CHAPTER II

RUBBER SEED OIL

Rubber seed oil is obtained from the seed of the tree Hevea brasiliensis of the Euphorbiaccae, nature to Brazil, which is extensively cultivated in many tropical regions, including Borneo, Ceylon, Malaysia, Indonesia, Thailand, etc.

The seed usually weighs from about 2 to 4 grams. The kernel, which amounts to about 55 per cent of the seed, contains from 42 to 50 per cent of oil, an active lypolytic enzyme, and a cyanogenic glucoside [1]. The oil is obtained from the seeds of the cultivated tree either by expression or solvent extraction with petroleum ether. The oil usually has a very dark red color. The cake or extracted meal is used as a fertilizer or feeding stock. The oil is chiefly used in the manufacture of soap, but it can be used as a printing oil, particularly after it is refined. Most, if not all, of the commercial oil is high in free fatty acids, because of the poor keeping qualities of the seed. Usually the quantity of free fatty acids is so large that it is not feasible to refine the oil. The oil is said to be a fairly good drying oil and gives a hard and transparent film [2].

2.1 Composition of Kernel [3]

Rubber seed consists of approximately 45 percent of hard shell and 55 percent of kernel. The kernel contains about 50 per cent of oil. The detailed composition of kernel is as follow [5]:

Moisture	8.5%
Oil	48.5
Crude protein	17.6
Ash	2.4
Carbohydrate	22.9

As rubber seed contains a very high oil content, a large amount of oil can be extracted by a simple mechanical press or expeller without resorting to solvent extraction. It is reported that by two-stage crushing the remaining oil left in the meal is about 5 percent by weight.

2.2 Characteristic of oil [3]

Rubber seed oil derived from good quality seeds is light yellow in color and has an odor somewhat resembling linseed oil. A dark color oil is normally associated with the extraction of deteriorated stored seeds.

Characteristics of rubber seed oils from various countries are uniform and similar as tabulated in Table 2.1.

2.3 Fatty Acids Composition of Rubber Seed Oil

Rubber seed oil is an inedible vegetable oil because of the cyanogenic glucoside and lypolytic enzyme. Cyanogenic glucoside is a glucoside toxin containing a residual of hydrocyanic acid, HCN. Lypolytic enzyme is a catalyst of lypolysis which will hydrolyse lipids into free fatty acids. Then, the acid value of the oil will increase and make a change in the oil property [1].

Table 2.1 Characteristics of various rubber seed oils [3].

	Rubber seed oil			
	Malaysia[1/]	Pakistan[2/]	Philippines[3/]	Thailand[4/]
Specific gravity	0.9163 (30°)	0.9178 (26°)	0.9123 (30.6°)	0.9180 (26°)
Refractive index	1.4690 (30°)	1.4723 (26°)	1.4730 (29.5°)	1.4732 (23.5°)
Saponification value	194.2	209	181.2	191.18
Iodine value	137.1	132.2	133.3	123.19
Acid value	1.5	22.6	5.1	36.12
Unsaponifiable matter,%	1.0	1.3	1.1	1.00
Saturated acid	17.1	-	14.6	-

[1/]Georgi et al. [5] [2/]Aslam and Imam [6] [3/]Tuason and Cruz [7]
[4/]As analysed by Analytical Chemistry Unit CTG,TRI.[3]

Most of the oil is a triglyceride of both saturated and unsaturated fatty acid. The composition is shown in Table 2.2. The structure of the unsaturated acids are shown in Figure 2.1.

2.4 Composition of Defatted meals [3]

The oil free residue is useful animal feed on account of its high protein content.

The results of analysis are shown in Table 2.3.

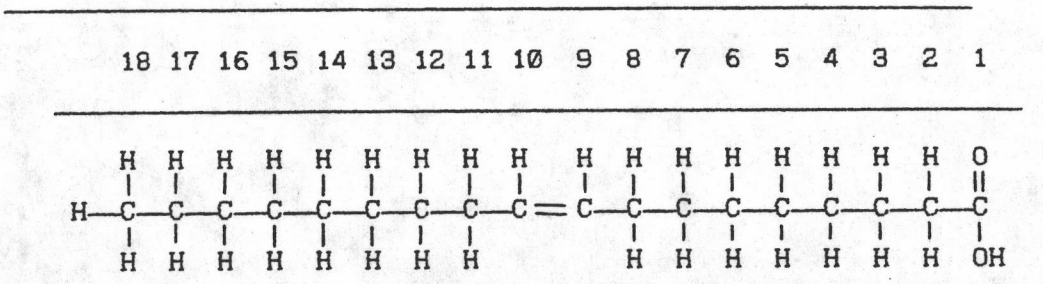
Table 2.2 Chemical compositions of rubber seed oils [3].

	Rubber seed oil			
	Malaysia[1/]	Madras[2/]	Philippines[1/]	Thailand[3/]
Palmitic acid, %	-	-	-	8.7-10.6
Stearic acid, %	-	-	-	10.2-12.3
Arachilic acid, %	-	-	-	1.0-1.3
Oleic acid, %	28.5	17	29.2	17.1-20.2
Linoleic acid, %	32.9	35	40.8	35.5-38.4
Linolenic acid,%	20.5	24	14.3	21.2-23.5

[1/]Tuason and Cruz [7] [2/]Sarma and Balasubrahmanyam [8]
[3/]Ploysuwan [9]

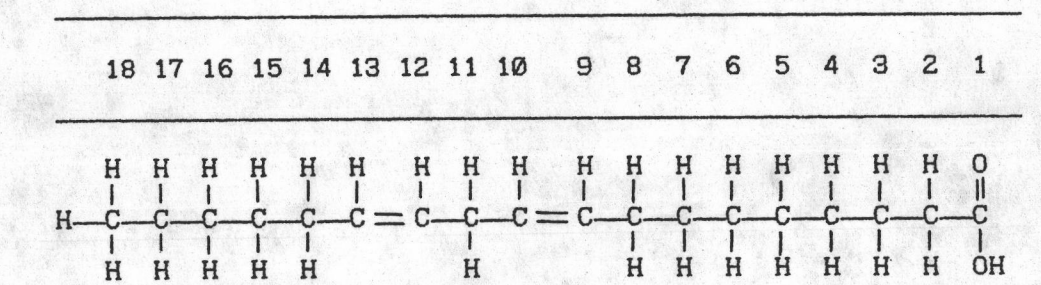
2.5 Potential Uses of Rubber Seed Oil [3]

Rubber seed oil is the most important and valuable component in rubber seed. For this reason there has been much research activity reported by scientists and technologists toward to the development of rubber seed oil products. Details of the physical and chemical properties of the constituents found in rubber seed oil are listed in Table 2.1 and Table 2.2. The oil can be easily obtained from seeds by either expelling or extraction. The yield of oil is somewhat variable, the average yield of over 40 percent of oil from the kernel is achieved. The pale yellow oil is normally extracted from freshly collected seeds, while darker oil results from extraction of deteriorated rubber seeds. Darker oil has a much higher free fatty acid content, and the acidity also continues to develop on storage. Good quality oil always has a chemical composition and physical



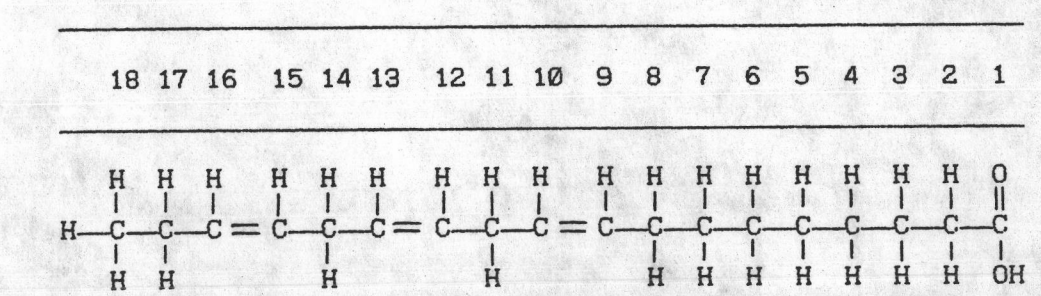
18:1 cis

Oleic acid



18:2 cis

Linoleic acid



18:3 cis

Linolenic acid

Figure 2.1 The structure of the unsaturated acid in the rubber seed oil.

Table 2.3 Composition of defatted meals.

	Extracted meal		
	Malaysia[1/]	Philippines[2/]	Thailand[3/]
Moisture	11.0	7.0	8.75
Ash	4.7	4.9	5.60
Oil	-	8.0 (ether extract)	8.71
Crude protein	33.6	30.5	30.19
Crude fibre	3.4	6.1	5.01
Carbohydrate (by difference)	47.3	43.5	41.74

[1/]Georgi et al. [5] [2/]Tuason and Cruz [7] [3/]Ploysuwan [9]

properties (including odor) close to those of linseed oil and can partly replace linseed oil in many applications. The oil can be neutralized and decolorized by standard practice used in most vegetable oil factories.

Therefore, the earliest research attempt on rubber seed oil utilization was necessarily to the direction of linseed oil substitution, and it is still used this direction for any principle research today. Research activities on oil have been active continuously and up date results can be found. This line of attack is likely to be the most promising and rewarding. It is well known that rubber seed oil in its unmodified form is inferior to linseed oil in drying and film-forming properties. Good oil can be admixed to a certain percentage with linseed oil without affecting the quality. The various published results in upgrading

rubber oil into a drying oil may be grouped methodologically as follows:

1. Partly physical methods i.e.freezing and extraction
2. Chemical methods
3. Miscellaneous methods

Attemps have been made to use rubber seed oil in soap making. On saponification, rubber seed oil yeilds a very good soap of commercial interest. It is known that Lever Brothers in Ceylon has formed a favorable opinion and has recently made a pilot-scale test and a feasibility study on saponification of rubber seed oil. It is true that the value of oil as raw material for soap is much less comparing with either edible oil or drying oil. The fact is that the very weakness of rubber seed oil as an edible and a drying oil are its strength for soap compounding, i.e. it is not subject to the vagaries of alternative demand.

Rubber seed oil is, however, classified in some textbooks as an edible oil. In practice it must be admitted that the inevitable time lapse between collection and oil extraction results in a high acid value, which makes the oil rancid and gives it a varnish-like odor on cooking with consequent objection to its use for edible purposes. It has been proved, nevertheless, that this unattractive odor can be reduced to an acceptable level for domestic consumption by either partial or full hydrogenation of the oil. Very little work is known concerning the hydrogenation of rubber seed oil and its actual application. It is known that in India upto 13 per cent of good rubber seed oil has been added to other edible oils without appreciable effect on the quality of the resultant cooking oil [10].

There are many possible uses for rubber seed oil other than those previously mentioned, such as factice, resin products, linoleum, foundry core binder, plastic compositions, and adhesives.

Therefore an immediate research and development of rubber seed oil is worth serious encouragement and attention. The ultimate success depends on many factors, some of which are mentioned below:

1. In the marketing of rubber seed, the value of defatted meal is an important factor in determining the price of the extracted oil.

2. Method of improving the drying properties of rubber seed oil need to be studied so as to determine the most economical method. Other specific uses for rubber seed oil need to be determined.