# Crismer Values and Erucic Acid Contents of Rapeseed Oils

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## ABSTRACT AND SUMMARY

Crismer Values of rapeseed oil extracted from different Canadian varieties are reported. Seventeen samples of oil containing up to 4.1% erucic acid gave an average value of 68.45 ± 0.92 C with a range of 67.10 to 69.29. Crismer Values of high erucic acid oils (20-45% erucic acid) ranged from 76 to 82 C.

## INTRODUCTION

The Crismer test (1) is a measure of the miscibility of an oil in a standard solvent mixture. Crismer Values (CV) are characteristic within certain limits for each kind of oil and are used in specification standards for oils in many countries, notably in Europe. Miscibility is dependent upon the solubility properties of glycerides and is influenced by the chain length and unsaturation of the fatty acids.

With the development of low erucic acid rapeseed oils (LEAR) it was of interest to determine the Crismer Values of oils from the various varieties of LEAR oils and compare them to those of high erucic acid rapeseed oils (HEAR). This paper reports on the correlation of CV to erucic acid content as determined by gas liquid chromatography (GLC).

## MATERIALS AND METHODS

Eighteen samples of rapeseed oil extracted from various varieties, eight samples of commercial rapeseed oil (LEAR and HEAR), and twelve blends of oils with erucic acid contents ranging from 0.1 to 54% were used in the study.

All samples were refined, bleached, and deodorized. Blends of different HEAR and LEAR oils were prepared to give erucic acid contents ranging from 5 to 20% as commercial oils in this range were not available.

### Crismer Values (CV)

The Crismer test was performed according to the AOCS Official Method Cb 4-35, (1). Sweet almond oil was used as a reference and standardized to a CV of 70.1 C with a solvent system consisting of *tert*-amyl alcohol, ethyl alcohol (95%), and water (5:5:0.27 v/v).

### Fatty Acids

The oils were analyzed by GLC for fatty acids as methyl esters on a Hewlett-Packard Model 5750 Gas Chromatograph equipped with dual flame ionization detectors. The columns were 6 ft x 1/8 in. stainless steel packed with 10% SP22PSP polyester on 100/200 mesh Support (Supelco Inc., Bellefonte, PA). Nitrogen flow rate was ca. 18 ml/min with a column temperature of 200 C.

## RESULTS AND DISCUSSION

Fatty acid composition of oils from selected varieties of rapeseed oil is given in Table I, and the erucic acid (C22:1) contents and CV of LEAR and HEAR oils and their blends are presented in Table II. As seen from the fatty acid distribution, the main difference between the LEAR and HEAR oils is in the erucic acid content with corresponding changes in $C_{18}$ fatty acids. The average CV of LEAR oils containing up to 5% erucic acid (Samples 1 to 11 and 19 to 23 inclusive) was found to be 68.45 ± 0.91 C. HEAR oils with erucic acid content from 20 to 54% gave higher CV ranging from 76 to 82 C.

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TABLE I

Fatty Acid Distribution in Selected Samples of Rapeseed Oil

| | Sample numbers[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fatty acid % | 2 | 3 | 8 | 10 | 11 | 12 | 14 | 15 | 18 |
| C14 Total[b] | 0.9 | 0.8 | 1.0 | 0.7 | 1.2 | 1.2 | tr[c] | tr | 0.9 |
| C16 Total[d] | 5.3 | 5.2 | 5.1 | 4.5 | 6.0 | 4.9 | 4.4 | 3.8 | 3.0 |
| C18:0 | 1.7 | 1.8 | 1.6 | 1.5 | 2.1 | 2.0 | 2.0 | 1.1 | 1.1 |
| C18:1 | 59.1 | 60.7 | 59.4 | 48.3 | 49.6 | 33.5 | 23.2 | 20.5 | 14.3 |
| C18:2 | 19.5 | 19.4 | 19.2 | 18.8 | 22.0 | 12.9 | 11.4 | 13.6 | 11.5 |
| C18:3 | 10.7 | 10.2 | 10.8 | 10.7 | 9.3 | 23.3 | 4.7 | 20.2 | 11.6 |
| C18 Total | 91.0 | 92.1 | 91.8 | 89.3 | 83.0 | 71.7 | 41.3 | 55.4 | 38.5 |
| C22:0 | 0.7 | 0.8 | 0.7 | 0.6 | 0.6 | 0.7 | 0.5 | 0.6 | 0.7 |
| C20:1 | 0.4 | 0.7 | 0.7 | 0.5 | 4.3 | 0.8 | 13.5 | 0.8 | tr |
| C20:4 | 0.1 | tr | 0.1 | 0.2 | tr | +[e] | 0.4 | tr | 0.2 |
| C20:5 | 0.9 | + | 0.2 | 0.3 | tr | + | 0.4 | + | 0.2 |
| C22:0 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.9 | 0.7 |
| C22:1 | 0.4 | 0.1 | 0.7 | 3.7 | 5.1 | 20.1 | 36.2 | 38.6 | 54.2 |
| C24:0 | 0.1 | + | + | 0.1 | 0.2 | 0.3 | 0.1 | 0.5 | 1.4 |

[a]Sample numbers same as in Table II.
[b]Includes C14:0 and C14:1.
[c]Trace, less than 0.01%.
[d]Includes C16:0, C16:1, and C17:0.
[e]0.01 to 0.10%.

TABLE II

Erucic Acid Contents and Crismer Values of Rapeseed Oils

| Rapeseed oil | Erucic acid % | Crismer Value |
|---|---|---|
| Varieties | | |
| 1 Zephyr (*Brassica napus*) | 0.5 | 68.2 |
| 2 Zephyr (*Brassica napus*) | 0.4 | 67.6 |
| 3 Midas (*Brassica napus*) | 0.1 | 68.3 |
| 4 Tower (*Brassica napus*) | 0.1 | 66.0 |
| 5 Tower (*Brassica napus*) | 1.5 | 67.8 |
| 6 Oro (*Brassica napus*) | 1.8 | 68.6 |
| 7 Span (*Brassica campestris*) | 0.3 | 68.6 |
| 8 Span (*Brassica campestris*) | 0.7 | 68.9 |
| 9 Span (*Brassica campestris*) | 2.7 | 68.3 |
| 10 Torch (*Brassica campestris*) | 3.7 | 69.9 |
| 11 Span (*Brassica campestris*) | 5.1 | 69.0 |
| 12 Bronowski (*Brassica napus*) | 20.1 | 76.7 |
| 13 Bronowski (*Brassica napus*) | 21.0 | 77.5 |
| 14 Nugget (*Brassica napus*) | 36.2 | 80.8 |
| 15 Target (*Brassica napus*) | 38.6 | 78.2 |
| 16 Echo (*Brassica campestris*) | 24.1 | 78.5 |
| 17 R-50 (*Brassica campestris*) | 54.2 | 82.0 |
| 18 Yellow sarson (*Brassica campestris*) | 54.2 | 81.8 |
| Commercial Samples | | |
| 19 Low erucic rapeseed oil (Canbra) | 1.5 | 68.1 |
| 20 Low erucic rapeseed oil (Canbra) | tr | 70.1 |
| 21 Low erucic rapeseed oil (Canbra) | 0.6 | 68.1 |
| 22 Low erucic rapeseed oil (Canbra) | 0.3 | 68.9 |
| 23 Low erucic rapeseed oil (Canbra) | 3.2 | 69.2 |
| 24 Low erucic rapeseed oil (Canbra) | 0.8 | 68.3 |
| 25 High erucic rapeseed oil | 25.8 | 76.4 |
| 26 High erucic rapeseed oil | 26.2 | 77.5 |
| Blends | | |
| 27 Blend No. 1 | 5.1 | 68.4 |
| 28 Blend No. 2 | 5.1 | 69.7 |
| 29 Blend No. 3 | 7.2 | 69.9 |
| 30 Blend No. 4 | 7.5 | 71.0 |
| 31 Blend No. 5 | 10.2 | 69.1 |
| 32 Blend No. 6 | 10.5 | 72.9 |
| 33 Blend No. 7 | 10.6 | 71.4 |
| 34 Blend No. 8 | 12.8 | 71.1 |
| 35 Blend No. 9 | 14.5 | 72.0 |
| 36 Blend No. 10 | 15.4 | 73.9 |
| 37 Blend No. 11 | 15.5 | 72.0 |
| 38 Blend No. 12 | 16.2 | 74.6 |
| 39 Blend No. 13 | 20.1 | 77.0 |
| 40 Blend No. 14 | 24.5 | 78.6 |

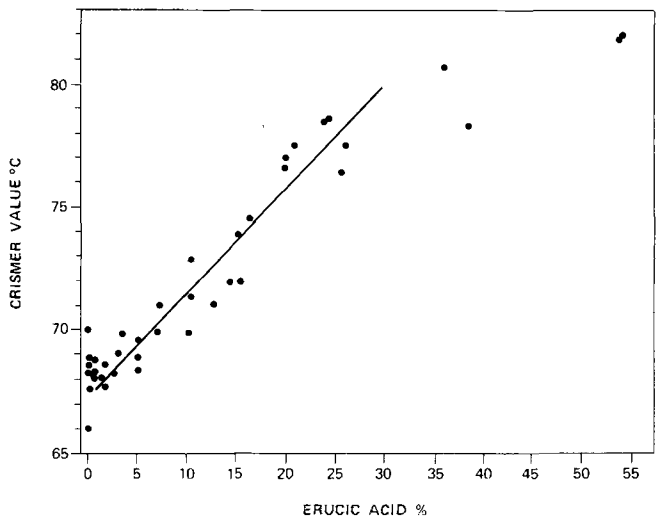


FIG. 1

CV shows a linear relationship to erucic acid content in the range of 1 to 30%. A regression equation was fitted (2) to the samples within this range. All points follow the line CV = 67.17 ± 0.4241 x (erucic acid %), with a correlation r = 0.96 and a standard deviation 1.10. (Fig. 1). The samples with the erucic acid content above 30% do not lie on the continuation of the regression line but somewhat below it. The samples with erucic acid content less than 1% showed a higher variation than other samples; their mean CV lies above the line. The theoritical range of CV for LEAR oils containing up to 5% erucic acid was found to be 67.10 to 69.29 C.

In Canada all rapeseed oil intended as food is required to contain less than 5% erucic acid (3). This study shows that oils in this range give a CV of less than 70.

Crismer test is not intended as a method for the determination of erucic acid. GLC is by far the most convenient and accurate method for the analysis of fatty acids; however, some European countries use CV as one of the specification cirteria for international trade.

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