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RESEARCHES CONCERNING THE USE OF CAMELINA OIL IN THE COMPOSITION OF COSMETIC PRODUCTS: REVIEW

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Abstract

Camelina (Camelina sativa) is a flower plant belonging to the family Brassicaceae, originating in Eastern Europe. Vegetable oil is not only for food use, it can also be used in many fields, such as the cosmetics industry. The oil obtained from Camelina seeds has a varied content of fatty acids with an intake of 50-60% unsaturated fatty acids, 35-40% omega 3 content and 15-20% omega 6. It has a high content of omega 3, being one of the richest vegetable sources compared to this fatty acid.
In this review, we discuss how some of the latest scientific advances such as the high content of tocopherol (E vitamin), the ability to extract lecithin from Camelina oil and the likelihood of being a replacement for the castor oil. Other approaches demonstrate the stability of Camelina oil both in the presence of synthetic and natural antioxidants. Finally, we discuss the potential of Camelina oil to be used in the cosmetics industry.

***Key words**: Camelina oil, fatty acids, tocopherol, lecithin, stability, antioxidants.*

INTRODUCTION

Ever since ancient times, emollients based on animal fats and vegetable oils have been used. Technology has advanced today no longer uses vegetable fat or oil as such, but incorporates into more complex preparations for a much better effect, called cosmetics. Many vegetable oils such as coconut oil, avocado oil, castor oil, argan oil, wheat germ oil, saffron oil, and hemp oil are used in the cosmetic industry (Berdick, 1972). In today's cosmetics science, the role of natural ingredients is very important because on the one hand their structure is compatible with human physiology, having no toxic role and very low allergenic capacity, and on the other hand, the interest is more and more for the protective properties and beneficial reactivation for the skin (Rigano et al., 2006).
Camelina oil is the main compound obtained from Camelina seeds, and its yield is between 30-40% DM (Budin et al., 1995; Rode, 2002; Zubr, 2003). Camelina oil has been used since ancient times for medical purposes as well as for lightening gas, but in the cosmetics industry, although its use is attempted, its true potential has not yet been decimated. It is part of the *Brassicaceae* family being a plant that does not require a special and complicated cultivation technology (Waraich, 2013).
With seed oil content (36-47%) twice that of soybean (18-22%) and a fatty acid profile (with >90% unsaturated fatty acids) suitable for making jet fuel, biodiesel and high-value industrial lubricants, *Camelina sativa* has tremendous potential to serve as a viable and renewable feedstock for multiple industries.
One of the most important used who has beed study was for sustainable bio-kerosene production.
The technology of Camelina oil was optimizated and can be valued all parts of the plant: roots, leaves, straw, silicules and the proteic part of the seed (included in camelina meal). Additionally, due to exceptionally high levels of α-linolenic acid (32-40% of total oil content), *Camelina sativa* oil offers an additional source of essential fatty acids.
The residual essential fatty acids combined with low glucosinolate levels in *C. sativa* meal make it desirable as an animal feed (Kagale et al., 2014).

GENETIC STRUCTURE OF *Camelina sativa*

Camelina sativa represents the first crop species to be sequenced from lineage I of the *Brassicaceae*. The well-preserved hexaploid genome structure of *C. sativa* surprisingly mirrors those of economically important amphidiploid Brassica crop species from lineage II as well as wheat and cotton (Kagale et al., 2014). study was undertaken to characterize two genes in the fatty acid biosynthesis pathway, fatty acid desaturase (FAD) 2 and fatty acid elongase (FAE) 1, which revealed unexpected complexity in the *C. sativa* genome. Genetically, *Camelina sativa* is closly to the model of *Arabidopsis thaliana*, and the regions downstream of CsFAD2 and upstream of CsFAE1 demonstrate co-linearity with this (Hutcheon et al., 2010).

EXTRACTION OF CAMELINA OIL

In a study made of Moslavac et al. (2014) they evaluated the oil extraction process from *Camelina sativa* (L.) Crantz seeds by screw pressing followed by extraction with supercritical CO_2. In pressing experiments, the response surface methodology (RSM) was conducted in order to study the effects of temperature, frequency and nozzle size on oil recovery and quality parameters. The cake resulting from pressing at optimal conditions was extracted with CO_2 in a new designed and built a homemade supercritical fluid extraction system. The residual oil in the pressed cake was almost totally extracted by supercritical CO_2 (Moslavac et al., 2014). Another procceding of extraction like SC-CO_2 extraction of Camelina seed oil was reported and compared with traditional extraction methods. The conditions used for this study was: pressure (35-45 MPa), temperature (50-70°C), and time (90-250 min). Oil yield increased with pressure and time, but not temperature. Oil yield was further increased to 31.6% at the RSM-optimized conditions by increasing the SC-CO_2 extraction time to 510 min. Soxhlet (hexane) and cold press methods yielded 35.9% and 29.9% oil, respectively. Extraction method did not have a significant effect on the fatty acid composition and tocopherol content ($P > 0.05$); however, phytosterol content of the cold pressed oil was significantly lower than that of SC-CO_2 and Soxhlet (hexane) ($P < 0.05$). Conclusion of the study was that the oil yield of SC-CO_2 extraction was higher than that of cold press (Belayneh et al., 2015).

CHARACTERIZATION OF CAMELINA OIL

Herbal vegetable oils are not only a non-polluting renewable source but also provide a wide range of fatty acids with various applications (Kumar et al., 2016). The chemical composition of Camelina oil is suitable for many branches of the industry, the one covered by this review is the cosmetics industry. The main characteristic of Camelina oil is its composition in linolenic fatty acid, 20-40% - essential and very rare omega 3 (Aldivia, 2007). The oil obtained from Camelina seeds has a varied content in fatty acids with an intake of 50-60% unsaturated fatty acids, 35-40% omega 3 content and 15-20% omega 6. Recently in a study, new proportions of component oils have been identified, namely 22,31-26,57% linolenic acid, 21,25-24,05% linoleic acid and 19,46-21,47% oleic acid (Ergönül, 2018). The process of extracting it is always improved to keep it as high as possible. The optimum condition for obtaining the best recovery oil and the best oil quality were recorded at 52°C, 20 Hz and 9 mm ID (Moslavac et al., 2014).

BIOCOMPOUNDS FROM CAMELINA OIL

The antioxidant activities of *Camelina sativa* methanolic extracts were evaluated by various chemical tests: reduction power, 2,2-diphenyl-1-picrylhydrazyl (DPPH) test, beta-carotene whitening method and metal chelating activity analysis (Terpinc, 2012). This study revealed that after pressing the oil, most of the phenolic compounds remain in seed residues, only a few compounds have been identified in the oil (Terpin, 2012). An interesting biocomponent found in camelina oil is lecithin. It is not found as such in camelina or oil seeds but is obtained by processes called enzymatic degumming and water degumming (Balayneh et al., 2018).

Lecithin obtained by enzymatic degumming contains a higher amount of lisophospholipids, generating a more stable emulsion. Camelina oil analyzed from this point of view promises to be a good alternative of emulsifier (Balazneh et al., 2018).
A comparison was been made regarding the total phenols content between safflower oil and camelina oil. The total phenol content of safflower oils was higher (272.20-525.30 mg GAE/kg) than Camelina seed oils (25.90-63.70 mg GAE/kg). Apigenin, luteolin, tyrosol, siringic acid, 3-hydroxytirozole, p-coumaric acid and synaptic acid have been detected in seed oils. Camelina seed oil was rich in tocopherol (144.11-168.69 mg/100 g). γ-Tocopherol was the predominant tocopherol in Camelina seed oils, consisting of 80% total tocopherol (Ergönül, 2018).
Another study was made to investigate the effects of protein extraction methods on the adhesion performance of different camelina protein fractions. Two Camelina protein fractions, globulin and glutelins, were isolated from defatted Camelina meal using three different methods resulting in total of six protein fractions including globulin 0-2 and glutelin 0-2. Dry adhesion strength of camelina protein adhesives exhibited nearly 100% wood cohesive failure at the curing temperatures of 150-190°C, except glutelin 2 and globulin 0. Glutelin had higher protein aggregation than globulin, as indicated by higher crystallinity, higher thermal stability, and dense protein aggregation (Ningbo Li et al., 2015).

CAMELINA OIL STABILITY

The stability of vegetable oils depends very much on chemical and physical factors. An important impact for maintaining stability is the method and storage conditions. The storage changes in tocopherol content, phenolic content as well as the presence of primary and secondary oxidative compounds wew studied (Abramovic, 2007). By the oil storage at 50°C and 60°C, respectively, the total content of phenolic compounds was reduced to 72% of its original value and 21% of its initial value (Abramovic, 2007). Camelina oil has been found to have a much lower oil stability index and higher p-anisidine storage rates compared to rape or sunflower oils. We have tried to stabilize Camelina oil with 21 antioxidants, both natural and synthetic, based on the Oil Stability Index (OSI). The stability index of Camelina oil was higher than that of rapeseed oil with TBHQ and its formulation with citric acid and above the sunflower oil with EGC, EGCG, carnosic acid, propyl gallate, extract of rosemary with ascorbyl palmitate or gallic acid. Accordingly, stabilized Camelina oils with TBHQ/citric acid and rosemary/ascorbyl palmitate extract were more stable than rapeseed and sunflower oils, respectively in terms of OSI induction times and p-anisidine rates (Frohlich et al., 2011).
A natural antioxidant that protects Camelina oil very well against oxidation is Rosmarin extract, as studies have shown (Moslavac et al., 2014).

THE BEHAVIOR OF CAMELINA OIL COMPARED TO OTHER VEGETABLE OILS

The behavior of Camelina oil has been analyzed compared to other vegetable oils, such as linseed oil, rapeseed oil, and sunflower oil. Several parameters have been analyzed, depending on the study. In order to make this comparison with linseed oil, a series of compounds, namely the fatty acid composition, the peroxide value, the acid value, the anisidine value, the chlorophyll pigments, the carotenoid pigments were analyzed. It was highlighted that they adhere to the Codex Alimentarius (2009) parameters for cold-pressed oils, even though there were differences between the two oils. Significant differences between the two were recorded for chlorophyll content and chlorophyll pigments. Regarding oxidative stability, Camelina oil proved to be more stable than the flax (Raczyk et al., 2015).
The cosmetic particle composition can essentially comprise *Camelina sativa* seed oil which is 100% completely hydrogenated, being in the form of strong cosmetic particles and transformed into soft cosmetic particles after introduction into a topical formulation. The transformed cosmetic particles can be adapted to have a soothing effect on the skin, hair and/or nails of a mammalian subject or other target. A study that had the purpose of building a patent, has fully utilized fully hydrolysed

Camelina oil. Camelina seed oil has at least 17% of its total fatty acid weight greater than 18 carbon atoms. Oil obtained from Camelina seeds is relatively inexpensive compared to many other seed oils, so the cosmetic particles formed with them are relatively cheap natural products (Kleiman et al., 2013).

CONCLUSIONS

The researches emphasized the high content of tocopherol (E vitamin), the ability to extract lecithin from Camelina oil and the posibility of being a replacement for castor oil, the stability of Camelina oil both in the presence of synthetic and natural antioxidants. In conclusion, Camelina oil has a potential to be used in the cosmetics industry.

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FOOD
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