

have been shown to consist essentially of glycerides of palmitic, stearic, oleic and linoleic acids.

2. Ergosterol was isolated from the unsaponifiable matter.

MADISON, WISCONSIN

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[CONTRIBUTION FROM THE COCONUT RESEARCH SCHEME, LUNUWILA, CEYLON]

The Seed Oil of *Aegle Marmelos*, Corr.

BY REGINALD CHILD

The fruit of the Bael or Beli fruit tree, *Aegle Marmelos*, Corr., is commonly used in India and Ceylon for the treatment of dysentery. A chemical investigation of the plant was commenced by the late Professor J. P. C. Chandrasena, of the University College, Colombo, at whose request the author examined the seed oil. The analytical constants and approximate composition of this oil have been thought worth recording since few examples of seed oils of the *Rutaceae* are to be found in the literature.

Dikshit and Dutt¹ obtained from the seeds an oil (11.94%) having d^{20}_D 0.914, saponification value 195.2, Hehner value 91.3, and iodine value 126.1. The constants recorded for the present sample differ somewhat from the foregoing.

The fruits resemble oranges in size; they have a hard gray-green pericarp and the seeds (twenty or more in a fruit) are embedded in a thick gummy pulp. The latter are roughly of the shape shown (Fig. 1) and average in dimensions $6.6 \times 5.6 \times 3.6$ mm.



Fig. 1.—($\times 2$).

Two samples were examined, 200 seeds from 9 ripe fruits, and 250 seeds from 11 fruits just short of complete ripeness. The leaves, fruits and roots of the trees from which the samples were taken were kindly identified by Dr. J. C. Haigh, Economic Botanist, Department of Agriculture, Ceylon.

In each case the shells were removed, the kernels ground, dried and extracted with light petroleum, b. p. 40–60°.

	Sample 1	Sample 2
Av. wt. of shell, g.	0.026 (23.5%)	0.023 (25.3%)
Av. wt. of kernel, g.	.084 (76.5%)	.068 (74.7%)
Av. wt. of seed, g.	.11	.091
Moisture of kernels, %	8.35	25.3
Oil of kernels		
{ wet basis, %	45.0	35.1
{ dry basis, %	49.1	44.0
Oil of whole seeds, %	34.4	25.3

The oil was clear and had a faint odor resembling linseed oil; Sample 1 was practically colorless, while Sample 2 had a pale yellow tinge. The usual constants were as follows.

	Sample 1	Sample 2
Density d^{20}_4	0.918
Refractive index n^{40}_D	1.4647	1.4647
Dispersive power ω	0.0202	0.0202
Free fatty acid (oleic %)	.42	1.26
Saponification value	193.6	196.8
Iodine value (Wijs)	108.0	107.1

Sample 1 only was examined further. Unsaponifiable matter was determined by the standard method described in the *Analyst*, **58**, 203 (1933). For the thiocyanogen value, 0.4 g. samples and 50 cc. of reagent were employed as recommended by Wiley and Gill,² titrations being carried out after twenty-four hours. Saturated acids were determined by Twitchell's method, and had a mean molecular weight of approximately 266.

Thiocyanogen value (24 hours)	70.4
Hehner number	93.7
Unsaponifiable matter, %	1.58
Satd. acids, % (corr.)	23.9

Calculation from the iodine value, thiocyanogen value and percentage of saturated acids in the usual way gives approximately the following composition for the oil (Sample 1). It should be emphasized, however, that on account of the limited amount of material available, these figures are not claimed to be more than approximate.

Palmitic acid	15.6	
Stearic acid	8.3	23.9%
Oleic acid	28.7	
Linoleic acid	33.8	
Linolenic acid	7.6	70.1%
Unsaponifiable matter		1.6%
Glyceryl C_3H_5		4.4%
		100.0%

(1) Dikshit and Dutt, *J. Indian Chem. Soc.*, **7**, 759 (1930).

(2) Wiley and Gill, *Ind. Eng. Chem.*, **6**, 298 (1934).

The constants here recorded for the seed oil of *Aegle Marmelos*, Corr., are very similar to those of other *Rutaceae* seed oils, as the following examples³ show.

	% oil	Density	
<i>Calodendron capense</i>	59.2	0.9219 (15°)	
<i>Limonia Warneckii</i>	38.5	
<i>Citrus Limonum</i>	Up to 54	.921-0.9236 (15°)	
<i>Citrus Aurantium</i>	54-57	.921-0.926 (15°)	
	n_D^4	Sap. val.	I val.
<i>Calodendron capense</i>	1.465	192.6	108.7
<i>Limonia Warneckii</i>	1.4578	188.8	75.2
<i>Citrus Limonum</i>	1.4645-1.465	188-198	103-110
<i>Citrus Aurantium</i>	1.4638-1.4649	193-197	97-105

(3) Grün and Halden, "Analyse der Fette und Wachse," Bd. II, 93-95 (1929).

Extracted Kernels.—The extracted kernels were noteworthy in containing a high percentage of nitrogen: Sample 1, 12.52% and Sample 2, 12.14% (Kjeldahl), indicating the presence of over 70% protein, probably a globulin since it is largely soluble in cold molar sodium chloride solution.

It is not proposed to continue work on this material.

Summary

The seed oil of *Aegle Marmelos*, Corr., has been examined and the analytical constants and approximate composition recorded.

LUNUWILA, CEYLON

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[CONTRIBUTION FROM THE ORGANIC CHEMICAL LABORATORIES OF THE UNIVERSITY OF FLORIDA]

Benzenesulfonyl Derivatives of *o*-Aminophenol

BY C. B. POLLARD AND L. H. AMUNDSEN

The preparation of *o*-benzenesulfonylamino-phenol and *o*-benzenesulfonylamino-phenyl benzenesulfonate, m. p. 134°,¹ has been described by Tingle and Williams.² Their paper states that their method did not give consistent results, the same method at times giving the first compound and at other times the second.

In this paper favorable conditions are described for controlling at will the formation of either compound obtained by Williams.

In the course of this work *o*-aminophenylbenzenesulfonate was isolated, the existence and stability of which is of interest since corresponding esters of carboxylic acids are unstable.³ This product showed no change during a period of six months. Proof of structure follows from: (1) its solubility in dilute hydrochloric acid and its insolubility in dilute sodium hydroxide and (2) the formation of *o*-benzoylamino-phenyl benzenesulfonate in its reaction with benzoyl chloride in ether solution.

Experimental

***o*-Benzenesulfonylamino-phenol.**—To 107 g. (nearly 1 mole) of *o*-aminophenol in 350 cc. of dry dioxane or toluene was added 87 g. (0.5 mol.) of benzenesulfonyl chloride and the mixture refluxed for half an hour. The *o*-amino-

phenol hydrochloride was filtered off and washed with hot dioxane. The product was precipitated with 1.5 liters of water. It was purified in a yield of 104 g. (85%) by dissolving in 10% sodium hydroxide and precipitating with dilute hydrochloric acid, followed by crystallization from toluene, m. p. 141°.

***o*-Benzenesulfonylamino-phenyl Benzenesulfonate.**—Twenty grams of *o*-aminophenol was mixed with 400 cc. of a 10% sodium carbonate solution and 65 g. (2 molecular proportions) of benzenesulfonyl chloride. The mixture was put into a 300-cc. suction flask having the side arm closed with a piece of rubber tubing and a screw clamp. The air in the flask was swept out with carbon dioxide to avoid the oxidation of the *o*-aminophenol during the experiment and the flask was stoppered tightly and shaken vigorously for thirty minutes. After filtering, the solid product was washed with dilute hydrochloric acid and then with water. The product was purified by crystallization from alcohol. Since the compound is not very soluble it is best to use nearly 20 cc. for every gram of the substance. This gives a very pure product; yield, 68 g. (about 95%); m. p. 134°.

***o*-Aminophenyl Benzenesulfonate.**—Thirty-six grams of *o*-aminophenol was dissolved in 265 cc. of a 10% solution of sodium hydroxide and 58 g. (about one molecular proportion) of benzenesulfonyl chloride was added. The mixture was shaken for thirty minutes. The flask should be of such size that the liquid nearly fills it and the air swept out with carbon dioxide very quickly. The solid material was washed with dilute sodium hydroxide, dissolved in dilute hydrochloric acid, and precipitated with sodium carbonate. Purification was accomplished by repeated crystallizations from one to one mixture of benzene and commercial hexane. About 10 cc. of the solvent was used per gram. The yield was 66 g. (about 82%);

(1) Incorrectly reported as 81-83° by Georgesco, *Chem. Centr.*, **71**, I, 543 (1900); *Bul. Soc. Scinte.*, **8**, 663 (1899).

(2) Tingle and Williams, *Am. Chem. J.*, **37**, 61 (1907).

(3) Ransom, *ibid.*, **23**, 1 (1900).