Design and Development of Oil Skimmer

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Abstract - : Oil skimmer is type of a machine which is used to extract the oil from river, sea, pond etc. or from small storage of water tanks. Like reservoir, tank or any storage device it is mostly used in a oil industries this oil industries are mostly seen in urban area. In today's world most of the oil industries are located in emirates Arab. They require such kindof machine which can extract the oil which is mixed in water or any liquid, so they mostly looking towards an efficient way to extract such oil and it should be extracted by cost efficient method.

So this kind of method is most efficient to extract the oil and in this the disc type skimmer is having a larger efficiency than any other type of skimmer

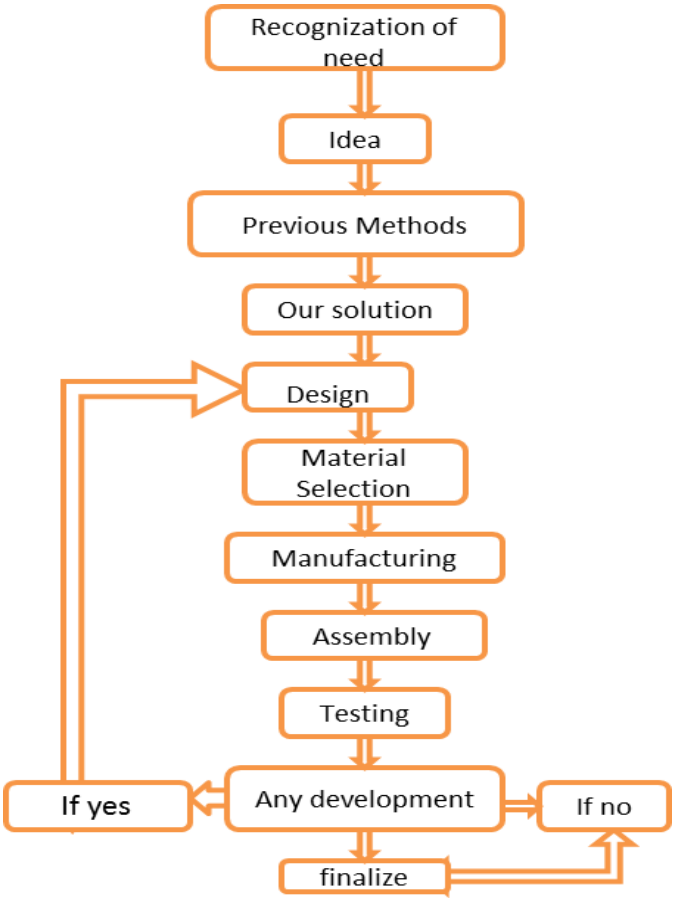
Key Words: **Disc, larger efficiency, oil, machine, tanks, reservoir, extract**

1. INTRODUCTION

In most of the oil industries, companies demand is more to extract the oil which is wasted after doing any operation. Very few amount of companies are using skimmers but they all are aware about the skimmer which can extract the oil from fixed position their machine that is skimmer is not portable, this produces more and more loss of oil and indirectly they are facing certain amount of loss issuesbecause of the skimmer they used, such skimmer are not portable that means that device only extract the oilfrom the certain amount of area it is difficult to extractthe oil above their working range due to this reason most the companies are looking towards anadvancement technology, so overcoming from this problems portable oil skimmer is to manufactured. So looking towards this need and observing the existence skimmer some kind of oil skimmer is to be produced which can cover the large amount of area, so for extracting the oil from large amount of area portable disc type oil extractor is manufactured.

Here after observing this all problems which is facing in Companies we have decided our topic that is nothing but a design and development of disc type oil skimmer.

2. METHODOLOGY



3. CONSTRUCTION AND WORKING:-

A. Working Principle:-

Extracting oil with the help of surface tension phenomenon this extract the oil which is sticked on the surface of the water with the help of scrapper.

B. CONSTRUCTION:-

This assembly is mainly consist of a rectangular frame made of the material mild steel (M.S) square tube this frame is firstly designed in a CAD software after design the manufacturing is then implemented step by step. The frame is welded with each other.

Square tube frame is fundamental part of assembly the total miscellaneous part is a mounted on frame. This frame is manufactured by step by step operation firstly the frame is designed and tube is purchased. Then the tube gone under the cutting operation with specific dimensions according to the designed as shown below. The edges of frame are cut in a 45 degree of angle in order to join it with the other tube with the welding operation. The Centre of the frame is welded with the two tubes for the fitment of the disc the motor assembly on the frame.

The three motors are mounted in the frame one on each side of tube the extreme end of the frame is built with the determined dimensions for the fitment of the wooden plate .The frame is designed in such manner that every component should perfectly fit on the frame .The frame has welded four legs in order to stand rigidly the polyvinyl pipe is fixed under the tubes with the help of cable tie This whole fitment is done in such a way that as the project star working that is as the project goes in water the water should not splash on the electronic component which is fixed on the wooden plate, and it should not harm the total spare parts of the project.

The material of square tube frame is mild steel (M.S) S355. This material has a good wear resistance. The MS square tube has a yield and tensile strength of 370N/mm^2 and 440N/mm^2.

Main parts in assembly are as follow:-

- **Acrylic Disc**

The acrylic disc having a three holes in order to fix the disc with the disc supporting plate with the help of bolt, this three holes are in a shape of circle of diameter 80mm the diameter of each three holes are equal that is diameter 5mm, the disc also having a single hole in Centre for inserting the motor shaft in it respectively the diameter of shaft hole in disc is 7mm.

- **Frame**

Square tube frame is fundamental part of assembly the total miscellaneous part is a mounted on frame. This frame is manufactured by step by step operation firstly the frame is designed and tube is purchased.

Then the tube gone under the cutting operation with specific dimensions according to the designed as shown below. The edges of frame are cutin a 45 degree of angle in order to join it with the other tube with the welding operation. The Centre of theframe is welded with the two tubes for the fitment of the disc the motor assembly on the frame.

- **Fins Plate**

It is in a rectangular shape the main Function of fin plate is to drive the whole skimmer assembly in water by its rotary motion in order to draw the water behind and move the assembly in a forward direction. The direction of the oil collector assembly depends ona fin rotation. There are six numbers of fin plate in a two fins assembly, three on each, these six fin plate are attached/welded at the extreme end of fin rod.

The each fin plate should be of equal size in order to move the assembly in the perfect statically manner and the assembly should not get viable or it should not create any vibrations in oil skimmer while floating. If the vibration occurs then there is a chance of failing of oil skimmer and chances of getting drown.

- **Oil Collector With Scrapper:-**

As the name indicates the oil container is used to collect the oil. This skimmer allows the oil on the surface to flow over the disc into a collection tank for disposal. The oil container is attached to the assembly and it collect the oil and store it in the container or we can also give the outlet to from the container to other storage tank via pipe or any other travelling medium. The sheet metal having the ductile property and the various operations are done while manufacturing the oil container.

The flat sheet is first cut and gives some as a slope then this slope is cutfrom the Centre with the distance of 2mm.The upper part of the sheet is mainly called as scrapper,

The function of scrapper is to collect the oil which is stickled on the surface of the disc. This distance is for collecting the oil from thedisc this slope of sheet is having very less clearance from the disc. The cuboid shape container is then manufactured with the sheet metal and fixed with the slope of sheet metal. his attachment is only for the purpose of collecting the oil coming from the scrapper travelling through slope and then this oil is fall in the container.

Now as the oil is extracted you can store it in a container or transfer it to the other tank with various connections.

- **Motor Support Plate:-**

There are three total mounting plates in assembly as the name indicates this mounting plate is used to support and mount the motor. This helps the motor to work with the resistance of vibration while working. This pate is directly welded on the frame thismakes the assembly to run freely and also vibration free. The mounting plate has a hole in a Centre of diameter 20mm which is same as the diameter of the shaft.

The material of the mounting plate is Mild steel, various operations done on the plate such as cutting of mild steel sheet of thickness 4mm. After the cutting operation the sharp edges is then finished with the help of grinder .After this finishing operation the hole is then drilled of diameter 20mm after drilling the hole again the finishing operation is done with the help of cutter .This cutter is having a rotary motion and the rough paper is covered on the rubber type of material. After this all manufacturing process the finished product that is mounting plate is ready for the assembly

- **Solar panel**

The main thing to know about the solar panel is that they absorb the sunlight and convert it into power that can be used for many different applications. The generated energy is either stored in special solar batteries for usage at convenient times or streamed directly in the grid. The electricity produced by the solar panel can be transferred as power source directly to connected devices for immediate consumption.inthis the produced electricity is transferred to the battery for recharging it's the battery is the one time investment in oil skimmer we don't have to spend money on recharging the battery so this will reduce the cost, it will automatically get recharged with the natural source that is sun light with the help of solar plate. Here we used three solar panels each of 7volt so they produced total 21 volt.

- **PVC Pipes (2nos.)**

Polyvinyl Chloride (PVC) is one of themost commonly used thermoplastic polymers worldwide. It is naturally white and very brittle (before the additions of plasticizers) plastic.

Density: PVC is very dense compared to most plastics (specific gravity around 1.4)

Economics: PVC is readily available and cheap. **Hardness:** Rigid PVC ranks well for hardness anddurability.

Strength: Rigid PVC has excellent tensile strength.

The main purpose of using (polyvinyl chloride)PVC pipe is that the main assembly of oil skimmer should float on the water easily .As the pvc is cheap and it is easily available in market it reduces the manufacturing cost of project and makes the project very cost efficient. We used a long single pvc pipe then the cutting operation is done with the help of hacksaw and blade or it could be easily cut with the help of grinder.

- **PVC Caps (4NOS.)**

To seal the pipes we used PVC cap for better packing. PVC end caps are used at the end of tubing as a cover to fit over insulated pipe fittings in an insulation system. Made of polyvinyl chloride (PVC), these end caps are impact resistant and durable.

Fit the cap using PV seal. PV Seal is a product of M Seal (Pidilite) its solvent cement for CPVC pipes and fitting.

WOODEN PLATE:-

Wooden plate in this assembly is used for holding the electronics parts we have chosen, the wooden plate is for holding the different part because it should not transfer the electricity in the frame. The mounted object on the wooden plate is covered with the water resistive material, because as the assembly floats in the water for extracting the oil then water should not get inserted in the electronic parts if this happens then there may be chances of damage.

C. WORKING:-

The main function of oil skimmer is that to extract the oil without getting drawn in the water, this only happens with the help of PVC tubes which is connected at the bottom of frame.

As the fins rotate, the rotation of fin decide the movement of oil skimmer assembly such as forward, reverse, left, right turn and also the rotation disc, the fins are connected with the two separate motors which helps in changing the direction of the skimmer. The center motor is used for only rotation of the disc it has a single motion only as compare to the fins motors, they have a rotation motion in two direction. For achieving only single rotation of the center motor of disc the relay is used.

So as the assembly goes into the water the fins motors start to rotate and whole assembly move towards the area where the oil is spilled then the center motor which is connected to the disc starts to rotate and due to the material of disc that is acrylic the oil get sticked on the disc surface and is then removed with the help of scrapper, this oil is then collected in the oil container but if your assembly is in the mid of the sea then you can transfer the oil from the container to the sea shore with the help of any transferring medium like pipe or any tube which is connected via motor, which helps to collect the oil from the main container source.

ACTUAL COST TABLE:-

SR NO.	DESCRIPT ION	MATERIAL	QUANTITY	COST
1	SQ. TUBES	MILD STEEL	02	1700
2	PVC PIPES/CAPS	PLASTIC	01 + 04	650
3	ELECTRICAL COMPONENTS	-	-	3000
4	SCRAPER	SHEET METAL	01	200
5	ACRYLIC DICSK	ACRYLIC	01	200
6	SOLAR PANEL	-	03	1200
7	MOTOR BOSS	S.S/PLAS TC	3	450
8	DC MOTOR	-	03	2400
9	TOTAL MACHINING COST	-	-	2000
10	OTHER	-	-	1000
11	**TOTAL COST**	**-**	**-**	**12700**

RESULT AND DISCUSSION: -

The two important parameters of disc type oil skimmer are likely to be oil recovery rate which meanshow oil extracted from the disc and collected in a tank.Another parameter is oil recovery efficiency whichmeans amount of oil extracted divided by the amount of oil mixed in the water.

Efficiency = (oil extracted from the water / oil mixed in the water) x 100

OBSERVATION TABLE:-

No. of trials and their efficiency

TEST NO.	INPUT (ML)	OUTPUT (ML)	TIME (MIN)	EFFICIENCY (%)
1	120	80	4	58
2	250	150	10	60
3	300	200	15	66.7
4	380	300	20	78.94

Advantages:-

- Low manufacturing cost
- It is potable
- Light in weight
- It can extract large amount of oil
- Easy to operate

Disadvantages:-

- Small amount of energy is generated in therainy season
- The oil will not be able to conduct in the large tide conditions
- Storage capacity is low

Future Scope:-

- We can rotate the solar plate according to the sunlight directing with the help of some electronic sensor arrangement.
- The Bluetooth control should cover the large amount of area in its range. By increasing the range of Bluetooth.
- We should build more than one acrylic disc to extract the oil; hence this process of impartingmore than one disc may increase the efficiency of the disc type oil skimmer.
- As we all know that there is still increasing demand for the oil and fuels. As a result there is more need to extract oil from the bottom of the ocean.
- Because of this there are going to be more spills and accidents resulting in more pollution. So as a remedy we are going to need the Bluetooth operated oil skimmer which is going to recover the oil efficiently from the surface of water.

Conclusion:-

Hence after implementing this process of extracting oil there will higher oil removal rate it can control the water pollution by means of extracting the oil through the disc type oil skimmer

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