COMPOSITION OF PARA RUBBER-SEED OIL.

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The increase in the cultivation of the Para rubber-tree (*Hevea brasiliensis*) during recent years and the consequent production in large quantities of the seed has suggested many inquiries regarding the possibility of utilising the oil contained in the seed. The subject of the industrial application of this by-product has been dealt with in the current issue of the *Bulletin of the Imperial Institute* (1911, **9**, 35), and attention is there drawn to the fact that the seeds yield a liquid drying oil very similar in properties to linseed oil and capable, like the latter, of being used in the manufacture of paints, varnishes, rubber substitutes, oil-cloth, soft soap, etc. The kernels of Para rubber-seed were first examined at the Imperial Institute in 1902, and were found to contain a fixed oil which had marked drying properties (*Bull. Imp. Inst.*, 1903, **1**, 156). Since then various samples of the seed and oil have been received from time to time. In some cases the seeds had been decorticated previous to exportation, and perhaps also crushed, bruised, and otherwise damaged. Such treatment results in the partial hydrolysis of the oil and the production of an abnormal product, the reason being that the seed kernels contain a lipase, which has the property of hydrolysing the oil, and which is liberated when the cells containing it are crushed (Dunstan, *Proc. Chem. Soc.*, 1907, **23**, 168). The oil, of which the composition is here given, was extracted in this country from the kernels of undecorticated seeds. The kernels contained 48·8 per cent. of oil, which was pale yellow in colour, liquid at ordinary temperatures, and dried to a hard varnish in about twelve days on exposure to air.

On examination the oil was found to have the following constants :

Sp. gr. at 15°/15° C.	0·9239
Acid value	29·9
Saponification value	185·6
Iodine value	133·3
Titer test (fatty acids)	33°
Hehner value	96·4
Reichert-Meissl value	0·5

Examination of the Fatty Acids.—The liquid and solid (unsaturated and saturated) acids were separated by the usual method by taking advantage of the different solubilities of their lead salts in ether. The mixed fatty acids consist approximately of (1) unsaturated liquid acids 86·0 per cent., and (2) saturated solid acids 14·0 per cent. The mixed unsaturated acids form a brown oily liquid, having an iodine value = 154·2. The saturated acids were obtained as a hard, white cake, melting-point = 55° C.

Saturated Acids.—The mixed solid acids were fractionally crystallised from alcohol, and, after several crystallisations, were finally separated into two main fractions, both of which were crystalline.

Fraction 1, melting-point 69° C. This acid crystallised in shining plates, and was

apparently pure stearic acid. On analysis 0·1742 grm. gave 0·4682 grm. CO_2, and 0·1995 grm. H_2O.

Whence C = 76·1 per cent. and H = 12·7 per cent.; $C_{18}H_{36}O_2$ (stearic acid) requires C = 76·0 per cent. and H = 12·7 per cent.

Fraction 2, melting-point 56·5° C. This acid or mixture of acids also crystallised in shining plates. On combustion the following results were obtained: 0·1710 grm. gave 0·4720 CO_2, and 0·1915 grm. H_2O.

Whence C = 75·3 per cent. and H = 12·5 per cent.; $C_{17}H_{34}O_2$ requires C = 75·5 per cent, H = 12·6 per cent.; $C_{16}H_{32}O_2$ (palmitic acid) C = 75·0 per cent., H = 12·5 per cent.

It is probable that this fraction is not a pure acid, but consists of a mixture of stearic and palmitic acids, which is extremely difficult to separate.

Unsaturated Acids.—The iodine value of the mixed liquid acids was found to be 154·2. The original oil was examined for the presence of linolenic esters, but on estimation it was found to yield only 6·66 per cent. of solid hexa-bromides, corresponding to not more than 2·5 per cent. of linolenic acid. It therefore seemed probable that the liquid acids consisted mainly of a mixture of oleic and linoleic acids, and confirmation was obtained on examining the products obtained from them on oxidation.

About 6 grms. of the mixture of unsaturated acids were oxidised with alkaline potassium permanganate, and the oxidation products were separated by means of ether. The ethereal solution yielded, on evaporation, dihydroxy stearic acid, which, when recrystallised from alcohol, was obtained in hexagonal plates, melting-point 130° C. The portion insoluble in ether was extracted many times with a large quantity of boiling water, and several lots of crystals were obtained, all melting, however, at 159° to 160° C. This was found to be a tetrahydroxy stearic acid (sativic acid) formed by the oxidation of the linoleic acid. It yielded the following results on analysis: 0·1312 grm. gave 0·2987 grm. CO_2, and 0·1250 grm. H_2O; C = 62·0 per cent., H = 10·5 per cent.; sativic acid ($C_{16}H_{36}O_6$) requires C = 62·1 per cent., H = 10·3 per cent.

The melting-point 159° to 160° C. is lower than that given for sativic acid by Hazura—viz., 173° C., and accordingly oxidations were conducted on pure linoleic acid obtained from Kahlbaum. The sativic acid thus obtained, however, always melted considerably below 170° C.

Summary.

From the results of this examination the composition of the mixed fatty acids from Para rubber-seed oil appears to be as follows:

(*a*) *Saturated* (*solid*) *acids* = 14 per cent., consisting of *stearic acid* (melting-point 69° C.) and an acid or mixture of acids, melting-point 56·5° C.

(*b*) *Unsaturated* (*liquid*) *acids* = 86 per cent., consisting of oleic acid, 32·6 per cent.; linoleic acid, 50·9 per cent.; linolenic acid, 2·5 per cent.

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