Specific Gravities of Rapeseed and Canbra Oils

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ABSTRACT AND SUMMARY

New varieties of rapeseed oils grown in Canada have bess than 1% erucic (*cis*-13-docosenoic) acid and also a reduction in *cis*-11-eicosenoic acid. The replacement of these acids with C_{18} acids increased the specific gravity (25 C/25 C) from 0.9123 for an oil with 23.1% erucic acid to 0.9171 for an oil with 0.7% erucic acid. Soybean oil data are presented for comparison.

The forthcoming changes to metric units in Canada for edible oils and fats at the retail level are tentatively set for January 1, 1979, for salad and cooking oils, and January 1, 1983, for margarines, shortenings, etc. This will require the recalibration of tanks, scales, pumps, and other equipment for handling edible oils. It is, therefore, opportune to draw attention to the change in specific gravity of rapeseed oil arising from the development of low erucic acid varieties in Canada (1) and elsewhere (2). To demonstrate the association of fatty acid composition and specific gravity, we have determined (Table I), by pycnometer, specific gravity values for one conventional rapeseed oil, possibly a *Brassica napus*, var. Turret, a low erucic acid oil (*B. napus* var. Span), a so-called "double-zero" variety (*B. napus* var. Tower), and included soybean oil for comparison. Some literature values for rapeseed oil at 25 C are 0.9064 (weight by volume) (3) or a specific gravity range of 0.906 – 0.914 (4). It may be presumed that these values were determined with high erucic (45-55%) European rapeseed oils. The weight by volume value for soybean oil given by Cocks and van Rede (3) at 25 C is 0.9172. Our specific gravity value of 0.9187 (average of three determinations) is reasonably consistent with this literature value. The slight difference between the specific gravity of Tower oil and soybean oil can reasonably be ascribed to the basic variations in composition such as the difference between a high oleic oil and a high linoleic oil. For example, d_4^{20} is 0.9125 for triolein, 0.9265 for trilinolein (5), although the arrangement of fatty acids on the triglycerol moiety is also a factor (6,7). Similarly the differences in specific gravity in Table I for the three Brassica oils, progressing from Canadian high erucic acid rapeseed oil through the variety Span to the variety Tower, allowing for other modifications such as in the proportions of eicosenoic and the C_{18} polyunsaturated acids, is in accord with the fatty acid densities demonstrated by the densities (d_4^{20}) of methyl erucate, 0.8706, and methyl oleate, 0.8740. Convenient basic definitions, weight by volume data in kilograms/litre, and conversion factors, together with corrections for water, free fatty acids, etc., are given in Cocks and van Rede (3).

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[Received May 2, 1977]

TABLE I

Specific Gravities[a] and Basic Fatty Acid Compositions of Some Brassica (Rapeseed and Canbra[b]) Oils and a Soybean Oil

Oil and condition	Specific gravity	(w/w%)		Fatty acid chain lengths (w/w%)[c]							Fatty acid types (w/w%)		
	25 C/25 C	20:1	22:1	C_{14}	C_{16}	C_{17}	C_{18}	C_{20}	C_{22}	C_{24}	Sat.	Mono.	Poly.
Rapeseed oil, fully refined	0.9123	11.4	23.1	0.1	3.1	0.1	59.2	12.6	23.4	1.4	5.5	69.0	25.5
Span erucic acid rapeseed oil, fully refined	0.9159	3.2	4.1	0.1	4.1	0.1	86.9	3.9	4.3	0.7	6.4	65.5	28.1
Tower "double-zero" low erucic acid rapeseed oil, fully refined	0.9171	1.6	0.7	0.1	4.6	0.1	91.4	2.3	1.1	0.3	6.7	61.5	31.8
Soybean oil, alkali refined	0.9187	0.2	Trace	0.1	10.5	0.2	88.1	0.6	0.4	0.2	15.9	24.7	59.4

[a] $\frac{\text{Weight in air of a volume of oil at 25 C}}{\text{Weight in air of same volume of water at 25 C}}$

[b] In popular usage a rapeseed oil with 22:1 ≤ 5%.

[c] Determined by open tubular gas liquid chromatography as described by Ackman (8) and Ackman et al. (9).