

FILTERING THROUGH THE NEWS No. 24

Date : 17-10-2015-rev 1

Attn :

To whom it may concern;



DETOX & ACTIVATED CARBON FILTRATION

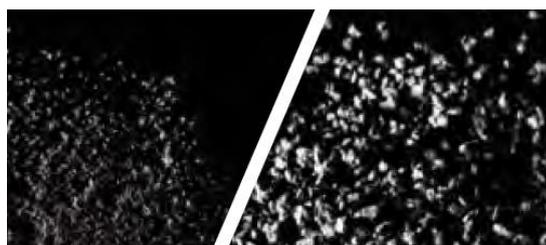


With reference to previous papers on this subject we like to present a small article on the use of activated carbon in detoxification applications . With the filters at some of our clients running for several years now and experience gathered at our reference installations we feel safe to say that the application can well be covered by the conventional leaf filters as well as in the more recent RPP PULSE type filters . For the various oils (Sun, Rape, Fish , etc) different carbon concentrations are used ranging from 0,01-0,1 for PAH (and dioxin, pesticide and PCB) from rape and sunflower seed oils to 0,1-0,5 % for some fish and coconut oils. With 0,5% dosing rate almost complete dioxin removal from fish oil and with only 0,1 % dosing rate >80% dioxin removal. Removal of dioxin like PCB's limited to 80% removal at 0,5% dosing rate.



The most important challenge during fish oil refining is to remove these contaminants without altering the levels of nutritionally valuable components and the oxidative status and stability of the oil. Treatment with a polar adsorbent e.g., activated carbon (AC) seems to be the most efficient process today. It is most important to remove the dioxins and PCB without losing the valuable minor components and without altering the oxidative status and stability of the oil. A choice needs to be made between high temperature deodorisation or adsorption on polar adsorbents such as AC. The later technique is preferred because of the mild processing conditions applied during the process. AC has been shown to be very effective in removing dioxins and other PCB or PAH like contaminants.

This paper focusses on the use of AC powders to remove these contaminants for the oil. In



the last years it became clear that the contamination of fish oils , coconut oils and some soft seed oils (sun ,rape, etc) with PAH , Dioxin , PCB and other components, required a different way to handle removal of the adsorbent (clay or carbon) after the bleaching process.

By removing the toxic matter from the oil the spend filter cake has become toxic waste and most refiners wanted to separately filter the AC to ensure a non contaminated cake stream. We have been involved at several tests on customer locations and it was found that the best way to handle the problem was a second filtration step after the main bleaching filters and before the deodorisation or polishing filtration.

The first and main bleaching will ensure that the oil is clean and non of the know contaminants are left . No soap ,phosphatide oxidation material will be present.

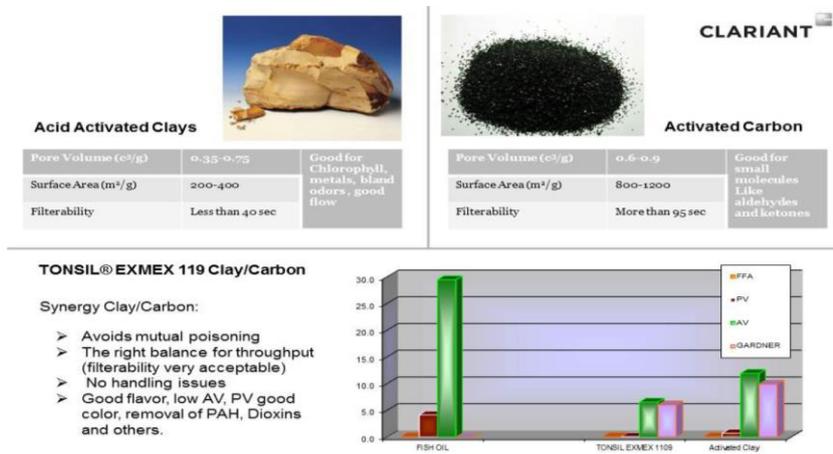
The selective use of small amounts special activated carbon in a separated “bleaching” vessel(Norit developed a special grade SA 4 PAH-HF with emphasis on filterability for this duty) and direct filtration on a Leaf filter or on the newly developed RPP pulse filter where cloth covered filter tubes showed excellent results in both final product specification as well as oil clarity.(new SA5 PAH-HF for cost efficiency).

It was initially only mend to be used in coconut oil known for it’s smoky way of copra handling where the open fire caused to oil to be contaminated with PAH.

The fact that this also was seen at Sunflower seed oil mainly form Ukraine and Russia was a new phenomena. The way the seed was dried had everything to do with this high PAH level but don’t forget the criminal acts seen in the palm oil industry where the oil was mixed with mineral oils (deliberately or by accident ??)

RPP pulse DCD type filters are now operating on this duty at locations in the Netherlands, Iceland , Spain, Poland, Russia, etc.

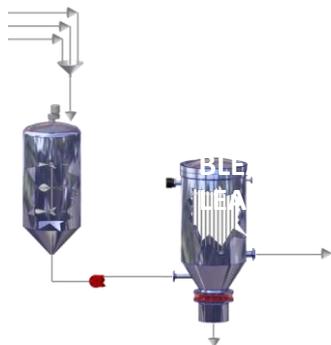
We have also a great number of clients that still work the “old” way i.e. they use a clay carbon mix either made by the plant based on the feed stock they have to treat or supplied by the clay manufacturer and already mixed AC with Bleaching Clay. **(Clariant Tonsil Exmex 119 clay / carbon.)**



HOW TO PREPARE THE OIL

The amount of AC added to the clay or even used in a separate AC beaching and filtration step was based or the requirements laid out in the EU regulated limits on PCB ‘s , Dioxins and PAH’s (Poly aromatic hydrocarbons).

In most case AC dosage of 0,01 –0,05 % is aimed for and in exceptional cases 0,1 to even 0,5 % is possible but will reduce the filtration cycle time considerable.



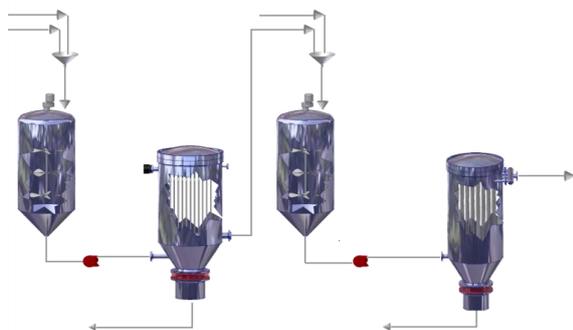
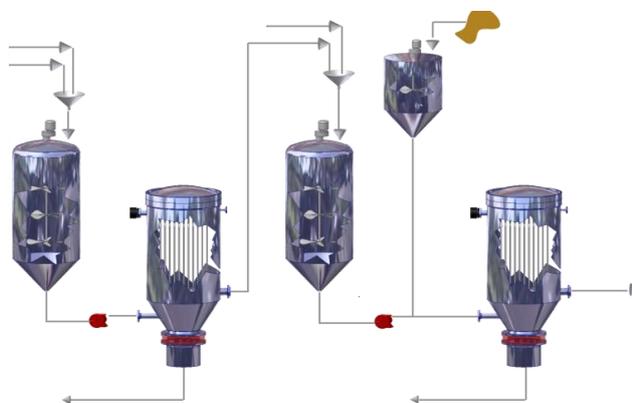
When mixed with conventional clay the mixture can be handled by the same filters as used in the filtration of bleaching clay. To ensure a proper filter cycle we would aim at minimal 4 hr cycle for continuously refined and bleached oil. The filter screen we would recommend is the PZ80S panzer weave with 80 micron retention.

This first and mainly used system will hold max 10 kg dry filter cake per sqm per cycle.

A second option is to filter the clay first but then install a second leaf filter of same size and configuration after the

bleaching filters. This will however require that this filter is pre-coated first before it is set on line. This pre-coat can be the already used bleaching clay (BE) or a separately chosen filter aid Perlite, DE /Kiesleguhr or Cellulose . Select a good grade that will stop all AC from slipping through the filter . We would recommend FW 60 , Standard filter cell or EFC 950 but speak to your local filter aid supplier.

Since the carbon is much finer than the conventional clay we will see reduced cake thickness on both a leaf or a tube filter when used to filter the carbon separately . In the leaf filter with pre-coat we need a firm cake in order to be able the drop the cake by means of vibration . The filters should be designed for a max 25 mm cake per cycle before cleaning.



The RPP pulse type filter can handle much thinner cakes and still discharges efficiently and good. For the sake of this paper we have assumed the use of NORIT AC products and for different brands we should run a test first. On the RPP filter the design is based on a max 10 mm cake thickness or could even be less if delta pressure over the filter elements indicates that cleaning becomes necessary.

Depending on the activated carbon

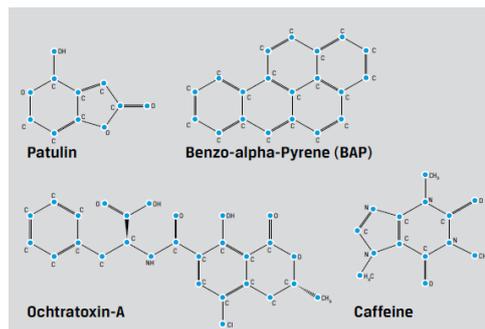
dosage(0,01 – 0,5 %) we expect that the filters will be on stream for periods varying from 8 – 60 hr. The cake load is assumed to be max 4 kg dry carbon per m² filter area and a maximum cake thickness of not more than 10 mm is most likely.

Cake is blown as dry as possible with N₂/air at 2-3 bar pressure and 0,1 Nm³/m²/minute for a period of 10-15 minutes. Steam drying optional but this will result in alternative cloth selection and shorter cloth life. Note ; some clients use air to dry.

Contamination contents:

1) PAH.

The old VEDIOL norm where the total PAH in ppb was limited to 25 ppb (heavy PAH below 5 ppb). Presently the EU regulations have been adopted and they say: BaP max. 2 ppb..



2) DIOXINE (EC Regulation 1881/2006)

The total sum of Dioxines in the industry this is seen as;

- In crude fish oil the max acceptable level is 6,00 pg/g TEQ
- In refined fish oil the max acceptable level is 2,00 pg/g TEQ
- In Vegetable oil the max acceptable level is 0,75 pg/g TEQ

With the correct AC type Dioxines can be adsorbed well.

- > 95 % can be removed.
- Based on PAC treatment of fish oil

3) PCB (EC Regulation 1881/2006)

The total sum of Dioxine like PCB's;

- Max 1,5 pg/g TEQ for vegetable oils.
- Max 10 pg/g TEQ for marine oils intended for human consumption.

Dioxin like PCB's are partly removed by AC

- Based on extensive research on fish oil
- Coplanar PCB's adsorb relatively good
- Mono-ortho PCB's adsorb weakly
- Total adsorbtion dioxin like PCB's 60-80%

The filtration of AC = Activated carbon is a well known and often practised step in the process of bleaching edible . vegetable / fish oil and will not require a change in process.

Relative simple filters can do the job and with the choice of a RPP pulse filter long filter cycles can be expected and a 100 % guaranteed separate removal f the BE (can be use in cattle feed and AC (=toxic and has to be dumped as land fill or better incinerated).

In other food related applications like sugar or sweetener industry the filtration of AC in their process is a standard step and we have over 100 filters installed the filtration of AC .



PMI-Technology
Sdn Bhd (568062-K)

For specific details on the Norit activated carbon contact Mr Marcel Scholten at scholten.marcel.nl@norit.com

Detailed information and filter specific write up's on all filtration steps in Oil processing, maintenance & trouble shooting , Cocoa, Gelatine, Oleo-chemicals and many more are available on request.

We hope that this will assist in the much wanted and required overall improvement and in case of any questions please call our service and support centre

VT Wong at PMI Sdn,Bhd. Malaysia (vtwong@pmi-group.com.)
Lochem , FGV rev 2 / 22-10-2015