# THE STUDY OF CAMELINA OIL CHARACTERISTICS

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***Abstract .*** *The main goal of this study was characterization Camelina oil obtained from marginal culture and cultivated by farmers in Banat region. New interest for this crop is determined by low input cost and oil quality. The Camelina oil characteristics were compared with rapeseed and soybean oil. The primary fatty acid identified in camelina oil was linolenic acid (C18:3; ) at 30.46 wt.%, with other unsaturated fatty acids such as linoleic (C18:2; 17.32 wt.%), oleic (C18:1; 22.06 wt.%), and eicosenoic (C20:1; 17.16 wt.%) acids also detected in significant quantities.*

***Key words****: Camelina, oil content, fatty acids profile, boidiesel*

## INTRODUCTION

The 2009 Renewable Energy Directive (RED), issued by the European Commission, states that biodiesels used within the EU for transport have to generate at least 35 percent less greenhouse gas emissions than equivalent fossil fuels. After 2017, biodiesels must provide a saving of at least 50 percent over fossil fuels. According to the commission's studies, rapeseed oil delivering greenhouse-gas cuts of at least 38% compared with conventional fuels, making it eligible for blending in biodiesels. Rapeseed oil is a major constituent of European biofuel [1, 2]. In this context farmers are turning to crops with lower costs. Camelina is a relatively common weed in much of Europe and is known as false flax or “gold-of-pleasure.” “Siberian oilseed” is another rather accurate, descriptive common name. Camelina sativa was cultivated in Europe from Bronze Age but after 1940 was largely displaced by higher-yielding crops [3].

New interest for this crop is determined by low input cost and oil quality. *Camelina* is demanding from the ground, being cultivated on land with low fertility. It can be easily cultivated by farmers and is, equally, a high quality food for animals as is grist after oil extraction (like soybean meal). It is also potentially a plant due to the fact that the support bushes camelina late spring frosts (up to -5 ° C). Therefore, the cultures can be sown camelina, without any problem, as early spring [4,5]. Camelina can be seeded and harvested with conventional farm equipment. Camelina yields an average of 420–640 L/ha and the protein and fiber content in its meal byproduct is comparable to that of soybean meal. The seeds of camelina contain 28–40 wt.% of vegetable oil which is far superior to that typically found in soybeans (18–22 wt.%). Camelina has traditionally been used for relatively high value products such as culinary oil, cosmetics. [6]. Due to high levels of essential fatty acids, particularly the omega-3 fatty acid α-linolenic acid, camelina oil is also being investigated as a food ingredient[1, 8].

## MATERIALS AND METHODS

Two samples of *Camelina sativa* seeds were analyzed.

Camelina seeds (1000 g) were ground in a coffee grinder and oil was extracted with hexane for 24 h in a Soxhlet apparatus. Hexane was removed by rotary evaporation under reduced pressure (10 mbar; 30 $^0$C). For determination of total oil content, 10.0 g triplicates of ground seed were extracted (Soxtet) for 24 h, and after hexane was removed by rotary evaporation (10 mbar; 30 $^0$C) the weight of the residual oil was calculated. The percentage of oil recovered from the samples was 34.0 wt.% (rM ± 0.5%).

**Fatty acid profile by GC-MS**

Fatty acid methyl esters (FAME) of camelina, rapeseed and soybean oils were separated using Shimadzu GCMS QP 2010plus Apparatus and a Zebron column (60 m , 0.25 mm i.d., 0.25 µm film thickness). Carrier gas was He at 2 mL/min. The oven temperature was initially held at 140 $^{0}$C for 10 min, then increased to 250 $^{0}$C at 7 $^{0}$C/min, which was then held for 10 min. The injector and detector temperatures were set to 210 $^{0}$C and 250$^{0}$C, respectively. FAME peaks were identified with NIST05 library and quantificated using external standard method.

Fatty acids were derivatised direct from ground seed and were extracted using QuEChERS ("quick, easy, cheap, rugged, effective and safe") method.

## RESULTS AND DISCUSSION

The oil content of camelina seeds was 34.0 wt.%, which was in agreement with the range reported in previous studies (Table 1).

The primary fatty acid identified in camelina oil was linolenic acid (C18:3; ) at 30.46 wt.%, with other unsaturated fatty acids such as linoleic (C18:2; 17.32 wt.%), oleic (C18:1; 22.06 wt.%), and eicosenoic (C20:1; 17.16 wt.%) acids also detected in significant quantities.

The majority of the remaining fatty acids aside from erucic acid (C22:1; 1.75 wt.%) were saturated species such as palmitic (C16:0; 5.17 wt.%), stearic (C18:0; 3,03 wt.%), and arachidic (C20:0; 1.37 wt.%) acids. These results are in close agreement with prior reports on the fatty acid profile of camelina oil. The relatively high polyunsaturated (47.78 wt.%) and trienoic (30.46 wt.%) acid contents of camelina oil was substantially higher than the other oils.

*Table 1.*

Fatty Acids Profile of Camelina oil

| | Fatty Acid | g/100g oil | % from Total Fatty Acids |
|---|---|---|---|
| 1 | Palmitic Acid $C_{16:0}$ | 4,5 | 5,17 |
| 2 | Linoleic Acid $C_{18:2}^{\Delta 9,12}$ | 16,3 | 17,32 |
| 3 | Linolenic Acid $C_{18:3}^{\Delta 9,12,15}$ | 17,5 | 30,46 |
| 4 | Acid Oleic $C_{18:1}^{\Delta 9}$ | 14,0 | 22,06 |
| 5 | Stearic Acid $C_{18:0}$ | 1,85 | 3,03 |
| 6 | 11-eicosenoic Acid $C_{20:1}^{\Delta 11}$ | | 17,16 |
| 7. | Acid arahidic (Eicosanoic) $C_{20:0}$ | | 1,37 |
| 8 | Acid erucic (docosenoic) $C_{20}^{\Delta 13}$ | | 1,75 |
| | MUFA | | 40,97 |
| | PUFA | | 47,78 |

*Table 2.*

Properties of *Camelina sativa*(CSO) and *rapeseed*(RO) oil

| | CSO | RO |
|---|---|---|
| R saturated | 10.3 | 14.6 |
| R unsaturated | 88.7 | 85.4 |
| R polyunsaturated | 54.3 | 61.3 |
| R C20+d | 16.5 | Trace |
| R trienese | 20.4 | 7.7 |
| CP ($^0$C) PP ($^0$C) OSI, 110$^0$C (h) | _10 (1)f _17 (1) 2.2 (0.2) | _7 (1) _9 (1) 8.3 (0.1) |
| t,40 $^0$C (mm2/s) | 28.28 (0.05) | 31.49 (0.02) |
| Lub, 60 $^0$C(lm) | 128 (2) | 124 (1) |
| AV (mg KOH/g) | 2.06 (0.04) | 0.03 (0.02) |
| IV (g I2/100 g) | 141 | 134 |
| c,24$^0$C (mN/m) | 32.3 (0.1) | 34.2 (0.1) |
| c,40 $^0$C (mN/m) | 30.7 (0.1) | 32.2 (0.1) |

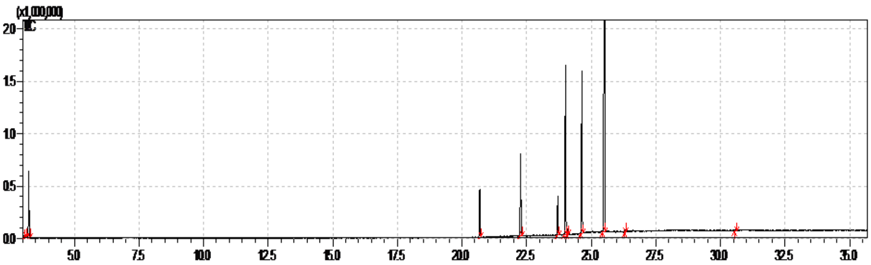

Figure 1. GC-MS Chromatogram of FAME of Camelina seed

**CONCLUSIONS**

Camelina has several positive agronomic attributes: low agricultural inputs, cold-weather tolerance, short growing season (85–100 days), compatibility with existing farm equipment, and grows well in semiarid regions and in low-fertility or saline soils. These qualities are unusual for an oilseed crop.

A low-viscosity oil is essential to improving biofuels. Regular vegetable oil is too viscous for a diesel engine, so the engine either has to be modified or the vegetable oil has to be converted to biodiesel. Camelina could provide a drop-in fuel that could address this issue.

The acidity index (AV) of crude camelina oil (2.06 mg KOH/g) was attributed to non-quantitative alkyl ester yields.

The oxidative stability of biodiesel prepared from camelina oil was unsatisfactory according to ASTM D6751 and EN 14214 as a result of its high polyunsaturated fatty acid content. The high iodine values were also in excess of the limit contained in EN 14214. The low temperature operability of CSME was similar to biodiesel prepared from rapeseed oils.

The kinematic viscosity, AV, DCN, lubricity, sulfur and phosphorous contents, as well as the surface tensions were satisfactory according to ASTM D6751 and EN 14214, where applicable.

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