

**Food Oils and Fats: Chemistry & Technology**  
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**Indian Institute of Technology Kharagpur**  
**Module 6 : Edible Oils Refining**  
**Lecture 27: Clarification and Degumming**



**NPTEL ONLINE CERTIFICATION COURSES**

**Food Oils and Fats: Chemistry and Technology**

**Professor H N Mishra**  
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**Module 6 : Edible Oils Refining**  
**Lecture 27 : Clarification and Degumming**

Hello everybody, Namaste. Now, in this lecture 27 today we shall discuss about Clarification and Degumming.

## Concepts Covered

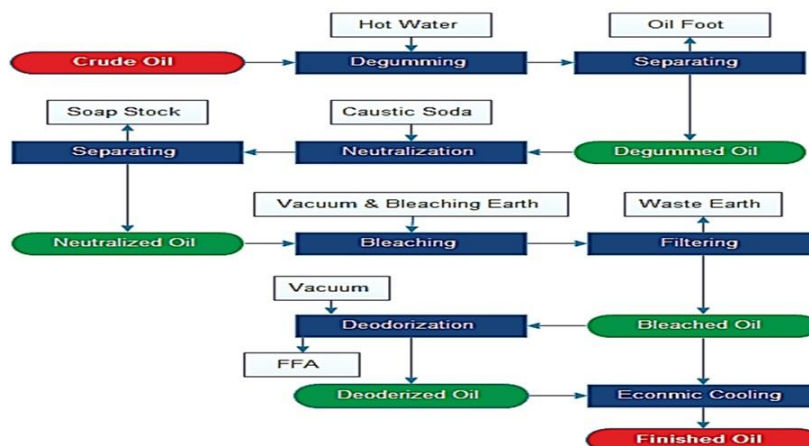
- Crude oil clarification - Filtration
- Filtration methods and equipment
- Degumming process - Principles and mechanism
- Technology of oil degumming
- Degumming methods and equipment



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The concept which I will cover today is the crude oil clarification and mainly the filtration process, what are the different methods and equipment that are used for filtration of oil. Then another important aspect of oil refining that is the degumming process, what is the principles of it and mechanism, then technology of oil degumming and we will also discuss degumming methods and equipment ok.

## Oil refining process

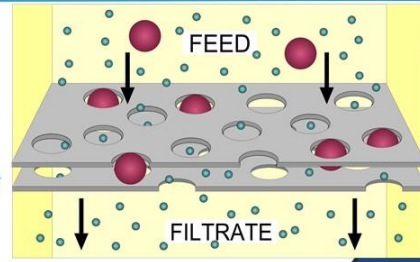


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In the earlier class I gave you an overview of the oil refining process and what are the various impurities which are removed at different stages. So, the same just to refresh your memory you see that these are the major steps that is the clarification, degumming, neutralization, bleaching and deodorization, these are the important operations or steps in oil refining process ok.

### Crude oil clarification by filtration

- Filtration is a process used to remove impurities and other unwanted particles from edible oil. The filter medium captures the impurities, leaving the oil clean and clear.
- The oil is passed through a filter medium, which can be made of various materials such as paper, cloth, or diatomaceous earth.
- Filter aids, such as diatomite, perlite, or cellulose are usually used in conjunction with the permeable filters for surface protection.
- The filtration process is usually repeated multiple times to ensure that the oil is as pure as possible.
- After filtration, the oil may be further processed, such as by deodorization or hydrogenation, to improve its quality and shelf life.



Source: <https://en.wikipedia.org/wiki/Filtration>



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So, the first step refining of oil in fact, starts with the clarification of oil because depending upon the process that is used for oil extraction whether it is a mechanical process or chemical process there are certain impurities that is the other than the triglyceride also they get extracted along with the oil and they come into the crude oil and I discussed all these things in that. So, in fact, that is before sending it to the for the food usage this oil need to be refined and the refining of the oil starts straight away from the clarification that is when the oil is kept in the storage tank then sometime it settles the impurities insoluble impurities etcetera they settle into the bottom and we say that some clarification has been used.

But the majorly that is it is again there are certain equipment which are used that is these are the filtration. So, filtration is a process used to remove impurities and other unwanted particles from the edible oil and the filter medium captures the impurities

leaving the oil clean and clear as you can see here that is the oil is subjected to some sort of filter medium.

So, the impurities are retained on the filter and the clear oil is allowed to percolate through. So, various filter aids which are used in the filtration process they are diatomite, perlite or cellulose in conjunction with the permeable filters for the surface protection. The filtration process is usually repeated multiple times to ensure that all the oil is clarified all the impurities are removed to the extent possible and after the filtration process the oil may be further processed such as by deodorization, hydrogenation etcetera. And normally it is sent to the other refining process, but there are certain oils which are one stage filtration double filter, triple filtered oil there also sometime after packaging they are sent to the market particularly for mustard oil etcetera because the people like the pungent test of the mustard oil and then olive oil and so on.

### □ Types of filtration

- Different types of filtration methods are used in the edible oil industry, such as:

#### ✓ Gravity filtration

The oil is poured into a container with a filter at the bottom. The impurities are separated from the oil due to the gravity and collected in the filter.

#### ✓ Vacuum filtration

The oil is poured into a container and a vacuum is applied, which pulls the impurities through the filter medium.

#### ✓ Pressure filtration

The oil is forced through the filter medium under pressure, which separates the impurities from the oil.



Then now let us see what are the different filtration processes that is type of filtration methods which are used in the edible oil industry. They include gravity filtration means in this case the oil is poured into a container with a filter at the bottom and the impurities are separated from the oil due to the gravity and collected in the filters. Then the other method is vacuum filtration the oil is poured into a container and vacuum is applied which pulls the impurities through the filter medium and also the other another

common method important method is pressure filtration. In this oil is forced through the filter medium under pressure which suppress the impurities from the oil ok.

### ❖ Gravity filtration

- Gravity filtration is a method used in edible oil refining to remove impurities and solid particles from the oil.
- The oil is poured into a container with a filter medium, such as diatomaceous earth or cellulose, which absorbs impurities and allows the clean oil to pass through.
- This process is commonly used in the refining of vegetable oils, such as soybean, sunflower, and canola oil.
- It is a relatively simple and cost-effective method for removing impurities and improving the quality of the oil.



Gravity Filter

Source: <https://www.mectech.co.in/filtration>



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Now, let us see the details of this that is some gravity filter equipment and system is also shown here. See this gravity filtration is a method used in edible oil refining to remove impurities and solid particles from the oil. In this case the oil is poured as I told you earlier also into a container which contains a filter medium such as diatomaceous earth or cellulose which absorbs impurities and allows the clean oil to pass through. The process is commonly used in the refining of oil such as soybean oil, sunflower oil, canola oil etcetera. It is a relatively simple and cost effective method for removing impurities and improving the quality of the oil you can see here some the pictures are shown. Then the vacuum filtration here they told you the it is a process used in the edible oil refining industry. In this case the oil is passed through a filter under a vacuum which helps to remove any unwanted particles and improve the overall quality of the oil. The process can also be used to remove any remaining water from the oil which can cause otherwise spoilage if not removed.



### ❖ Vacuum filtration

- Vacuum filtration is a process used in the edible oil refining industry to remove impurities and solid particles from the oil.
- The oil is passed through a filter under a vacuum, which helps to remove any unwanted particles and improves the overall quality of the oil.
- This process can also be used to remove any remaining water from the oil, which can cause spoilage, if not removed.
- Vacuum filtration is typically done after the oil has been degummed, neutralized and bleached.



Vacuum filter

Source: <https://www.rexonop.com>



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Vacuum filtration is typically done after the oil has been degummed, neutralized and bleached particularly that is in during the bleaching process the bleaching earth etcetera which is done. So, that is also removed using vacuum filtration. So, before packaging this these filters vacuum filtration is added.

### ❖ Pressure filtration

- Pressure filtration is a method used in the refining of edible oils to separate solid impurities from the oil.
- The oil is typically passed through a filter press, which consists of a series of plates with a filter medium (such as filter cloth or paper) between them.
- The plates are squeezed together under pressure, which forces the oil through the filter medium and traps the impurities.
- This method is commonly used to remove particles such as sand, clay, and other debris that may be present in the oil.
- The filtered oil is then ready for further processing or refining, such as degumming or neutralization.



Filter plates for vegetable oil filtration

Source: <https://www.gkd-group.com>



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Then pressure filtration then it is a method used in the refining oil. In this case the oil is typically passed through a filter press which consists of a series of plates with a

filter medium such as filter cloth or paper in between then that you can see here in this figure ok. The plates are squeezed together under pressure which forces the oil through the filter medium and traps the impurities between it ok. This method is commonly used to remove particles such as sand, clay and other debris that may be present in the oil. The filtered oil is then ready for further processing or refining such as degumming, neutralization and so on.

### □ Filtration equipment

Several types of filtration equipment are used in the edible oil refining process, including

- ✓ Plate and frame filter press
- ✓ Leaf filter
- ✓ Centrifugal separator
- ✓ Vacuum drum
- ✓ Membrane filter press
- ✓ Bag filter



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As far as the filtration equipments are concerned various systems or equipment few of them I showed you in the earlier slides. Then some are there they are used in the oil refining by the industry and they include press, plate and frame filter press, leaf filter, centrifugal separator, vacuum drum, membrane filter press, bag filters and so on.

### ❖ Plate and frame filter press

- ✓ A plate and frame filter press is a type of filtration equipment commonly used in the edible oil refining process.
- ✓ It works by passing oil through a series of filter plates, typically made of cloth or paper, which removes impurities and solid particles.
- ✓ The oil is passed through the press using pressure, and the filtered oil is collected for further refining.
- ✓ The plate and frame design allows for easy replacement of the filter media, making it a cost-effective solution for edible oil refining.

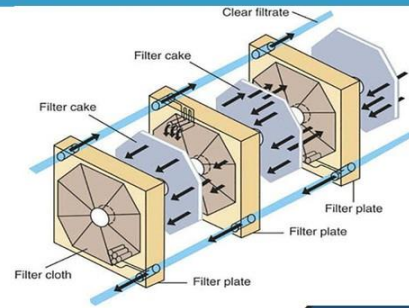


Plate and frame filter

Source: <https://www.oilpressing.org/plate-and-frame-oil-filter.html>



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So, plate and frame filter press as you can see here in this figure that is shown schematic of a plane and frame filter. In this case a plate and frame is there ok and this filtration equipment is commonly used in the edible oil industry you can say these are the different plates and plates. So, where the it works by passing the oil through a series of filter plates which are typically made of cloth or paper which remove the impurities and solid particles. The oil as you can see this arrow that is oil is passed through the press using pressure and the filtered oil is collected for further refining ok. The plate and frame design allows for easy replacement of the filter media making it a cost effective solution for edible oil refining.

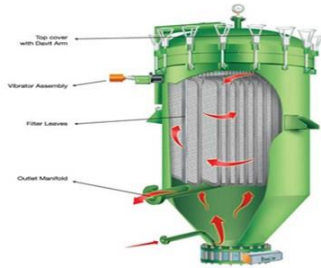


## ❖ Leaf filter

- It operates by passing the oil through a series of filter elements, usually made of metal or mesh, which removes impurities and solid particles.
- It is a popular choice in the edible oil refining industry.

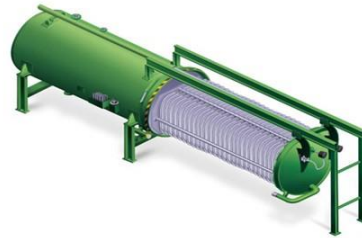
### Advantages

- ✓ High filtration efficiency
- ✓ Compact design, and
- ✓ Ease of maintenance.



Vertical pressure leaf filter

<https://www.mectech.co.in/filtration>



Horizontal pressure leaf filter

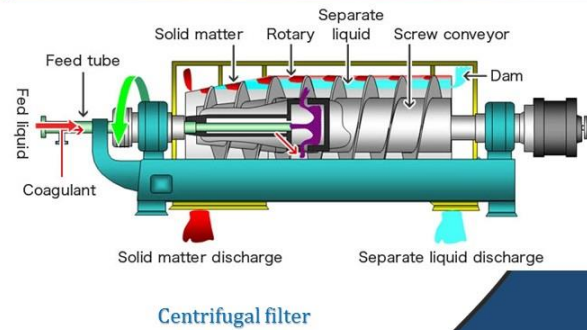


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Leaf filter operates by passing the oil through a series of filter elements usually made of metal or mesh as you can see here in this figure that is shown ok. And these filters that is leaf filters they remove the impurities it is popular choice in edible oil industries it can be a vertical pressure leaf filter or a horizontal pressure leaf filters. The advantages of this system are it has high efficiency that is the filtration efficiency is high in this case, it has a compact design it requires a less space and it has a ease of maintenance ok.

## ❖ Centrifugal separator

- ✓ It works by spinning the oil mixture at high speed in a container, causing the heavier impurities to be separated out due to centrifugal force.
- ✓ The separated impurities are then removed, while the purified oil is collected for further refining.
- ✓ Centrifugal separators are commonly used in the edible oil refining industry due to their ability to handle large volumes of oil and their high separation efficiency.



Source: <https://cannonwater.com/blog/centrifugal-separators-working-principle-and-applications/>



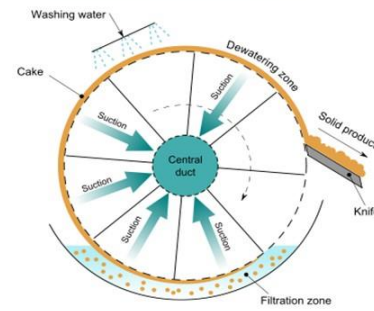
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Then centrifugal separator as you can see in the figure provided in the slide it works by spinning the oil mixture at high speed in a container causing the heavier impurities to be separated due to the centrifugal force ok. This is you see it spins here the separated impurities are then removed while the purified oil is collected for further refining ok. This is the oil discharge comes impurities are collected separately. The centrifugal separators are commonly used in edible oil refining industry due to their ability to handle large volumes of oil and their high separation efficiency.

### ❖ Vacuum drum filter

- ✓ It operates by passing the oil through a rotating drum that is partially submerged in a vat of filtrate.
- ✓ The drum is covered with a filter media, such as cloth or paper, which removes impurities and solid particles from the oil.
- ✓ As the drum rotates, it is partially lifted out of the vat, creating a vacuum that draws the filtered oil through the filter media and into a collection area.
- ✓ The vacuum drum filter is a continuous operation, and the filtered oil is collected for further refining.
- ✓ Vacuum drum filters are commonly used in the edible oil refining industry due to their high filtration efficiency and ability to handle large volumes of oil.

Source: [https://en.wikipedia.org/wiki/Rotary\\_vacuum-drum\\_filter](https://en.wikipedia.org/wiki/Rotary_vacuum-drum_filter)



Vacuum drum filter



Vacuum drum filter again schematic of the vacuum drum filter is shown here in this figure it operates by passing the oil through a rotating drum that is partially submerged in a vat of filtrate. The drum is covered with a filter media such as cloth or paper which removes impurities and solid particles from the oil. As the drum rotates it is partially lifted out of the vat creating a vacuum that draws the filtered oil through the filter media and into the collection area. The vacuum drum filter is a continuous operation and the filtered oil is collected for further refining. Vacuum drum filters are commonly used in edible oil refining industry due to their high filtration efficiency and ability to handle large amount of oil.

### ❖ Membrane filter press

- ✓ It works by passing the oil through a series of filter plates, each equipped with a semi-permeable membrane, which removes impurities and solid particles.
- ✓ The oil is forced through the filter plates under pressure, and the filtered oil is collected on the other side of the membrane.
- ✓ The working principle of a membrane filter press is based on the difference in pressure on either side of the semi-permeable membrane.
- ✓ The membrane filter press is a continuous operation and is known for its high filtration efficiency.



Membrane filter press

Source: [http://www.insoftek.com.my/picture/16bar/16bar\\_side\(novatek\)small.jpg](http://www.insoftek.com.my/picture/16bar/16bar_side(novatek)small.jpg)



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Membrane filter press ok, membrane separation process is earlier also we have discussed in this course ok. It works on the by passing the oil through a series of filter plates you can see here in this figure that is and these filter plates are made of semi permeable membranes which selectively removes the impurities and solid particles and allows the clear oil to pass through.

The oil is forced through the filter plates under pressure and the filtered oil is collected on the other side of the membrane. The working principle of a membrane filter press is based on the differential says in the pressure on either side of the semi permeable membrane. The membrane filter press is a continuous operation and it is known for its high filtration efficiency. Vac filters again you can see here in this figure it is very popular filter that the system typically consist of a filter housing that contains filter bags made up of a porous material such as polypropylene or nylon. As the oil is pumped through the system it passes through the filter bags which traps any solid contaminant while allowing the purified oil to pass through.

### ❖ Bag filter

- ✓ The system typically consists of a filter housing that contains filter bags made of a porous material, such as polypropylene or nylon.
- ✓ As the oil is pumped through the system, it passes through the filter bags, which trap any solid contaminants, while allowing the purified oil to pass through.
- ✓ Bag filters are a cost-effective and efficient way to remove impurities from edible oils and can be used in a variety of applications, including vegetable oil refining, biodiesel production, and animal fat processing.



Bag filters

Source: <https://www.aquasystemstech.com/Bag-Filter.html>



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Bag filters are a cost effective and efficient way to remove impurities from edible oil and they can be used in a variety of applications including vegetable oil refining, biodiesel production and animal fat processing etcetera ok. So, after this clarification that is at least suspended and dissolved solids etcetera that is colloiddally dissolved or other suspended solids or impurities dust all those things are removed. Then this filtered oil is a sent for the degumming process ok.

### Degumming

- ✓ Degumming is a process used in the production of vegetable oils, such as soybean oil, to remove gums and other impurities.
- ✓ The process typically involves treating the oil with water and an acid or an alkali to neutralize the gums, which are then separated from the oil.
- ✓ Degumming can also be done using enzymes or other chemical treatments.
- ✓ Degumming is used to remove impurities, such as phospholipids, from crude oil before it is refined.
- ✓ Degumming improves the quality and stability of the oil and is an important step in the refining process.



Edible oil degumming equipment

Source: <http://www.agico.com.cn/oil-degumming.html>



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And in the degumming as the name itself in case that is the gum gums are removal of gums degumming. Degumming is a process used in the production of vegetable oil and most of the this is soyabean oil and such other oil ground nut and all those things which has high amount of gums and other impurities. The process typically involves treating the oil with water and an acid or an alkali to neutralize the gums and which are then separated from the oil. Degumming can also be done using enzymes or other chemical treatments. Degumming is used to improve impurities such as phospholipids from the crude oil ok. And it degumming process improves the quality and stability of the oil and is an important step I told you earlier also in the oil refining process it is a very very important step ok.

**❑ Aim of degumming operation**

- ✓ The emulsifying action of PL increases oil losses during alkali refining.
- ✓ Gums lead brown discoloration of oil after heating during deodorization.
- ✓ Salts may be formed with copper, magnesium, calcium and iron, accelerating oxidative degradation of oil.
- ✓ Certain PL, such as lecithin, find widespread industrial application.

**❖ Gums : Two types**

- **Hydratable**
  - ✓ Easy to remove by simple water washing
- **Non-hydratable**
  - ✓ Hard to remove from oil.
  - ✓ Requires the use of an acid to convert to hydratable for complete removal.

**❖ Different degumming processes**

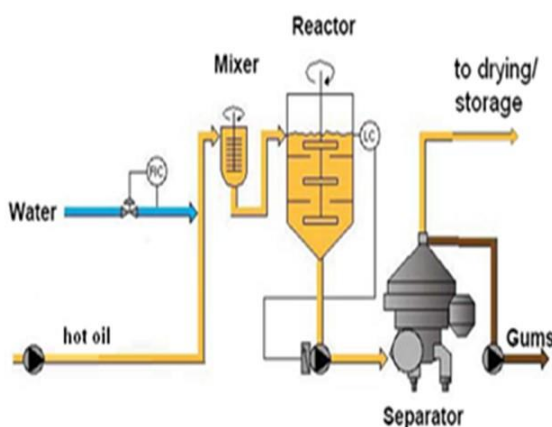
- ✓ Water degumming
- ✓ Acid degumming
- ✓ Enzymatic degumming
- ✓ Membrane degumming

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So, the objective of the degumming process aims of the degumming obviously, they told you earlier also it the emulsifying action of the phospholipid will increase if the oil losses during the alkali refining if they are not removed. So, the first and most important purpose of the degumming process is to remove the phospholipids or which are also commonly known as gums. Otherwise if they are not removed then these gums lead brown discoloration of oil after heating during deodorization process. The salts may be formed with copper, magnesium, calcium and iron accelerating oxidative degradation of the oil. Certain phospholipids such as lecithin find widespread industrial application

otherwise it goes as a waste in the oil. So, these are phospholipids, gums, etcetera, use and the gums that is they are further processed into further preparation of phospholipids and this phospholipid that is further preparation of lecithin which is an emulsifier used commercially in many food products. So, if we see that categorize that the gums which are present in edible vegetable oils they are of two types mainly hydratable gums and non-hydratable gums. Hydratable gums are those which are easy to remove by simple water washing and this step is generally done at the oil extraction plant itself that is in the oil extraction plants this crude oil is treated with water alright and then this water soluble or that is I can say that the hydratable gums which they form the emulsifier they form the precipitate they get agglomerated at the get precipitated and removed. So, these are they are this is done in the water extraction plant itself and then after removing hydratable gums the oil is sent to the non-hydratable gums which are hard to remove from the oil they require the use of an acid to convert to the non-hydratable gums to hydratable gums for complete removal and this part removal of treatment with acid generally done at the refining plant. So, different water degumming processes accordingly they include water degumming, acid degumming, enzymatic degumming and membrane degumming. So, these different methods can be used to remove the gums.

### ❖ Water degumming

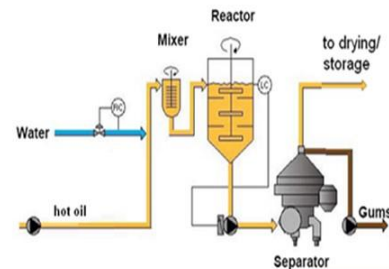


- **Hydration process;** warm water is added to the crude oil at 80-85 °C and the mixture is agitated slowly for approximately 20 min.
- The water dosage used is usually based on the expected amount of phospholipids (PL) in the crude oil.
- The hydratable PL agglomerate at the interface of the oil and water, capturing even some non-hydratable PL with them.

Source : <http://lipidlibrary.aocs.org/OilsFats/content.cfm?ItemNumber=40324>

So, let us see first the water degumming process you can see here in the figure that is there is a system this is a reactor vessel in this hot oil is coming and it is mixed with the water that is simple thing and after that the gums which are performed that is the warm water at the temperature of around 80 to 85 degree Celsius is mixed in the reaction medium with the water and then it is agitated slowly for approximately 20 minutes. The water dosage used is a usually based upon the expected amount of phospholipids that is phospholipids content of the crude oil. So, the what happens when it is mixed with water and hot water and oil and allowed to stay for some time. So, the hydratable phospholipids agglomerate at the interface of the oil and water capturing the some of the non-hydratable phospholipids with them ok.

- Oil is also trapped by the PL, forming an emulsion, referred to as “gums” or “wet gums”.
- After a certain reaction period the hydrated PL can be separated either by decantation (settling) or continuously by means of centrifuges.



The extracted gums can be processed into lecithin for food, feed or for technical purposes.



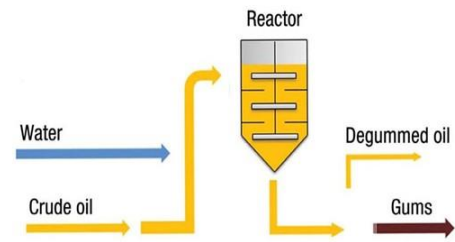
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And then the oil is also trapped by the phospholipids forming an emulsion referring to as gum or wet gums. So, after a certain reaction period is given may be 20 minute, 30 minute or so depending upon the type of the oil amount of phospholipids present etcetera. These hydrated hydrated gums hydrated agglomerates gum they are separated either by decantation that is simple settling or continuously by the centrifugal method or other methods ok. The extracted gums I told you they are processed generally to prepare food grade lecithin or commercial grade lecithin and which is used in various food preparation in even in the fat and oil industry in the margarine. There is the

vegetable oil which is further converted into a butter like product their lecithin as I has 8 to 10 percent lecithin is used as an emulsifier.

### ❖ Batch water degumming

- ✓ Batch water degumming is a process used in the production of vegetable oil where impurities, such as phospholipids and proteins, are removed from the oil.
- ✓ The process involves adding a small amount of water to the oil, which causes the impurities to coagulate and form a gummy substance that can be easily removed from the oil through centrifugation or filtration.
- ✓ This process is typically used for oils such as soybean oil and canola oil.



Source: <https://www.oil-refinery.com/process-solutions/degumming-process/>



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Then batch water degumming you can see here the simple reaction it is a crude oil and water. It is a process used in the production of vegetable oil where impurities such as phospholipids and proteins are removed from the oil. The process involves adding a small amount of water to the oil which causes impurities to coagulate and form a gummy substance and which can be easily removed from the oil through the centrifugation or filtration. This process is typically used for oil such as soybean and canola oils ok.

## ❖ Soft degumming

- ✓ Soft degumming is a variation of the batch water degumming process used in the production of vegetable oils.
- ✓ The main difference between soft degumming and batch water degumming is that in soft degumming, less water is added to the oil, which results in less coagulation of impurities and a gentler process overall.
- ✓ This results in a lower yield of gums, and less damage to the oil's natural properties.
- ✓ Soft degumming is typically used for oils such as sunflower oil and corn oil.



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Soft degumming is a variation of batch water degumming process under the production of vegetable oil. The main difference between soft degumming and batch water degumming is that in soft degumming less water is added to the oil which results in less coagulation of the impurities and a gentler process overall. This results in a lower yield of gums and less damage to the oils natural properties. Soft degumming is typically used for oil such as sunflower oil and corn oil.

## ❑ Acid degumming

### ❖ Dry acid degumming

- Dry acid degumming is particularly suitable for processing oils with low gum contents such as palm oil, coconut oil, or animal fats.
- Intensive mixing is implemented following addition of acid to the pre-heated crude oil.
- The conditioned gums are absorbed into the bleaching earth and are separated by filtration.
- The benefits of the dry acid degumming process are
  - ✓ Efficiency as a result of
    - Low energy consumption,
    - Low operation and maintenance costs
  - ✓ Long service life (the components are acid proof)
  - ✓ Low investment costs
  - ✓ Environmental-friendly as no waste water or soap stock occur

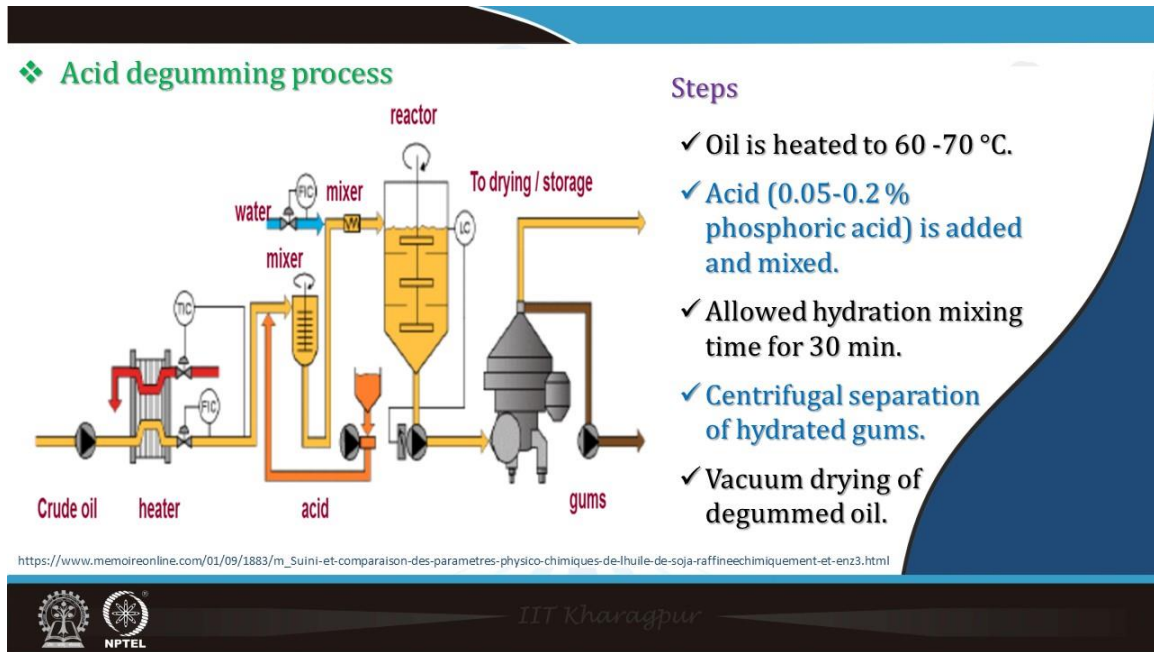


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Then now we come to the acid degumming. Acid degumming it is done at the refining plant. Here dry acid that particularly is a suitable for processing oils with low gum content such as palm oil, coconut oil or animal fats.

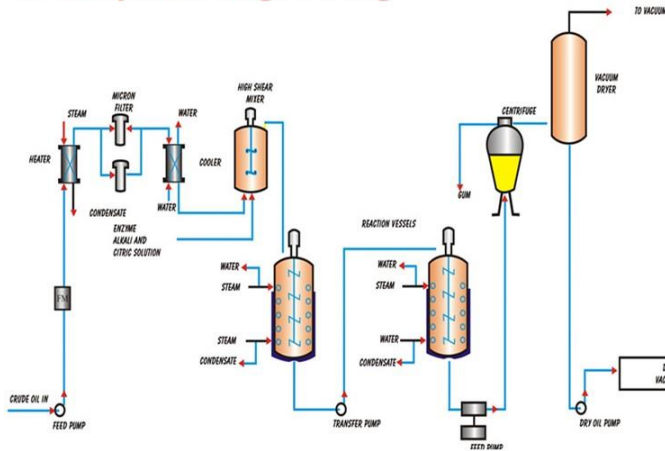
So, that is dry acid degumming. Here intensive mixing is implemented following the addition of acid to the preheated crude oil. The conditioned gums are absorbed into the bleaching earth which are also added to remove the pigments etcetera and they are all separated by filtration. The benefits of the dry acid degumming process are efficiency as a result of low energy consumption and low operation and maintenance cost. It has a long service life that is the components are acid proof, low investment cost and it is an environmental friendly process as no waste water or soap stock occur in this step, ok.



So, you can see the acid degumming process here crude oil water is coming here heated and there is a system to introduce hot water. Then this acid that is acid from the tank concentrated acid solution ok, or dry acid from the tank is pumped here it is mixed with oil alright and then again water is mixed and given the desired reaction time. So, the steps are that is oil is heated to 60 to 70 degree Celsius, then acid at the rate of 0.05 to 0.2 weight percent phosphoric acid is added and mixed. The hydration mixing time is allowed for about 30 minutes and then centrifugal separation done for the removal

of the hydrated gums. Then finally, the oil is vacuum dried to remove any traces of moisture that is.

## Enzymatic degumming



- The enzyme solution (aqueous solution of citric acid, caustic soda and enzymes) is dispersed into filtered oil at mild temperature.
- A high speed rotating mixer is used for effective mixing of enzyme solution and oil.
- The conversion of non-hydratable PL into hydratable PL is attained by the effect of enzyme.



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Then enzymatic degumming process here there is a enzyme solution that is the enzyme solution which is aqueous solution of citric acid, caustic soda and certain enzymes that is this is dispersed into the filtered oil at mild temperature. You can see here there is this is the reaction medium ok, then the solution of that is condensate which can enzyme alkali and citric acid solution as there a high speed mixture the crude oil is coming. So, this oil is mixed with the enzyme solution sent to the reaction medium and that in the reaction medium that high speed rotating mixture is a used for effective mixing of the enzyme solution and oil and the conversion of non-hydratable phospholipids into the hydratable phospholipid is attained by the effect of enzymes and the rest process is same that is this agglomerates are removed by centrifugal method and vacuum drying.

## □ Membrane degumming

- Membrane degumming is a type of physical degumming process that uses a membrane filtration system to remove impurities, such as phospholipids, from the oil.
- It does not use chemicals or enzymes to break down the impurities and is also known as "Ester-Gumming"
- In membrane degumming, the oil is first heated and then passed through a membrane filtration system, which is typically made up of several layers of different types of membranes, such as microfiltration, ultrafiltration, and nanofiltration membranes.
- The impurities, such as phospholipids, are trapped in the membrane, while the purified oil is collected on the other side.

### Advantages of membrane degumming

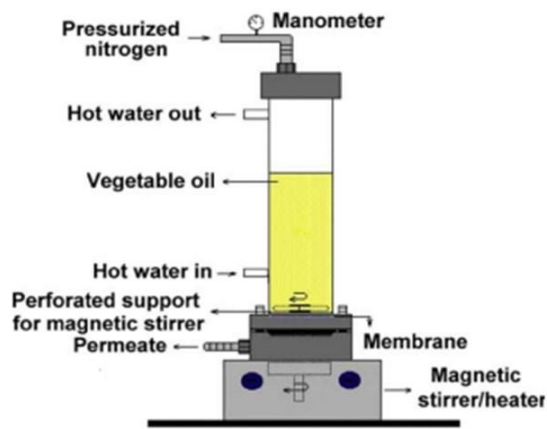
- ✓ Continuous process
- ✓ Highly efficient with high accuracy
- ✓ Environmentally friendly as it does not generate waste stream
- ✓ Used for soybean, rapeseed, sunflower and palm oil(s)



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Then again like in the earlier cases we discussed membrane degumming again it is a very important use method it is a novel technology of degumming and here that is the it is a basically a physical degumming process that uses membrane filtration system to remove impurities like phospholipids, etcetera from the oil and it is it does not use any chemicals or enzymes to break down the impurities. So, it is also known as ester gumming alright the membrane degumming of the oil if this process the oil is first heated and then passed through a membrane filtration system. The details of membrane filtration principles etcetera we have earlier discussed. So, this system is typically made of different layer different types of membrane like microfiltration membrane, nano filtration membrane or ultrafiltration membrane as the case may be depending upon the size of the impurities present here gums etcetera. So, these phospholipids and other such gums they are trapped in the membrane while the purified oil is collected on the other side. So, the advantages basic advantages of the membrane degumming process include it is a continuous process, it has high efficiency with high accuracy, it is environmentally friendly as it does not generate waste streams. It is used for soyabean, rapeseed, sunflower and palm oil etcetera ok.

## ❖ Membrane degumming process



Source : de Moura et al. (2005)

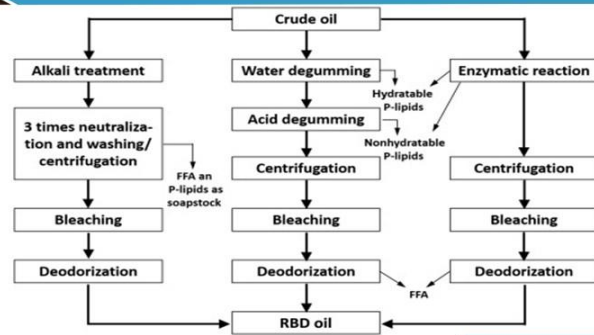
- MF and UF have been explored for membrane based degumming.
- Membrane degumming of the oil can be done in two ways
  - ✓ Degumming of crude solvent free vegetable oil
  - ✓ Degumming of oil-solvent micella
- The major problem in membrane degumming of the crude oil was the drastic flux drop at the initial experiment stage which was attributed to the pore blocking, concentration polarisation, and cake formation by the rejected solids.

The membrane degumming process you see here it is shown in the picture here schematic diagram here mostly microfiltration and ultrafiltration process membranes has been explored for this membrane degumming processes. And this membrane degumming of the oil can be done in the two ways like degumming of the crude solvent free vegetable oil or even the degumming of the oil solvent micella also that is come in the from the micella itself gums can be removed only thing you have to here select the proper type of the membrane and it is a pore sizes ok. So, the one major problem that is a in and forth that is seen here which occurs in this membrane degumming of the crude oil is the drastic flux drop at the initial experiment stage and which is mainly attributed to the pore blocking concentration polarization and cake formation by the rejected solids normally if they block the pores and this. So, it require frequent cleaning of the membrane.



## ❑ Total degumming

- ✓ The process typically involves a combination of physical and chemical treatments, such as the use of acids, enzymes, and/or heat.
- ✓ This results in a higher purity oil with minimal impurities.
- ✓ Total degumming is commonly used for refining of edible oils like rice bran oil, sunflower oil, soybean oil and also used for industrial purpose for example in the production of lecithin.



Source: <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/degumming>



Finally, there is a concept of total degumming that is the process typically involves a combination of physical and chemical treatments such as the use of acids, enzymes and or heat. This results in a higher purity oil with minimum impurities. Total degumming is commonly used for refining of vegetable oils like rice bran oil, sunflower oil, soybean oil and also used for industrial process for the purpose of there is a for example, for the production of less ethylene etcetera the total degumming process like you see here crude oil and in this case the oil is subjected to all that is the water degumming, acid degumming, then centrifugation, pitching, deodorization etcetera, enzymatic reaction, enzymatic. So, may be the most all the process the water, acid, enzyme and so that the complete removal of the phospholipids is done ok and this is basically process for rice bran oil degumming oil is given here ok.



## □ Degumming efficiency

- To evaluate degumming efficiency for a given refined oil sample, an analysis test known as degumming efficiency is reported.

$$\text{"Degumming Efficiency"} \left( \frac{g}{100 g} \right) = \frac{(P_0 - P_d)}{P_0} * 100$$

Where,  $P_0$  is phospholipid (ppm) in crude oil, and  
 $P_d$  is the phospholipid content (ppm) in degummed oil.



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So, that there is a term degumming efficiency that is to just to see that how much of the has been removed to evaluate the degumming efficiency of the process of degumming for a given refined oil sample and analysis tests known as degumming efficiency is reported ok. That degumming efficiency can be defined as that is in gram per 100 gram is defined as is equal to that is the phospholipids that is content in crude oil that is  $P_0$  minus the phospholipid content of the degummed oil divided by phospholipid content of the crude oil multiplied by 100 that is  $P_0$  minus  $P_d$  divided by  $P_0$  into 100. So, that gives the degumming efficiency ok.

$$\text{"Degumming Efficiency"} \left( \frac{g}{100 g} \right) = \left( \frac{P_0 - P_d}{P_0} \right) * 100$$

## Summary

- Filtration and degumming are important processes in the refining of crude oils, such as vegetable oils, animal fats, and petroleum.
- Filtration is the process of separating solid impurities from liquids through a filter medium.
- Degumming, on the other hand, removes gums and other impurities from oils. Gums are substances that can cause the oil to become cloudy and can negatively impact its flavour and stability.
- In the refining of oils, degumming is typically done by adding water and an acid to the oil, which causes the gums to precipitate out. The gums are then removed by filtration or centrifugation.
- Together, filtration and degumming help to improve the quality and stability of oils, making them suitable for use in a variety of applications.



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So, finally, I will summarize this lecture by saying that filtration and degumming are important processes in the refining of the crude oil ok, vegetable oil, animal fats, petroleum products etcetera. Filtration is the process of separating solid impurities from liquid through a filter medium. Degumming of on the other hand remove the gums and other impurities from the oils. Gums are the substances that cause the oil to become cloudy and can negatively impact its flavor and stability if they are not removed and that is why it becomes a very important that in the refining of oil degumming is typically done by adding water and an acid to oil which causes the gum to precipitate out the gums are then removed by filtration or centrifugation. Together filtration and degumming help to improve the quality and stability of oil making them suitable for use in a variety of applications.

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So, these were the references that were used in preparing this lecture.



So, this thank you for your patience here.