

RAFF/BM/vdg

DE SMET

CONTINUOUS BLEACHING PLANT

600

OPERATORS MANUAL

Contents

	pages
1. BLEACHING PLANT	3
1.1 Generalities	3
1.2 Operating principle	5
1.2.1 Oil earth mixture	5
1.2.2 Oil heating	6
1.2.3 Bleaching	6
1.2.4 Filtration	7
1.2.5 Recovery of oil from bleaching earth	7
1.3 Start-up of the plant	7
1.3.1 Generalities	7
1.3.2 Bleaching	8
1.4 Filtration	9
1.5 Steam blowing of filters	10
1.5.1 Draining off the dead volume	10
1.5.2 Steam blowing	10
1.5.3 Vibration and elimination of used bleaching earth filter cake	11
1.5.4 Total draining of the plant	11
1.6 Filtration and steam blowing cycle	11
1.6.1 Filling	11
1.6.2 Recirculation	11
1.6.3 Draining of idle volume and change-over of filters	12
1.6.4 Steamblowing	12
1.6.5 Cleaning of the filter	13
1.7 Stopping of the plant	14
1.8 Checking the correct plant operation	15
1.9 Specific processing conditions and checking of the equipment	16

1. BLEACHING PLANT

1.1 Generalities

Generally, the bleaching process essentially consists in eliminating most of the pigments contained in the oil, by absorption with an adequate bleaching earth.

During the bleaching process, other products such as traces of soap, gums, etc.. are removed. It is most important that these products are removed to obtain a stable final product.

In general, natural pigments are easy to remove. However, some colours may have developed in the crude oil, elimination of which is difficult and requires a substantial increase of bleaching earth.

The prolonged storage or the excessive heating of the oilseeds during extraction of crude oil by expelling, or the prolonged storage of crude oil at high temperature, can increase the colour of the oil.

It is recommended to take the necessary precautions in order to avoid any increase of colour in the oil during the seed storage and processing so as to facilitate the bleaching process and reduce the consumption of bleaching earth.

As indicated earlier, the bleaching process consists in removing most of the colouring matter, as well as traces of gums, soap, and other products remaining in the oil.

These products are removed by mixing the degummed or the caustic soda refined oil with an adequate bleaching earth, under a vacuum of 50 Torr and at a temperature of approximately 95°C. Citric acid can be added to the oil-earth slurry to improve the purifying action.

The earth is removed by filtration in a hermetic leaf filter.

The oil then is filtered again in a safety filter to remove any traces of earth that accidentally might have passed through the main filter.

The bleaching process also comprises a bleaching earth extraction section so as to recover the major part of the oil remaining in the filter cake. This operation is realised by blowing live steam through the filter cake.

The recuperated oil and condensed water are collected in a tank from where after decanting the oil is pumped either to the crude oil tank or to the bleaching reactor 622.

The quality of the bleaching earth is of the utmost importance. If the granulometry of the earth is too fine, the precoating of the filter will be difficult and after precoating the filter might clog up very quickly. To avoid this inconvenience an adequate filter aid can be mixed with the bleaching earth.

Another important factor is the bleaching capacity of the earth and this factor will determine the amount of bleaching earth that has to be used to obtain the required result.

Most bleaching earths have been activated through an acid treatment. It is important that such earths react neutral otherwise heavy corrosion could occur in the plant.

As mentioned earlier, the bleaching process consists on removing not only colouring matter but also other products such as gums, soaps, etc.. It is therefore important that the oil be placed in contact with a sufficient amount of earth even though the colour of the oil before bleaching might be considered as satisfying and that little or no bleaching earth would be needed.

1.2 Operating principle drawing 144.544

The bleaching plant proper is operating continuously, whereas filtration and recovery of residual oil are batch operations.

The user should ensure continuous feed of :

- oil
- saturated steam
- cooling water
- compressed air

Bleaching earth and if necessary active carbon should be available to be fed to hoppers 603A/B with a pneumatic conveyor 609A.

1.2.1 Oil earth mixture

A part of the dried oil coming from dryer 1115 and buffer tank 601 and entering the bleaching plant is fed to the mixer 635 where bleaching earth is constantly fed. The level in the mixer is kept constant with a level controlled valve situated in the line between item 635 and the bleacher item 622.

The slurry from the mixer 635 is transferred to the bleacher 622 by the vacuum suction.

The bleaching earth is introduced into the mixer 635 with a metering screw 606, driven by a variable speed gear motor.

The flowrate of bleaching earth is regulated by adjusting the metering screwspeed with the variable speed drive.

The flowmeter feeding oil through the mixer 635 has to be set so as to obtain a slurry of 10 to 20% solid matter in the oil.

Citric acid in a 20% solution can be added with metering pump P634.

1.2.2 Oil heating

The oil that is not sent to the mixer 635 is heated with steam in the upper part of the bleacher 622 before entering by gravity the bleacher reactor. The required temperature ($\pm 90^{\circ}\text{C}$) is obtained by adjusting the steampressure with the control valve VR621.

1.2.3 Bleaching

The bleacher item 622 operates under an absolute pressure of about 50 Torr or 65 mbar and continuously receives both the oil and homogenized oil-earth slurry from mixer 635 in the upper part.

Both the oil and the oil-earth slurry are mixed by means of live steam injection. The agitation under vacuum ensures the deaeration and the perfect dispersion of earth in the oil. The perfectly homogenized mixture of oil and earth finally flows down to the holding section of the vessel where a uniform retention time is ensured with a vertical baffle system.

The oil-earth mixture reaches the normal level in the central chimney of the bleacher where the level is maintained constant by the return of filtered oil through the level controlled valve in the constant level tank 637/22.

1.2.4 Filtration

Filtration is effected in hermetic leaf filters with stainless steel filter elements.

Filtration pressure, filtering surface and bleaching earth capacity of the filters, as well as the filtration program are given further in the manual.

1.2.5 Recovery of oil from bleaching earth

When the filtration is finished and the oil drained from the filter, the filtercake of spent bleaching earth contains about 50% of oil. This oil can be partly recovered by blowing the cake with steam.

After blowing with steam for about 30 minutes, the cake is removed through the bottom of the filter by vibration.

1.3 Start-up of the plant

1.3.1 Generalities

A test with water of all the vessels and pipes has to be done before starting-up.

After testing drain all the water. A vacuum test has also to be done afterwards. The following parts have to be checked.

- drive mechanism of items 609A, 603, 606, and 635;
- correct operation of level controlled valves VR635/VR622/VR682B/VR601.
- Shut all the valves of the filter and all by-pass valves.

- Check the delivery of the earthmetering screw 606 by weighing the amount of earth fed into the 603 during a set period of time and at different speeds. This can easily be done by opening the special gate provided for this purpose on the metering screw 606.

1.3.2 Bleaching

Start the vacuum group 641A by opening the watervalves to the barometric condensers and the steam valves to the ejectors. When the vacuum in the bleacher 622 reaches about 50 Torr or 65 mbar, start pump P601 and open the flowmeter by-pass valve to the mixer 635 until the air in the lines has been eliminated. Slowly open the valves before and after the flowmeter and close the by-pass valve.

Start the bleaching earth agitator 603, earthmetering screw 606, and the agitator of the mixer 635. If required start the metering pump P634 to feed citric acid to the mixer 635.

When the oil reaches the operating level in the mixer 635 and in the level control tank 637/35, open valve to the bleacher 622. At the same time, open the steam valve to the upper part of the bleacher 622 and the flowmeter valves to the bleacher. Open the steam-injection to the bleacher 622.

Set the flowmeter to the mixer 635 at a rate so as to obtain a slurry with 10 to 20% solid concentration. The oil and oilslurry are mixed in the bleacher 622.

As soon as filtered oil is obtained open valve to return filtered oil to the constant level tank 637/22 so as to maintain a constant level in the bleacher 622.

1.5 Steam blowing of filters

After a certain time and depending on the percentage of earth used, the filter in operation will contain + 350 kg bleaching earth.

It is then necessary to switch over to the second filter. In the meantime, steam blowing and cleaning of the first filter can be carried out as follows :

1.5.1 Draining off the dead volume

The oil-earth mixture still contained in the filter is transferred directly to the other filter as described further.

1.5.2 Steam blowing

The oil contained in the cake is recovered by blowing it with steam at 3 kg/cm² during about 30 minutes. The oil flows off through the filtrate manifold to tank 682A, where the condensed water will be decanted and drained.

From this tank, the recovered oil is transferred to the bleacher 622 or safety filter 616B by means of pump P682A.

1.5.3 Vibration and elimination of used bleaching earth filter cake

The filter bottom valve is opened after steam-drying the cake and the vibrator is then intermittently operated manually at a rate of 10 times 20 seconds during 5 minutes.

The partly de-oiled filter cake is then removed by a chute or conveyor.

1.5.4 Total draining of the plant

The dead volume of a filter can be filtered through the safety filter 616B, with pump P682A when draining the plant.

1.6 Filtration and steam blowing cycle

1.6.1 Filling

We suppose starting up with filter "616A1" and pump P622 working.

- Open valves "IA1" and IIA1". When oil flows out of sightglass "R1", close valve "IIA1".

1.6.2 Recirculation

Open valve "IIIA1" to recycle the oil and thus form the filter precoat. When the oil in the sightglass "R2" is clear, slowly close the valve "IIIA1" and at the same time slowly open the valve "IVA1". The filter is now in operation.

1.6.3 Draining of idle volume and change-over of filters (616A1 to 616A2)

The filter in operation has to be stopped and the dead volume of oil transferred from one filter to the other, as soon as the maximum allowed pressure has been reached, or that the maximum amount of earth has been put into the filter, (10kg of earth per m² of filtration surface), whichever comes first.

Close valves "IA1" and IVA1" and open valve "XIA1". Open the steamvalve VIIIA1" and immediately after, open valves "VIA1", "VIA2" and "IIA2". The dead volume of oil from filter "616A1" will be transferred to filter "616A2". When the filter "616A1" is empty, close valves "VIA1", "VIA2"; open valve "IA2" until the filter 616A2 is full, then proceed as indicated earlier in 1.6.1-Filling.

1.6.4 Steamblowing

Check at the sightglass "R2" of filter "616A1" if oil is still flowing from the filtrate manifold to the bleacher 622 through valve "XIA1". As soon as steam starts passing through the sightglass, close valve "XIA1", open valve "VIIA1" and blow for about 30 minutes so as to recover a maximum of the oil contained in the filtercake.

The oil and condensed water flow to the tank 682A. The water decants and has to be drained, whereas the oil is transferred with pump P682A to the bleacher 622.

- Stop pump P601.
- Open the drain valve of upper part of 622.
- Shut the filtrate valves "IVA" (1 or 2) from the filter 616A in operation to the constant level tank 682B and open the filtrate valve "IIIA1" to the bleacher.
- Open the drainvalve of the bleacher 622. Recirculate in this way until the oil from pump P622 is practically clear.
- Shut valve "IIIA" and open "IVA". Shut the filtered oil valve before VR622LC to the constant level tank 637/22 so that no oil returns to the bleacher 622.
- When the bleacher is empty stop pump P622 and shut the valves "IVA" and IA". Close the live steam injection in the bleacher.
- Open the by-pass valve of the constant level tank 682B and when it is empty stop pump P682B and shut the valves.
- Open valves "VIA", "V", and "VIIA" and steam valve "VIII A" to drain the dead volume of oil to the tank 682A. Feeding water valve on 630 has to be opened.
- When the filter is empty blow the filter as indicated earlier.
- After decanting and draining the water in tank 682A transfer the oil to the bleacher by vacuum suction to eliminate all traces of water in the oil. When 682A is empty, start P622 and transfer the oil through the safety filter 616B by opening valve "XV".

- Note that if necessary idle volume from 682A could be transferred through 616B by means of P682A.
- Stop the vacuum system 641A by shutting the steam and water valves.

If the plant has to be stopped for less than 4 hours, it is not necessary to empty the equipment, just keep the agitator 635 running. Shut the flowmeters valves to 622 and 635, stop pump P601, stop agitator 603A/B and metering screw 606, and shut the valve between 635 and 622. Shut the steam valve to the 622. Open valve "IIIA" and shut valve "IVA" to recirculate the oil in the following manner : 622 to P622 to 616A to 622.

1.8 Checking the correct plant operation

The main point of the bleaching plant is removal of pigments, gums, soap etc. This can be realised by the sufficient addition of bleaching earth at the correct temperature and vacuum. It is important that the earth be well mixed with the oil.

The main points to follow in the plant are :

- Flow of oil to the oilmixer 635 : a slurry of 15-20% of earth-oil is to be obtained.
- Flow of oil to the bleacher 622.
- Temperature of the oil-earth mixture in the bleacher 622 : approximately 90°C.
- Quantity of earth : check that the metering screw is turning at the right speed.
- Check the clarity and colour of the filtered oil after the filters 616A1 or A2, 616B.
- Check that the vacuum is approximately 50 Torr or 66 mbar.

1.9 Specific processing conditions and checking of the equipment

1. Total capacity : 150 T/day.

2. Total oil flow to adjust at the two flowmeters feeding the bleaching section : 7000 liter/hour
The flowmeter to mixing tank 635 to be adjusted so as to obtain an oil-earth slurry of approximately 15-20%.

3. The amount of bleaching earth depends on the colour of the crude oil but should be at least 1% which corresponds to about 62 kg/h.
The amount of active carbon should be more or less 0,15% which corresponds to about 10 kg/h.
This is an approximate figure and can be adapted according to the conditions.

4. Vacuum : approximately : 50 Torr
steam pressure : 9 kg/cm²
inlet water temperature : 34°C

5. Oil temperature : after 622 : \pm 90°C

6. Filters 616A1 and 616A2
Surface of each filter : 38 m²
Maximum amount of earth per filter : \pm 350 kg
Air pressure for vibrator : 6 kg/cm²

7. Citric acid : 1 per 10.000 in a solution of 20% or 0,8 liters per hour.