

**INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH  
TECHNOLOGY****DESIGN AND FABRICATION OF OIL SEPARATING DEVICE WITH WATER  
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**ABSTRACT**

In metal working industries, various water-based emulsions industries such as sugar factory, food processing, chemical etc are used as coolant to enhance productivity. This emulsion is mixture of water and different types of cutting oils in a specific ratio.

The processed water at sugar factory has created pollution. The sugar factory is requiring huge amount of water daily and the processed water has to be wasted to the river. The processed water contains low pH value which causes the land salty which cannot be used for agriculture and this is dangerous. The oil and grease contents in water effects on the land as well as on human beings. Due to chemicals present in water, the water lives are on the edge of destroying. To avoid all these problems, Endless belt type oil skimmers are manufactured. These skimmers consist of geared motor that continuously rotates a Belt made up of special material which allows the oil particles stick to it. these oil particles are then scrapped by scrapper and collected in separate oil collecting bin. The objectives are to separate the oil from water and purify the water from dirt particles. To reuse the water, High efficiency and ability to meet environmental regulations. Belt-type skimmers use an endless belt of stainless steel, elastomer or poly medium, which is lowered into the tank or vessel to be skimmed. The belt passes through resilient wiper blades where the oil is removed from both sides of the medium.

**I. INTRODUCTION**

The world is knocking the door of 21<sup>st</sup> century. Rapid industrialization has made our country as the 10<sup>th</sup> most industrial country in the world. INDIA is ranking third in world in respect of technological talent and the man power. Rapid industrialization gave the country an opportunity to improve our economy. It give the benefits but it also created a lot of problems. "Pollution problem" is versatile one. Pollution has created lot of problems in industries. Sugar factories are captured by pollution. These are captured by water, air, sound, etc. The processed water at sugar factory has created pollution. The sugar factory is requiring huge amount of water daily and the processed water has to be wasted to the river. The processed water contains low pH value which causes the land salty which cannot be used for agriculture and this is dangerous. The oil and grease contents in water effects on the land as well as on human beings. Due to chemicals present in water, the water lives are on the edge of destroying. 'Oil Skimmer' is new mechanical equipment which used in the environmental pollution control from oil spillage. Oil skimmer help in removing the oily effluent from the waste water. By removing the oil from waste water, it becomes free of oil pollutions. Oil skimmer can remove even a thin floating film of an oil from the water. This is mainly due to the "Oleophilic material" used in the oil skimmer. These oil skimmer are manufactured as required for the effluent treatment plant. Where the tanks or ponds are very large above ground and gravity drain is not possible, the oil collected is pumped out with pumping system. Where the tanks are under ground and size is small, belt type oil skimmer is suggested. Oil spillage problems mainly occur in the industries like oil refiners, sugar factories, petrochemical industries etc. Oil spillage contributes to heavy water pollution as it is not biodegradable. In the sugar factory spillage of mainly contributes from the mill section. Daily 200 to 300 liters of oil and grease is being used for lubrication of heavy gears in the every sugar factories. Whenever oil spills over water it forms an emulsified layer. At the effluent treatment plant (E.T.P.) in the every sugar factory recovery of oil is big problem as it seriously affects the quality of treated effluent water. To

separate the oil from water and purify the water from dirt particles. To reuse the water, High efficiency and ability to meet environmental regulations. Belt-type skimmers use an endless belt of stainless steel, elastomer or poly medium, which is lowered into the tank or vessel to be skimmed. The belt passes through resilient wiper blades where the oil is removed from both sides of the medium. Oil skimmers are pieces of equipment that remove oil floating on the surface of a fluid. In general, oil skimmers work because they are made of materials to which oil is more likely to stick than the fluid it is floating on. At the same time, the fluid has very little attraction to oil skimmers. Oil skimmers are usually all that is necessary to remove oil from a liquid. In some cases, however, oil skimmers may be used to pre-treat a fluid. In this case, the oil skimmers remove as much of the oil as possible before more expensive and time-consuming measures are employed. Pre-treating the fluid with oil skimmers reduces the overall cost of cleaning the liquid.

## II. SELECTION OF COMPONENTS

### 2.1 Motor

Reversible synchronous motor of 300 rpm with the supply of AC 230v and frequency of 50 Hz. The weight of motor is 140 gram with the torque 80g-cm. It must be mounted with gear box for reducing speed. MTR5 reversing synchromesh motor is of the permanent magnet type with two stator windings for single phase AC50/60Hz. Phase displacement of excitation current is achieved by connecting a capacitor in series with one of the stator winding. The sense of rotation is determined by resulting circular rotating field. Electrical reversal of sense of rotation is affected by means of single pole change over switch. The 12 pole rotor has a steel shaft. Motor can be provided with mounting plate/screw clip for fixing.

### 2.2 Gear Box

Gear box is mounted with motor for reduction in speed with the torque of 10kg-cm with weight of 65gms. The whole assembly of the motor with gear box is mounted in the molded box. One end of gear box shaft is attached to motor shaft and other end is attached to the coupling.

### 2.3 Belt

The belt should be made of such a material which can easily lift/carry the oil above head and pour it over the blade. The oil lifts through belt by having the its materials following inherent properties:

- 1) Belt material is selected according to its polar & non-polar properties. Water consists of polar molecules as H<sup>+</sup> and OH<sup>-</sup> whereas oil doesn't have any polar molecules hence it reacts as non-polar element. Polar & non-polar molecules attract towards their respective elements and bond with it. Moreover to these, Oil is lighter in density as compare to water so always oil floats on it. Hence water and oil form a separate layer in the reservoir. Belt material has been selected in such a manner so it can react as a non-polar element and oil gets attract toward it and get stick on it which permit us to easily lift the oil through belt. Here we are selecting the belt materials of polymers (non-polar). like., Cotton, Steel, Rubber, Polyurethane, Oleophilic.
- 2) Adhesive property of oil is greater than water so we select such a material for the belt having adhesive property greater than water and having close to oil, hence it can easily absorbs oil over the belt which ultimately gets separate from water. Since water having poor adhesive property, it doesn't stick much to belt and remains in the reservoir.

Common types of belts used are as follows-

#### a) Corrosion Resistant Steel :

One of our most popular belt materials. Works well in most industrial applications where **rust inhibitors** are *not* a component of the wash water.

**Used On:** All skimmers except Petro Extractor.

#### b) Elastomer:

Can handle abrasive and harsh environments. Used where **rust inhibitors** are a component of the wash water.

**Used On:** All skimmers

#### c) Standard Polymer :

Reinforced to resist stretching, able to withstand reasonably high temperatures (up to 170°F), and textured to retain a small amount of oil thus drawing more oil to itself on subsequent passes. Used where **rust inhibitors** and **temperature** are a component of the wash water or where UV sensitivity is an issue.

**Used On:** All skimmers

d) **HT (High Temp) Polymer**

Similar to the Standard Polymer but for higher temperature applications (up to 180°F continuous). Also used when a smoother surface is required.

**Used On:** All skimmers

e) **Nylon Polymer**

The endless belt is being the most important part of our system. Basically we are going to move this belt on the surface (mixture of oil plus water) and because the belt have been made up of the combination of “nylon and polymer” which are having qualities like sticking oil to the material. This belt is been connected to two pulley one have been mounted on the motor and other have been mounted on the upper side of the hopper / container. It is made up of polymer material. It is endless type which has width of 50 mm. The material is so selected to stick the oil to the belt. It is mounted on the aluminum pulley. The length of the open belt is 1500 mm. It is immersed in the liquid up to the 150 mm.

## 2.4 Hopper (container) -

So basically hopper is place where we are going to store the mixture of waste oil and water. The square or spherical shape (the shape of hopper (container) is not having that much importance in our fabrication. We only need to fulfill one requirements that the capacity in liters. We are going to use sheet rolling process for fabrication. Mainly we will be using the MS plate since it is cheap and easily available.

## 2.5 Oil Scrapper-

Oil scrapper is device which we are going to use to store the separated oil. This scrapper is been connected to the belt. Scrapper will have one small rectangular ms sheet to it. Which will make contact with the belt and segregate the oil.

## 2.6 Aluminum pulley-

We are going to use to pulleys to support the belt and to achieve the endless belt drive. This process is very much the essential part of the system. The reason behind the selection of aluminum pulleys is that they are corrosion free. That does mean if they get in contact with the oil they will not get corroded.

## 2.7 M. S. roller-

It is made up of mild steel. It is hanging with belt in the liquid. It helps to keep the belt straight due to its weight.

## 2.8 Molded box –

It is made up of asbestos which are plastic granules which is made by molding operation. It is used for the mounting of the motor with gear box and other electrical accessories. It is also used for safety purpose.

## 2.9 Water filter-

A water filter removes impurities from water by means of a fine physical barrier, a chemical process or a biological process. Filters cleanse water to different extents for purpose of providing agricultural irrigation, accessible drinking water, public and private aquaria and that safe use of ponds and swimming pools.

Common types of water filter:

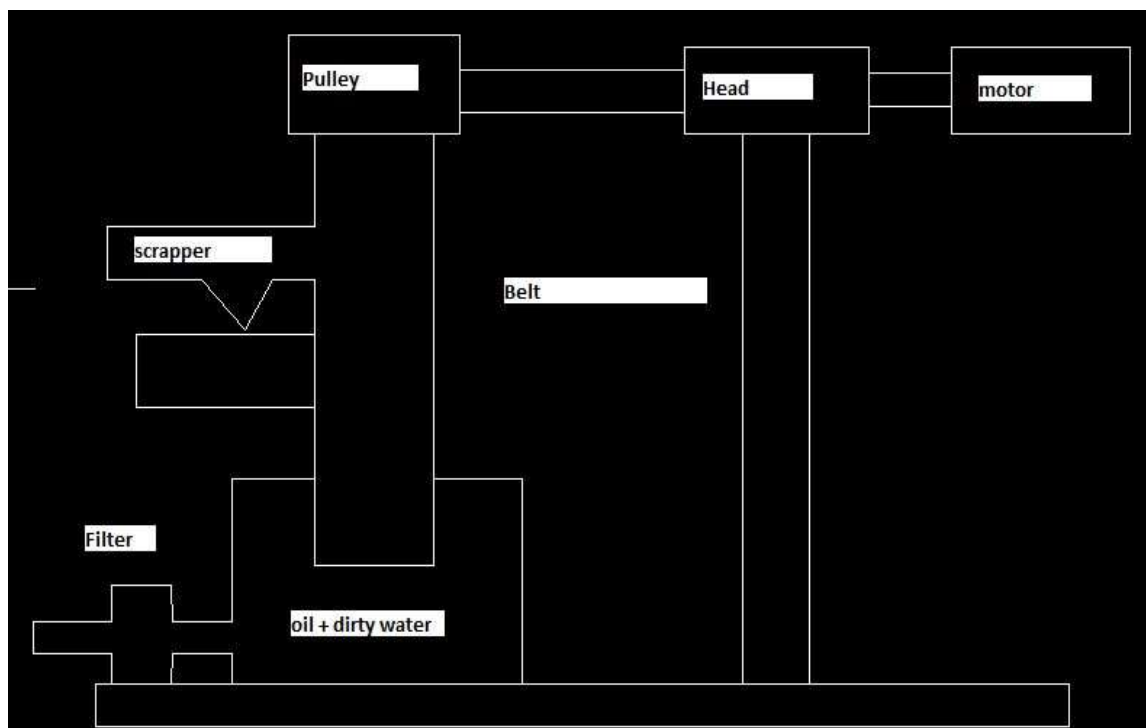
1. **Activated Carbon Filters** : These are also known as carbon filters or pre-filters and are generally responsible for removing larger particles like sediment and silt from your water. They work by attracting and absorbing these particles so they're no longer present in the liquid that comes out of your faucet. An activated carbon filter will also make sure the end result has less in the way of odor and tastes much better. This is because they reduce the amount of chlorine and other contaminants that can make your water smelly or just darn right unpleasant to drink.
2. **Reverse Osmosis** : This type of filter is incredibly popular mainly because it has the ability to remove all sorts of contaminants that can be a danger to your health, as well as making sure the end result is clear and odor free. I know this sounds a little vague, so if you want to find out more, feel free to take a look at my section on reverse osmosis water filtration.
3. **Alkaline/Water Ionizers** : These filters use a process known as electrolysis. What this means is the water is passed Over plates which are electrically charged, and it's separated into two streams. One is

alkaline and the other is acidic. Not only do you get softer water as a result, water that's low in acidity is much better for your skin as well.

4. UV Filters : These types of filters are possibly one of the newest technologies on the market. When ultraviolet radiation is used to treat water, it has the ability to destroy various bacteria that can be damaging to your health. If you want a more environmentally friendly way of purifying your water, this filter will be the answer because it doesn't need any chemicals or additional heat to be effective.
5. Infrared Filters : As with alkaline filters, this technology is used to help soften your water, so if you live in a hard water area, infrared technology will help. Much like alkaline filters, infrared uses heat and light to negatively charge the water, and give it a softer feel.

Manual water purifier is used to purify the water from impurities and dirt particles. This is made by following substances- cotton, coal, sand, stone particles,

### III. WORKING



Firstly switched ON the supply by means of which the motor is started. As the motor is coupled to the gear box the speed of motor is reduced. As the aluminum pulley is mounted on the shaft of motor the aluminum pulley also starts rotating. The aluminum pulley is fitted to the shaft with the help of grub screw for avoiding the slippage of pulley at the time of operation. The belt is mounted on the pulley so that it is rotated at the speed equal to the speed of pulley. The belt rotates the roller. As the roller is immersed in the liquid with the help of belt the oil present in the liquid stick to the belt. This oil is separated with the help of scrapper. This oil is collected in the separate tank such that the oil is separated from the liquid. After the completion of operation switch OFF the supply. Then in the hopper only dirty water is remaining, through the valve supplied to the filter. In filter, filtration process is carried due to which water is filtered. And this purified water is used for many purposes.

#### IV. RESULT

| PARAMETERS             | VALUES |       | MPCP STANDARD |
|------------------------|--------|-------|---------------|
|                        | 1      | 2     |               |
| pH                     | 7.87   | 7.38  | 5.5 – 9.0     |
| Total Suspended Solids | 488.0  | 8.0   | <100.0        |
| Total Dissolved Solids | 598.0  | 624.0 | <2100.0       |
| Chlorides as Cl        | 78.0   | 77.0  | <600.0        |
| Oil & Grease           | 37.0   | 4.0   | <10.0         |

#### V. CONCLUSION

Separation processes are essential elements of the technological foundation of industry. In addition to the importance of separation technologies in industrial processes separation processes also present opportunities for waste reduction and more efficient. Removal of unwanted oil from water which saves environmental and economical problems. Belt skimmer gives best results comparatively. The separator is simple in design and very reliable considering all the constraints. The trial taken shows that design satisfies its purpose. It is found to be very convenient for skimming the oil for the operator. It is very much helpful to operators, as it avoids their tedious work of skimming the oil and grease from the wastage water. It also helps in

- Controlling the water pollution.
- Efficient and economical removing of oil

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