

PHYSICOCHEMICAL CHARACTERISTICS OF YELLOW PASSION FRUIT
(PASSIFLORA EDULIS VAR. FLAVICARPA) SEED OIL

by

W. Debideen, Lever Bros. (W.I.) Ltd., Champs Fleurs, Trinidad
G.M. Sammy, Dept. of Chemical Engineering, University of the West Indies, Trinidad

SUMMARY

A programme of work has been carried out on oil extracted from local yellow passion fruit in order to determine its physicochemical characteristics and hence its suitability as a source of edible oil for human consumption. The yield of crude oil from the seeds was found to be 24.8% on a dry weight basis. The oil was about 85% unsaturated, had a yellow colour and a measured linoleic acid content of 69.0%. It was therefore considered to be a highly acceptable oil for human consumption. A comparison with Hawaiian yellow passion fruit seed oil showed some differences in both the unsaturated and saturated fatty acid contents.

1. INTRODUCTION

The exercise described in this paper was part of a composite study into the possible commercial utilization of the total fruit, of the 'yellow passion fruit'. This composite study was divided into three separate sections:

- (i) A study of the pulp¹
- (ii) A study of the rind²
- (iii) A study of the seed oil and meal³

This paper is associated with the third section and deals with the physico-chemical characteristics of the seed oil as a possible source of edible oil for human consumption.

2. PREPARATION OF SEED OIL

The seeds were obtained from fruits bought on the open market, which were cut in half and the seeds, together with the pulp, scooped out by hand. The pulpy seeds were washed several times with water, sun-dried, and rubbed between a rough cloth to remove adhering pulpy matter. The cleaned seeds were further dried in an oven at 80°C for six hours before being then coarse ground in a mill and solvent extracted in a laboratory scale all-glass apparatus, using Analar grade-diethyl ether as the solvent. The yield was 24.8% on a dry weight basis of the seed.

The crude oil was refined by conventional methods for the removal of free fatty acids (3.7%), drying, bleaching and deodorizing. The yield of refined oil was 91.9% of the crude oil.

3. ANALYSIS OF THE REFINED OIL

The chemical and physical analyses of the refined oil were determined by the American Oil Chemists' Society Methods⁴ (AOCS 1946). The results are given in Tables I and IA.

4. FATTY ACID COMPOSITION

The fatty acid composition was determined by G.L.C. after the methods of Metcalfe and Schmitz¹⁰ (1961) and Metcalfe, Schmitz and Pelka¹¹ (1966).

4.1 Equipment and Conditions

The instrument used was a PYE Unicam Series 104 Chromatograph. The detector used was Flame Ionization (FID) (Carrier Gas N₂). The recorder was a Servogor 5, Model RE 546.34, Nr 640667. The recorder speed was set at 300 mm/hour at an MV = 10. The column was a 5 ft. glass column of 10% polyethylene glycol adipate (PEGA) on 100-120 mesh Diatomite C. Column operating temperature was 192°C. Gas flow rate was 60 ml/minute. The sample size was 3 µl. Attenuator

TABLE I
Analyses of Passion Fruit Seed Oils

	Purple Passion Fruit Seed Oil				Yellow Passion Fruit Seed Oil	Yellow Passion Fruit Seed Oil
	India	India	U.S.A.	Kenya	Hawaii	Trinidad
	Pruthi ⁵ (1962)	Pruthi ⁶ (1955)	Jamieson ⁷ & McKinney (1934)	Anon ⁸ (1973a)	Otagaki ⁹ & Matsumoto (1958)	Authors' Findings (1976)
Yield of oil %*	-	23.85	-	24.50	-	24.8
Saponification Value	190.30	190.30	190.4	-	191.30	192.00
Iodine Value	142.10	140.10	140.4	141.2	137.50	135.00
Acid Value	.20	.20	-	.30	-	0.19
Thiocyanogen Value	80.94	80.94	81.2	-	84.20	79.82
Polenske Number	-	-	0.21	-	0.25	0.28
Acetyl Number	-	-	8.10	-	19.40	14.60
Unsaponifiable Matter %	0.65	0.65	0.62	0.80	0.77	0.96
Degree of Splitting	-	-	-	-	-	9.97
Smoke Point °C	-	-	-	-	-	210.6
Specific Gravity 25/25°C	0.9214	0.9214	0.9207	0.9261	0.9208	0.9201
Refractive Index 25°C	1.4727	1.4727	1.4737	1.4761	1.5729	1.4720

*Solvent Extraction

TABLE IA
Colour Characteristics of Oils from Purple & Yellow
Passion Fruit Seeds

Passion Fruit	Optical Density at (mu)			Lovibond	
	420	520	650	Red	Yellow
Purple*	.507	.089	.043	0.6	5.0
Yellow†	.560	.095	.045	4	10.2

*Pruthi

†Authors

setting for the Unknown (passion fruit) and for the known Linoleic Acid was 4×10^3 . Attenuator setting for Palmitic Acid was 16×10^3 .

4.2 Analyses of Chromatograms

The G.L.C. peaks were identified by comparison with retention volumes (V_r) of pure samples and by comparison with published chromatograms (Pidgeon)¹².

The percentage compositions were determined from areas under the peak without considering the relative response factor. The results are given in Table II.

TABLE II
Fatty Acids Composition

Peaks	Name	Height	$\frac{1}{2}$ Peak Width	Area
1	Myristic Acid (C14:0)	2	20	40
2	Palmitic Acid (C16:0)	181	25	4525
3	Palmitoleic Acid (C16:1)	4	40	160
4	Stearic Acid (C18:0)	25	42	1050
5	Oleic Acid (C18:1)	126	47	5922
6	Linoleic Acid (C18:2)	470	56	26320
7	Linolenic Acid (C18:3)	2	70	140

5. DISCUSSION

A comparison of the characteristics of the yellow passion fruit seed oil as obtained by Otagaki and Matsumato⁹ showed that the Trinidad oil had a slightly high saponification value, but slightly lower values for iodine value, thiocyanogen value, acetyl value, specific gravity and refractive index. The same trend holds when the Trinidad oil is compared (Table I) with the oils obtained from purple passion fruits^{5,6,7,8}.

A comparison (Table IA) of colour intensity between the oils obtained from the purple and yellow (Trinidad) fruits showed that the latter had a more intense yellow colour.

A comparison (Table III) of fatty acid composition of the Trinidad yellow passion fruit seed oil with that from Hawaii, showed differences. It is to be noted that Otagaki and Matsumato⁹ only accounted for 84.0% of the fatty acids and the only saturated fatty acid reported was Arachidic (0.90%), which was not detected in the Trinidad oil. However, 0.1% Myristic, 11.86% Palmitic and 2.75% Stearic acids were reported. There are also differences in the unsaturated fatty acids contents. The Trinidad oil showed a higher proportion for both oleic and

linoleic acids but a lower proportion of linolenic acid.

TABLE III
Fatty Acid Composition of Yellow Passion Fruit Seed Oil

Name	Trinidad	Hawaiian
Myristic Acid (C14:0)	0.1	-
Palmitic Acid (C16:0)	11.86	-
Palmitoleic Acid (C16:1)	0.42	-
Stearic Acid (C18:0)	2.75	-
Oleic Acid (C18:1)	15.52	13.00
Linoleic Acid (C18:2)	68.98	67.50
Linolenic Acid (C18:3)	0.37	2.60
Arachidic Acid (C19:0)	-	0.90

6. CONCLUSION

The yield (24.0%) of oil from the Trinidad yellow passion fruit seed makes it an economic possibility particularly since it has a high (Ca 85%) poly-unsaturated fatty acid content which makes it a highly desirable oil for human consumption. Other than normal uses, it may be used as a health oil because of its high (68.98%) Linoleic acid content, or in the manufacture of high or medium PUFA (Poly-unsaturated fatty acids) margarines as well as salad dressings because of its low (-10%) freezing point.

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