.41m
Height - 13.50cm= 0.135m
2) Disc :
Diameter - 20cm= 0.2m
Hole dia. - 0.5 cm= 0.005m
Thickness - 0.1cm= 0.001m
3) Tank :
Diameter - 100cm= 1m
Height - 45cm= 0.45m
Water level in tank - 35cm= 0.35m
Calculations:
a) Weight of body in water:

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W= γ* V [7]
Where,
V = volume of material, 3 *m*
γ = sp. Weight or weight density, KN/ 3*m*
27% of volume of body submerged in water,
= 9.81 *(0.27 * V)
= 9.81 * (0.27 * (0.57 * 0.41* 0.135))
= 0.0835 KN
= 83.56 N
W = 83.56/9.81 = 8.51 kg.
1) Buoyancy force :
By Archimedes' principle,
BF= ρ* g * V [7]
Where,
ρ = density of sea water.
V = volume
=1010 * 9.81 * (0.57 * 0.14 * 0.135)
=312.59 N
2) Center of buoyancy: (Acrylic) = 1050- 1200 kg/ 3*m*
= ρ * g [7]
= 1075 * 9.81
= 10545.75 N/ 3*m*
= 10.54 KN/ 3*m*
Weight of body = volume * γ(acrylic)
= 0.57 * 0.41 * 0.135 * 10.54
=0.332 KN
By Archimedes principle,
Weight of body= weight of liquid displaced V = 0.332/9.81 = 0.0338 3*m*
V = 0.0338 3 *m*
Let,
h = height of body,
Volume of liquid displaced= L * b * h 0.0338 = 0.57 * 0.41 * h
h = 0.144m
Centre of buoyancy = h/2 = 0.144/2 = 0.072m
3)Weight of body= volume of liquid displaced
= γ * A * h
332 = 980 * (0.57 * 0.41) * h h = 0.144m = 14.49cm
Before the immersion, liquid level is 35cm deep.
The collector floats at level = 35-14.49 = 20.51c m The collector floats at 20.51cm from the bottom of tank.

4. Forces Acting:

While the oil collector is moving through the water, numerous factors are working against it. There are many more,these are just a few. One of the forces at work on the sailboat is drag. The boat's bottom encounters resistance from the water as it moves through it, slowing it down. Lift happens when the sails divide the wind coming from the boat's windward side.Lift is caused by the pressure differential between the sail's leeward and windward sides. The lift is basically a change in pressure that allows you to advance. When a boat is submerged in water, buoyancy acts to keep it there. The boat's hollow hull is inflated with air. Because air is lighter than water, a buoyant force is produced, keeping the boat afloat. symmetrical forces We refer to two forces as balanced forces when they exert an equal amount of force on an object while acting in opposing directions.

This is what happens when an object is subject to equal and opposite forces, or when no forces are present at all.

- An object that is moving continues to travel in the same direction and at the same speed even if there are no external forces acting on it.
- An item that is not moving remains stationary.

Examples

Here are some examples of balanced forces:

1) Static items

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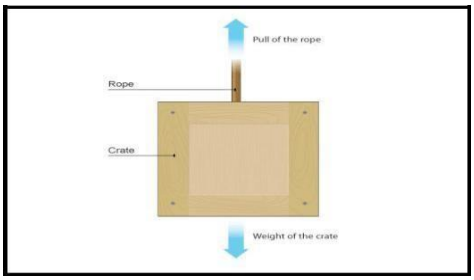
This hanging container is subject to equal but opposing forces that act in different directions. The strain in the rope pulls up while the weight pulls down.
Fig. 4.1: A hanging item
This hanging crate is supported by balanced forces.



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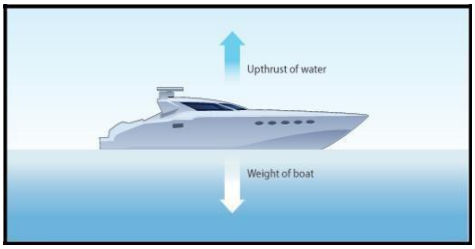
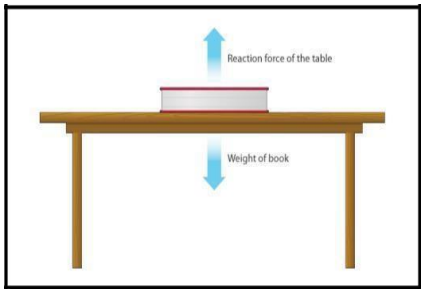
2) Water floating
Fig. 4.1: A hanging item
When the up thrust from the water balances an object's weight, it floats in the water. Until the weight of the water it expels is equal to the weight of the thing, the object will sink.
Figure 4.2: A floating body

Figure 4.2: A floating body



A boat can float because the up thrust from the water balances out its weight.
3) Taking a stance on the floor
The reaction force from the ground balances an object's weight when it is supported by a surface, such as the ground. The object is pushed back by the ground. As you remain still, the response force is what you can feel in your feet. You would become weightless if not for this force that keeps you balanced. The reaction force from the tabletop balances the weight of a book that is laying on a table.



5) OIL COLLECTOR

5.1 Working:

Seawater oil removal can be a difficult task. Oil floats on top of saltwater because it has a lower specific gravity (0.79 to 0.84) than seawater (1.023 to 1.028), making "skimming" one of the most efficient "immediate" methods to recover crude oil from seawater. Various approaches have been devised, such as sinking the oil with a dispersant, introducing "oil-eating" microbes, or just letting the oil degrade naturally.
Figure 5.1 Oil Collector,
Our project's major goal is to rescue marine life without causing pollution; it's a fairly straightforward idea.

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Although oil floats on top of water because water has a higher density than oil, this project uses four aluminium discs connected to a motor shaft that is powered by a 12V DC battery.

The methods utilised in the past to obtain oil are ineffective and extremely hazardous to the environment. For instance, one of the most common methods is burning all the oil that has been spilled on the water's surface. Because of the high amount of toxic gases, such as Carbon Monoxide and Carbon Dioxide, that are released when this happens and mix with the air, the marine life is negatively impacted. However, our project does not create any pollution and instead collects about 85 to 90% oil and a small amount of water.

Our project is based primarily on the concept of viscosity difference. Since oil has a higher viscosity than water, oil flows over the aluminium disc during project operation at a much slower rate than water, which makes it simple to separate oil from water. Oil is then collected in a plastic tub and can be used again after filtration.

6) CONCLUSION

1) Based on the results of this experiment, we have come to the conclusion that this technology can help us lower the cost of oil collection while simultaneously reducing marine and air pollution.
2) We can improve the effectiveness of oil collecting.
3) The project is eco-friendly because it doesn't hurt the environment.
4) In comparison to other approaches, we may employ this separator with optimum efficiency at a reasonable cost.
5) It can extract between 85 and 90 percent of the oil from seawater.

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