

# The Dry Refining Process

## Hyam Myers Consulting Pty Ltd

### **Introduction**

The traditional caustic refining process has been known and used for over a century. It has proved to be both effective and reliable, but has relatively high refining losses and produces large quantities of effluent.

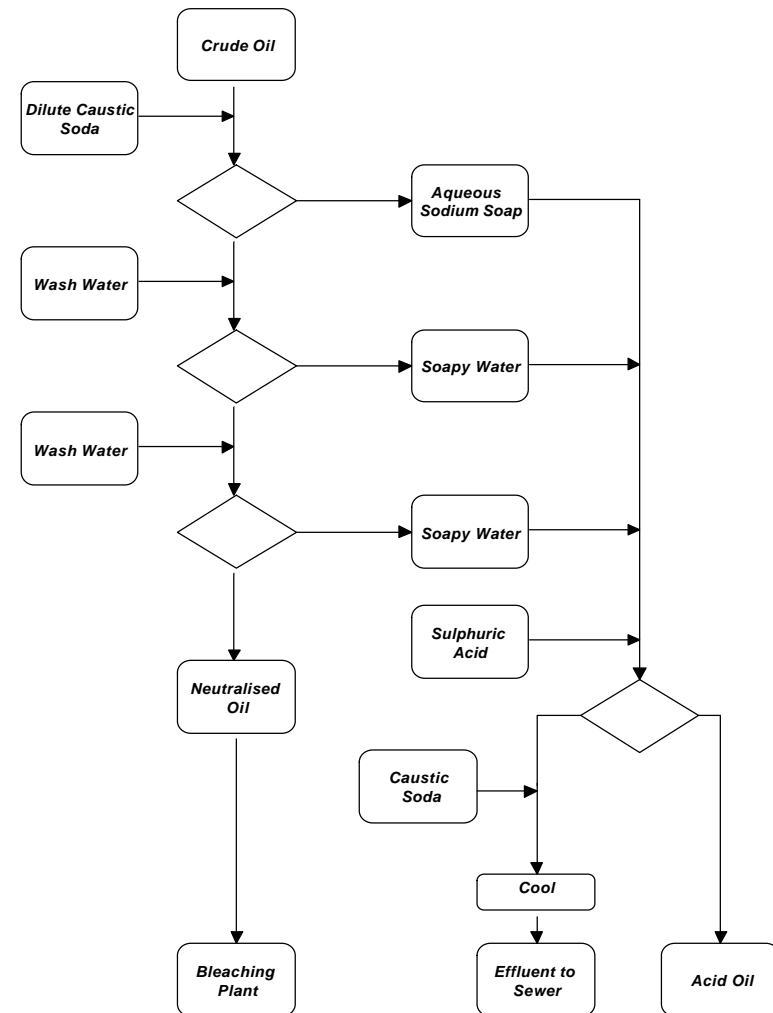
In more recent times physical refining has become favoured because of its lower running costs and low effluent generation. However, there is increasing concern with the high processing temperatures and the loss of natural micro nutrients.

Hyam Myers Consulting has been working on a novel new process known as the “dry refining process” (DRP) that, potentially, can deliver low cost refined oil without the disadvantages of existing processes.

### **Conventional Alkali Refining**

First consider the conventional alkali refining process. The diagram opposite depicts a typical caustic refining line.

This process removes the majority of the free fatty acids as well as phospholipids contained in the oil, but in doing so, generates considerable quantities of aqueous soap. This soap is either converted to free fatty acids in a soap splitting plant and sold as a by-product, or mixed with meal. The considerable quantity of acid water that is produced in the soap splitting plant must be further treated before discharge to sewer.

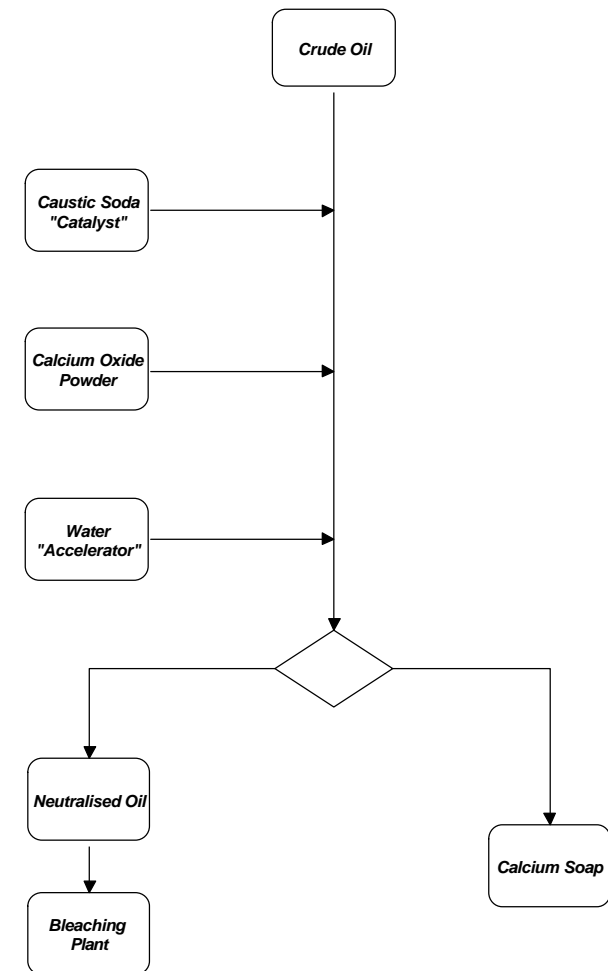


## The DRP Process

The DRP reduces free fatty acids using an alkali metal earth oxide and a “catalyst”. Very low concentrations of water may be used to speed up the reaction but does not result in any liquid effluent.

DRP is a much simpler arrangement as shown in the flow chart opposite. A small quantity of aqueous sodium hydroxide (“catalyst”) is mixed with the oil, followed by the calculated quantity of calcium oxide, and finally a small quantity of water (“accelerant”).

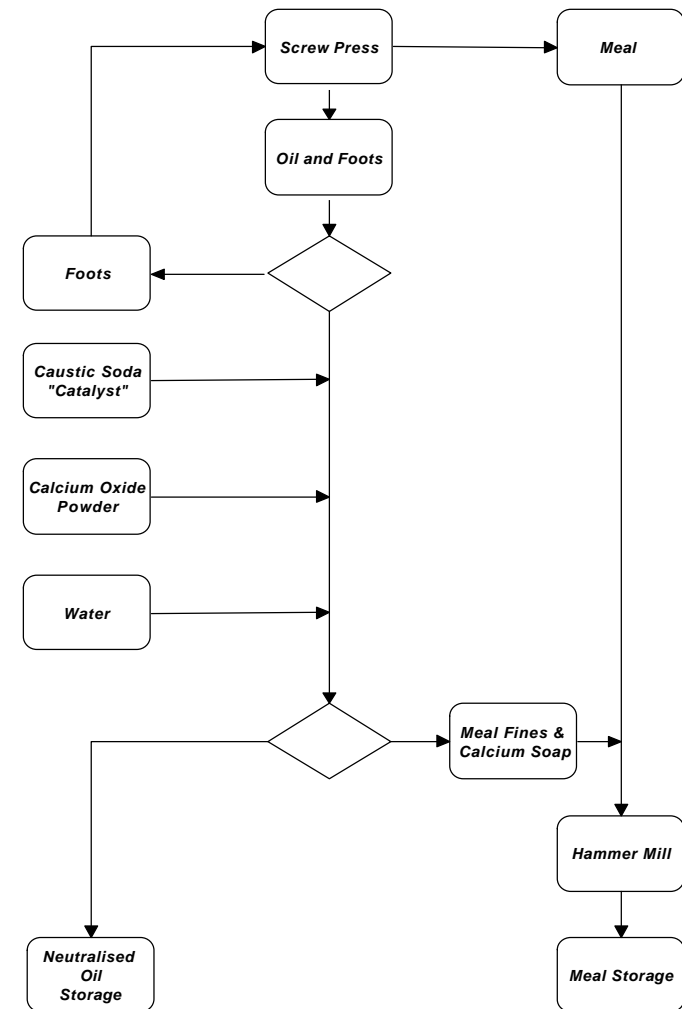
Alternative “catalysts” (to caustic soda), such as ammonium sulphate, may be substituted for the caustic soda if cost and safety factors dictate. The calcium oxide in micelles created by the reaction of caustic soda and fatty acids reacts with the free fatty acids (FFA) to produce insoluble calcium soap. The calcium soap is removed as a solid in the separator and can potentially be sold as a valuable by-product, or added to animal feeds to produce a nutritionally enhanced product. The oil continues on to bleaching or further processing as necessary.



## Mill Configuration

An alternate configuration, shown opposite, is to incorporate the DRP into an oil seed extraction mill. This is particularly attractive, since it provides an extremely effective way of handling the by-product.

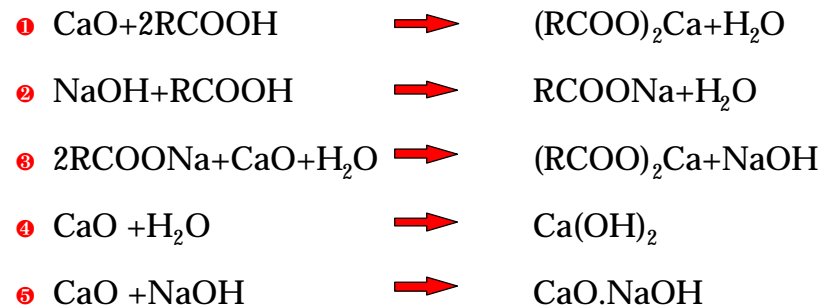
A perceived possible disadvantage of the DRP is that the removal of phospholipids is negligible. Also, residual calcium soap, at about 50 ppm, is not easily removed by bleaching. However, both are very easily removed by an acid based super degumming treatment after the calcium oxide neutralisation. This is contrary to conventional processes where super degumming usually precedes neutralising.



## DRP Chemistry

The chemistry of the DRP is very simple, but elegant. In the early 1930's calcium hydroxide was used to neutralise free fatty acids, but the process lost favour when it could not achieve FFA levels below about 0.2%. It was also extremely slow and expensive.

The DRP produces free fatty acids of 0.05% or lower, is fast and proceeds at low temperatures  $\sim 30^{\circ}\text{C}$  or less. The various reactions believed to take place are shown below.



The essential feature of the process is the production of micelles within which the further reaction with calcium oxide occurs. By this means the number of reaction sites is dramatically increased with a resulting higher reaction rate.

We have found that the reaction proceeds to completion more rapidly if a small amount of water is added. Without the water the reaction seems to terminate above 0.1% free fatty acids. Various theories have been postulated to explain the role of the water. The most plausible is that the micelles require rehydration as the water is taken up by the excess calcium oxide.

## ***DRP Benefits***

The DRP can be carried out in a conventional refinery with little additional capital expenditure. We believe new refineries will, in fact, be of lower capital cost because there is no need for the treatment of the soap by-product. The inclusion of DRP in the oil extraction mill would seem to be the lowest cost option from the point of view of both capital and operating costs.

The DRP is extremely effective at neutralising very high free fatty acid oils. Almost unbelievable results were obtained on trials with tallow with 17% free fatty acid content. There is considerable potential to upgrade very high free fatty acid oils using DRP, especially tallow and palm oil.

We believe, but have not substantiated yet, that the DRP may be useful as a means of retaining valuable micronutrients in the neutralised oil. Alkali earth metal soaps have a very low solubility in either oil or water and are, therefore, unable to act as solutes for removal of these compounds.

We have found that the DRP is not as effective as caustic soda refining at removal of gossypol from freshly extracted cottonseed oil. However, it appears to give better results in the removal of gossypol from “old” cottonseed oil where the gossypol has become “fixed”.

## ***Summary of Benefits***

- Lower chemical cost
- Lower (neutralisation) plant operating costs
- Lower refining losses
- Lower capital for new plants
- No effluent
- Potentially valuable by-products
- Incorporation into mills or refineries
- Preservation of alkali soluble micro nutrients
- Lower deodorisation temperatures
- Increased capacity of physical refining plants

The DRP is protected by a PCT Patent Application Number PCT/AU96/00494 which was filed on August 7, 1996.

## ***Want to Know More?***

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