

# FEATURE ARTICLE

## THE PROCESSING OF SOYA BEANS

### Introduction

In issue No. 37 of "Engineering News" we included an article on the processing of canola seeds and as some interest was shown in this article we will now briefly describe the processing of soya beans (American technology – soyabeans).

### Soya Beans

The bean pods usually contain two or three seeds and these are spherical in shape with a diameter between 6 to 8 mm. The seeds have a bulk density of about 0.77 kg/dm<sup>3</sup> (48 pounds per cubic foot) and their average composition is as follows:

Water	8 – 10%
Fat	17 – 20%
Nitrogen substances (protein)	38 – 40%
Nitrogen-free extractives (carbohydrates)	26 – 29%
Raw fibre	6 – 7%
Ash	5.5%

The seed consists of two main parts – the kernel (88 to 91% on a dry basis) and the hull (8 to 10% on a dry basis).

### Processing

The processing of soya beans produces a degummed oil, raw lecithin and a meal and, depending on the processing route followed, the meal can either be rich or low in protein (*Figure 1*). Cleaning is carried-out to remove any dirt, trash and loose hulls and the beans may be dried or not depending on their moisture content and whether a high or low protein meal is desired. With the production of high protein meal the beans are dried to about ten percent moisture, this ensures proper cracking and dehulling.

After drying the beans are tempered to loosen the hulls which assists in the dehulling stage but if a low protein meal is desired there is no need to temper and the beans go directly to the crackers. In the cracking operation the beans are broken into small pieces and this is usually done with roller mills consisting of two or three pairs of rolls. With the front-end dehulling process the cracked beans are fed to a decorticator where the cracked beans and loose hulls are separated. The removed hulls may be ground in a hammer mill and then toasted (cooking with steam).

The cracked beans are next cooked at 65 – 75°C, for about 20 to 30 minutes, which makes them pliable for flaking. Flaking is carried-out in mills having two smooth rolls running against each other in a horizontal plane. One of the rolls is fixed to the mill housing and the other is movable to allow varying pressures to be applied on the bean particles so as to control the desired thickness of the flakes. The optimum flake thickness is the one that

gives the lowest residual oil content in the flakes leaving the oil extraction plant. Originally the oil was extracted mechanically by pressing but today the majority of the mills are using solvent extraction. The extraction time varies depending on the bean quality but is not less than one hour. The final miscella (oil plus solvent) has a 25% – 30% oil concentration and the meal a maximum of 0.5% oil. The miscella coming from the extraction plant has to be separated to produce a marketable oil and a solvent which can be re-used in the process – this separation is done by evaporation.

The meal itself contains about 35% solvent, by weight, and this solvent is removed by evaporation and returned back to the system. If the meal is to be used for animal feeds it has to undergo another stage (toasting) to deactivate the urease enzyme. The toasting process is usually carried-out in the same machine used for desolventising the meal by the addition of large quantities of sparge steam. The meal is quite rich in protein, 40 to 50%, and is a valuable animal feed ingredient.

The soya bean oil coming from the solvent extraction plant has a lecithin content of about 2.5 to 3.5% and lecithin, which is a blend of phospholipids, is a valuable food additive. The removal of the lecithin involves heating the oil to about 60°C – 70°C, then a metered quantity of water is added and the resulting mixture is vigorously agitated after which the mixture is fed to a centrifuge to recover the oil. The secondary discharge from the centrifuge, which contains the lecithin and water, is then dried to recover the lecithin.

Soya bean oil is used extensively for margarines and shortenings and, of course, is a competitor of palm oil products.

### Main Characteristics of Soya Bean Oil Fatty Acids

Lauric	0.1%
Myristic	0.2%
Palmitic	10.5%
Stearic	3.9%
Palmitoleic	0.2%
Oleic	22.8%
Arachidic	0.2%
Linoleic	50.8%
Linolenic	6.8%

### Physical Properties

Melting point, °C	-8/-18
Iodine value	120 – 141
Saponification value	189 – 195
Unsaponifiable, %	0.2 – 1.6
Titre, °C	20 – 21

(Ir. J.H. Maycock)

Figure 1. Flow chart for the processing routes of soya beans.

