

FILTERING THROUGH THE NEWS No. 22

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Attn :

To whom it may concern;

THE FILTRATION OF CRUDE REDERED FAT , TALLOW BLEACH AND THE ROLL OF POLYETHYLENE:

With reference to the much heard questions on the problems encountered with the filtration of Tallow & crude rendered fats we have pleasure to submit the information related to the latest developments in this application. Where tallow and lard in the past where used in edible (frying) fats they now are mainly used as feedstock in oleo chemical applications and for bio-diesel.



Changes in meat distribution have sharply altered the rendering industry.

In the range of tallow we could include poultry fat, Lard and Fish oil but we will limit ourselves to Tallow since this covers most of the other oil as well and on top of the expected problems we have to deal with unexpected problems like how do we remove Polyethylene a nasty product that should not be there but influences filtration very much. In the book about bleaching & purifying fats & oils by HBW Patterson more can be learned about the process.

Removal of polyethylene from animal fat is part of the bleaching step and complete bleaching lines can be offered by De Smet Ballestra(Malaysia & Belgium), Crown Iron Works in Minneapolis USA, Alfa Laval USA and many others.

The processing of edible oils and fats is currently very much discussed. The use of different process , adsorbents, less adsorbents, re-use of clay's and more optimal use of clays plus process developments in other parts of the process are all being practiced within modern refinery organizations. Most of this is true for single feed stock applications and large capacities but in practice we run into many special oils and conditions of which we will explain the influence on filtration of Animal fat i.e.

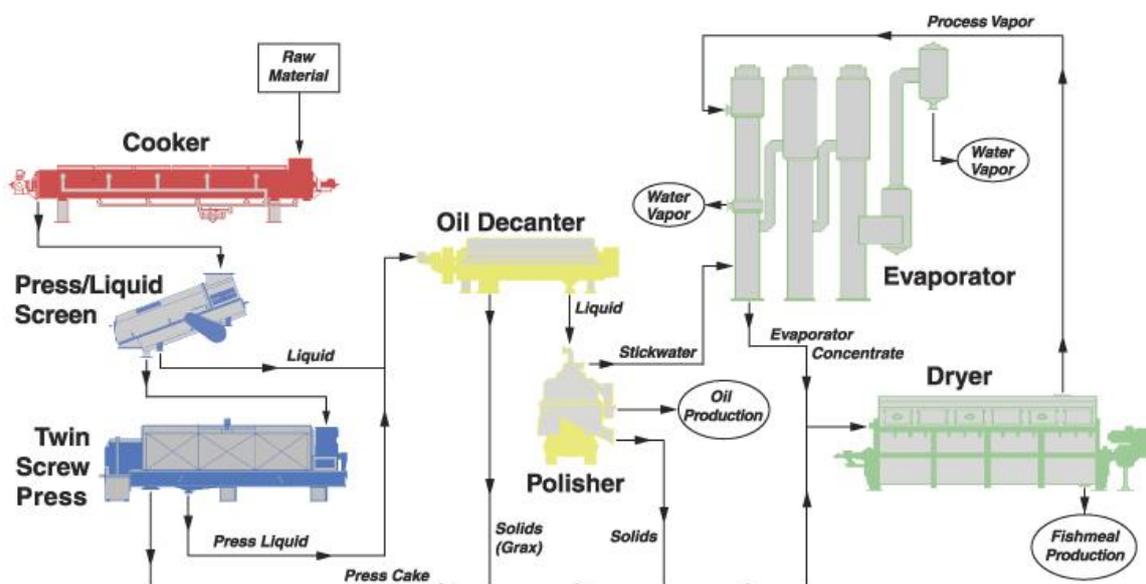
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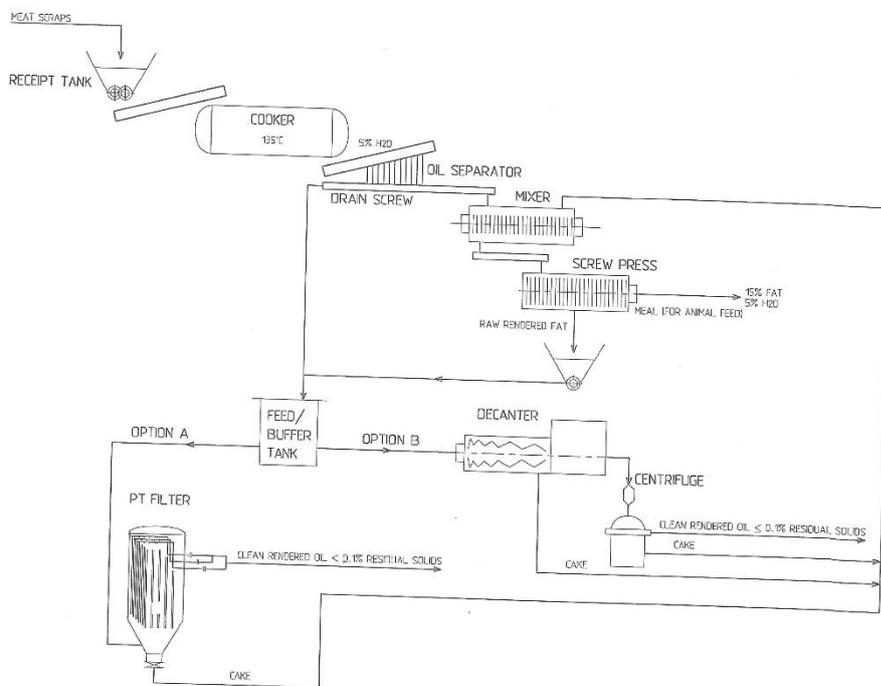
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Tallow both in crude rendered fat and in bleaching . The oil contains PE (= polyethylene) and in this paper we try to explain how to filter these products.



Fat derived from cattle is usually softer than that of sheep or goats and as with pigs ,inner organs yield the firmest fat and subcutaneous tissue the lowest. Climate and diet have a market effect upon the fatty acid make up of tallow . Edible tallow is less popular and in some parts of the world completely disappeared. BSE and other veterinarian diseases have made the product in-edible and it shifted towards the soap , oleo –chemical applications and the Bio-diesel industry .

Remnants of polyethylene packaging, earmarks and other PE articles are a nuisance in animal fats. To find out if PE is present a sample of tallow is kept for 5 hr at 60 degrC, When the sample remains completely clear negligible plastic is present .



RENDERED FAT:

PMI has an interest in the rendering industry and in the last few years we have supplied several filters to replace decanters , to filter after the decanter and even polish centrifuges at fat rendering plants or to only filter the crude rendered fat without centrifuges. Amongst the

applications we had filters for Mechanique Moderne in France where we filtered chicken rendered fat at la Reunion Island (3-4 m3 in 8 hr day) and a big installation at Caillaud in France(engineered through SIL-De Smet) for approx. 5 mt/hr rendered cattle and several filters at Rietmann/Saria France or Rendac in The Netherlands.

The new legislation in Europe makes it difficult to mix bone meal with cattle feed and the thread of BSE and other scandals in the European territory made the renderers to look at different processing ways. One of the demands was a better clarity of the oil/fat stream since it all had to go to direct fuel oil or is converted into FAME (fatty acid methyl ester) =bio diesel .

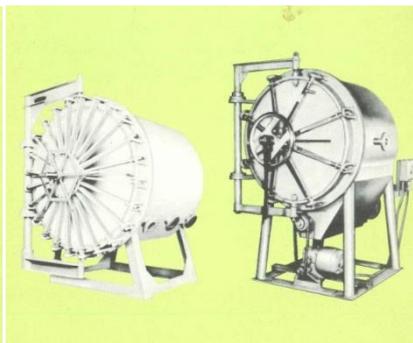
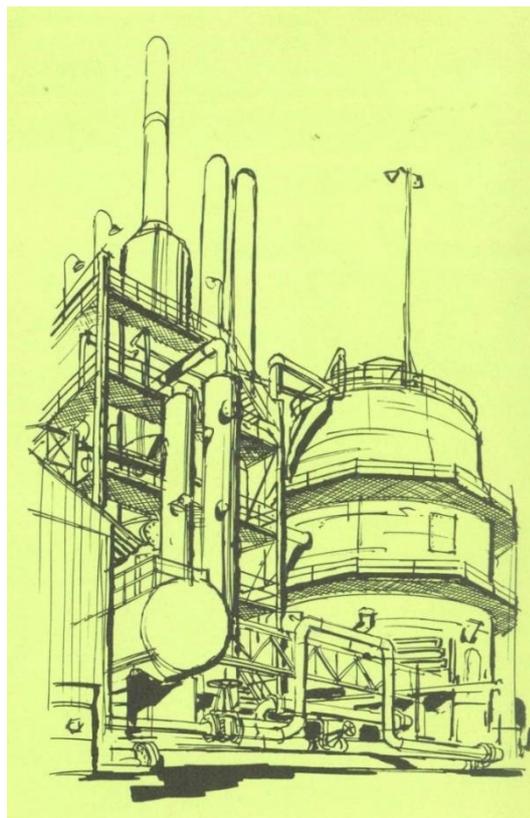
The traditional way was a filter system and in the old De Laval installations "Hercules" Rapidor leaf filters where used(pre coat type). Other installations like Dupp's also used leaf filters and we sold several filters in the USA for this duty (EXCEL, KALUZNI BROTHERS,etc).

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Like all process also the rendering developed . The oil was mainly used for non edible purposes and the main applications where soap, fatty acid and mixed with animal feed. This required a relative clean product but some solids where tolerated. The process starts with the reception tank from where the product/ meat scrap is mixed and chopped up before it goes to the cooker. The heated product leaves the cooker via a drain screw to the mixer and then to the expeller or screw press. From here we have meal and raw rendered fat.

The crude rendered fat contains 10 up to 15 % solids at this stage and the common way to handle it was a **decanter** that brought it down to less than 1 % (most common is >0,5 %). If a more clean product was needed another **clarifier centrifuge** was added to bring it down to less than 0,2 residual solids.

With the new legislation and a clean oil demand to be used in industrial applications and avoid clogging ,in one of the applications like nozzle injection in Diesel engines, the **filter** option could give them a less than 0,1 % residual solids. . Plant capacity and number of units (centrifuge or filter) will be the major driver in this application.

The filters used in the past where leaf type filters (PL Vertical or PL horizontal) but the newer plants use our Lochem Filter type RP Pulse filter. Due to expected thick cakes and high solid loadings we design the filters with a 200 mm element pitch for >50 mm cake thickness.

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TALLOW:

The filtration of tallow is either a bleaching application or it is done to remove the polyethylene. The polyethylene (PE) content is important since it will have a big influence on the filterability of the product. PE is in solution at a bleaching temperature of 95-105 °C. At this temperature the bleaching is as all other oils provided that we have clean fancy tallow. Only at <70 °C the PE becomes solid, agglomerate and can be removed.

The PE causes many problems such as the coverage of instruments and the plugging of distillation columns and a haze in finished FAME. Most users therefore specify a max PE content of not more than 200 ppm in the incoming oil but it can range from 200 to 1000 or even more.

Many filters have been sold and are used to filter the bleaching clay first at 95-105 °C followed by cooling the oil to 70 °C, solidify the PE, and filter again. In this case clay can act as a body feed.

If filtration is only used to remove PE we need to pre-coat the filter for every cycle (1 kg /m² kieselguhr, perlite or cellulose). During the entire filter cycle we also "body feed" to keep the cake open and filtration going. Another option is that the clay and the polyethylene are filtered at the same time. In this case the clay can act as a filter aid. At process temperature below 70 °C we will design on a low flow rate of approx 200 kg/m²/hr.

We looked into some old files from tallow customers and their filter aid use. We found clients that use bleaching clay and filter aids like kieselguhr / perlite both used to enhance the filtration rate and to keep the screen/cake open.

The pre coat is used to form a layer that will be tight enough to retain all the solids we want to remove and at the same time we keep the screen clean from a direct contact with the dirt.

Pre coat should if possible be done with clean oil but we have also seen that not filtered oil is used. For pre coat we use approx 1 kg / m² filter aid and we have seen that Hyflo super cel or Celite 512 and 545 are used (Celite corp. or equivalent by Dicalite).

The body feed given to keep the cake open during filtration and to prevent plugging depends greatly on the incoming turbidity and the tallow quality. With so called fancy tallow with no more than 200 ppm incoming tallow we have had cases where we only had a body feed of 0,1-0,2 % by weight and again we used Hyflo super cel, Celite 512 or Celite 545 (equivalents used from Dicalite where speed plus or super aid). In one case we had a higher use and up to 0,2-0,3 % by weight was required to handle this material. The filter aid suppliers mention that the filter aid consumption is anywhere between 0,1-1 % by weight depending on the incoming tallow quality

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A recent report from a client showed that on a tallow with 1,3 gr/kg polyethylene in the incoming crude tallow we used 1 kg / m² pre coat and up to 0,8 % body feed to reach a filtered tallow quality of max 8 mg/kg polyethylene(guarantee is <20 ppm) in the filtered tallow.

Cake is dried with air/N₂ and 25-30 % residual oil/tallow was measured in the cake after a drying period of 20-30 minutes.

The filtration of bleached oil where not more than 200 ppm PE is present we filter the bleached oil at 90-110 degrC and ensure the PE is in solution. The clay content is not more than 2% and we allow no more than 250 kg bleached tallow per sqm filter area per hr. With the knowledge that we have to remove the PE at later stage and at lower temperature it is recommended that the filter leaves are pre-coated before the clay filtration starts and this is mainly done to ensure that the plugging material does not get to the screen and make cake discharge almost impossible.

Pre-coat with one of the three known filter aids but preferably with DE (hyflo super cel, FW40 or 50) or Cellulose (JRS)

FISH OIL:

We only want to mention fish oil here as one of the more exotic oils. In Europe , SEA and USA fish oil is one of the smaller oils and considered exotic. In South America fish oil is more popular. In countries like Chile and Peru some plants process up to 300 mt/day.

The oil is very sensitive to contact with oxygen and it dries in only a matter of minutes. It is therefore important to avoid exposure to air and Nitrogen blanketing is recommended.

Crude fish oil is handled by Centrifuges.

TALLOW BLEACH:

Tallow is in general caustic or chemical refined and In good chemical refined tallow the soap is low and Phosphatides are 5-10 ppm max with max 2,5% FFA

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Bleaching Products

With reference to filtration-characteristics

• CLARIANT (Sud Chemie)	Tonsil 424-OPTIMUM FF	= Fast Filtration.
• BASF(FILTROL)	GRADE 105 SF	= Speed Filtration.
• Norit ACTIVATED CARBON	SA4 –PAH- HF	= High Filtration.
• OIL DRY	SELECT FF	= Fast Filtration.



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It is safe to say that the increased P and soap levels will have a negative effect on the filtration rate.

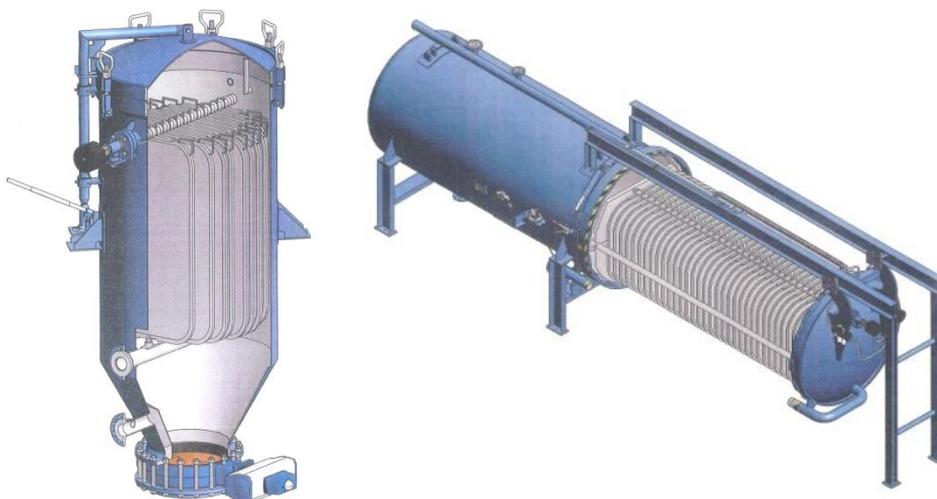
In the bleaching of tallow we see activated and non activated clays depending on the final destination of the oil. In Europe it is safe to say that no tallow will end up in the human food chain and it will be mainly used in Oleo chemical applications or as feed stock for bio -fuel .

This means that bleaching is

not always about color but can be the removal of insoluble's only. In most cases the better acid activated clays are used.

- TONSIL OPTIMUM FF by Sud Chemie (Clariant) where FF = FAST FILTRATION.
- FILTROL 105 SF by Engelhard (BASF) where SF = SPEED FILTRATION
- OIL DRI Select FF = FAST FILTERING.

In non-edible applications we see however also the on activated grades and in some of the oleo chemical applications we see clay as catalyst being used to modify the product.



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Fullers earth , Dixibond , Bentonite and others are seen and some of them require a decent pre-coat and even a body feed might be required.

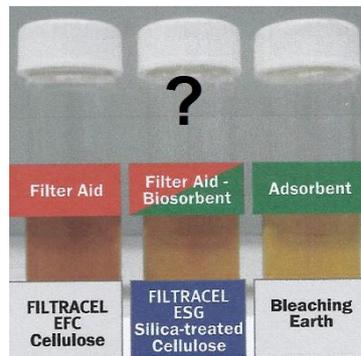
In most tallow applications it is recommended to pre-coat in order to protect the screen from being clogged by jelly , slimy type of insolubles and we can chose of the three most common filter aids as there are;

- A) KIESELGUHR (Diatomaceous earth).
- B) PERLITE= volcanic glass.
- C) CELLULOSE.

In other articles we have explained about the differences in these materials..

Both batch and continuous bleaching is used and the filter selection is very much depending on the type of refining..

The use of silica and carbon is possible and should be treated as in the case of normal bleached vegetable oil filtration,



CAPACITY:

The filter model and size chosen in the result of the final destination of the tallow. After std bleaching practice with max 2% clay used and caustic refined oil we size the filter on filter cycle length or batch size and a max allowable filtration rate of 300 kg/m²/hr. If we have to filter a batch in a given time frame we will allow higher low rate's but in conjunction with thinner cakes.

The normal cake thickness obtained is 18-20 mm which will nicely fit with the 3 inch or 75 mm leaf pitch. In batch bleach systems we see in most cases max cake thickness of 15 mm. If the bleached oil filtration run is followed by another filtration to remove the polyethylene from the oil we need to drop the temperature of the bleached tallow to less than 70 degrC , and mix it with some body feed .

To filter the clay first in the bleaching/ pre-treatment step at 95-105 °C followed by cooling the oil to 70 °C and filter again. In this case clay can act as pre-coat layer and also can be used as a body feed . In case of alternative body feed to keep the filtration going and the cake open we should calculate on approx. 0,1-1% body feed based on the incoming PE content. It is also common practise that the clay and the polyethylene are filtered at the same time so the clay can act as a filter aid. At below 70 °C we need to use low flow rate of < 200 kg/m²/hr. The residual PE content after filtration should be < 20 ppm. In the cases where PE filtration takes place as a separate step it will be necessary to pre-coat the filter first .

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For this pre coat we use approx 1 kg / m² filter aid and we have seen that Hyflo super cel or Celite 512 and 545 are used (Celite corp). or equivalent by Dicalite and JRS (Filtracel EFC) . The body feed given to keep the cake open during filtration and to prevent plugging depends greatly on the incoming turbidity and the tallow quality.

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The filter aid suppliers mention that the filter aid consumption is anywhere between 0,1-1 % by weight depending on the incoming tallow quality. This pre coated filter with flexible body feed at 70 degrC should be sized on 250 kg/sqm/hr flow rate .

MATERIAL CHOICE:

In the caustic refining process there is less acid degumming used but the correct material choice remains essential. It is for this reason that our filter elements ,for any bleaching filter, are always made in material AISI 316L(1.4404) but with the actual filter screen can be either std 316L/1.4404 or a special alloy NSCD or 316S which is a 904L alloy(1.4539) with high Cr,Ni,Mo and some copper. This material has proven to be resistant against all acid influenced process conditions where 316L is questionable.

The vessel is in most cases carbon steel but options like stainless steel AISI 304 cover disc are available.

CAKE DRYING:

The cake blowing is std done with steam since this will give you the lowest residual oil contend. The steam consumption is approx 0,5 kg steam at 2-3 barG pressure (140 °C) per kg of dry clay cake based on max 15-20 minutes drying time. The residual oil contend in the spend clay will be approx 22-25%.

When air/N₂ is used the consumption is 0,12-0,15 nm³ /m²/min at 2-3 bar pressure and the residual oil content in the cake is not less than 30-35 %.

All these figures are based on the use of first class clays and possible use of filter aid or pre-coat material.

The processing of edible oils and fats is currently very much discussed. The use of different process , adsorbents, less adsorbents, re-use of clay's and more optimal use of clays plus process developments in other parts of the process are all being practiced within modern refinery organizations.

Like everything in life these new products , processing methods, additives and claims needs to be verified before we can safely assume that they function and the claim is true.

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At all times it should be avoided that the use of a specific clay, adsorbent or filter aid results in a dedicated design that makes the use of other products not possible.

More and special Info about bleached oil filtration is available in our **RECENT DEVELOPMENTS IN BLEACHED OIL FILTRATION**

With special attention to which filter is used for which application in the vegetable /animal oil & fat , bio-diesel and oleo-chemical industry we are able to provide you with actual up to date write up 's on the following applications;

- Crude oil filtration after expeller presses in both cold & warm or pre-press and full-press applications.
- Miscella filtration (lecithin)
- Bleached oil filtration (BE) and Detoxificated oil filtration (AC).
- Pre-treatment of oil following (BE or Silica) degumming and prior to trans esterification in bio-diesel process
- Hydrogenated oil filtration.
- Post bleached oil filtration.
- Sterol/Glucosides Filtration in bio-diesel process
- Winterised oil filtration.(both full conventional winterising and polish winterising after centrifugal dewaxing)
- Fractionation.
- all polishing filtration.

Other area's of expertise are ;

- Sugar and sweeteners (Cane sugar carbonitiation and sulfitation, corn fructose ,ect.)
- Cocoa, Gelatine, pectine, and oleo chemicals.
- Oil & Gas incl GTL and CTL
- Chemical applications
- Mineral processing (leaching process mixed sulphides) Nickel , Zinc., Gold (Merril Crow process), Copper polish sulphides , Uranium (yellow cake), molten sulphur, etc .

We hope that this will help in the quest for improvement and in case of any questions please call one of our service and support centres

VT Wong at PMI Sdn,Bhd. Mail (vtwong@pmi-group.com.)

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