

GRAPE SEED OIL: FROM A WINERY WASTE TO A VALUE ADDED COSMETIC PRODUCT-A REVIEW

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ABSTRACT.

A large volume of winery wastes remains unexploited every year on an international level. Grape production is considered to be one of the most important agro economic activities in the world, with more than 67 million tons of grapes (*Vitis vinifera*) produced globally in 2012, about 22 million tons of them produced in the European Union (FAOSTAT 2012).

In this respect, the major aim of this research work is to explore possible ways for the use of winery wastes. The objective is to encourage companies to apply value adding technologies in order to reduce their waste generation and disposal, provide further alternatives to diminish the environmental impact of winery activity and introduce additional sources of income. This research focuses on grape seeds and reveals its promising future as a distinct product with potential usage in cosmetology.

Mechanical extraction (cold-pressed or hot pressed oil) and chemical or solvent extraction (Soxlet methods and hexane as solvent) are the most common and widespread methods of extracting grape seed oil. Cold-pressed oil is greatly used to produce grape seed oil for cosmetic usages mainly as this method preserves the natural structure of oil by keeping away all residual chemicals.

Grape seed oil is an excellent cosmetic ingredient for controlling moisture of the skin. It is very light thus it is easily absorbed by the skin and it will not leave any oil residue. According to a report of an independent study published in Free Radical Biology and Medicine, grape seed oil can also accelerate the healing process of wounds on human skin and can also be valuable for the cure of any acne problems.

To conclude with, it is rich in vitamin E, linoleic acid, omega fatty acid and antioxidants. Its antioxidant properties are essential for minimizing skin aging. The oil can be beneficial for the reduction of wrinkles appearance, since it provides moisture and protection against free radicals. As stated by the University of Maryland Medical Center, grape seed oil is able to increase the amount of antioxidant in the blood and to maintain the existence of collagen and elastin.

Introduction

During the last decade a trend towards natural cosmetics has been developed and therefore scientists and industry are moving towards the research of alternative ingredients that won't cause any allergies or other kinds of skin irritations to consumers.

Natural remedies have been used for centuries for treating skin and also for a wide variety of dermatological disorders (inflammation, phototoxicity, psoriasis, atopic dermatitis and alopecia areata).

Protection of the skin hydration and producing softening effects to skin and hair preparations is achieved using seed oils rich in fatty acids and triglycerides that reduce transepidermal water loss [1].

Nowadays, many cosmetic companies are using natural ingredients like different types of herbs, honey, sugar, beer and wine. Apart from wine, grape seed oil, grape seed extract and grape juice is used as a main ingredient for the production of creams, shampoos, body lotions and hair treatment products.

According to a study of CCR group, wine and its' by products are assets for many subsidiary businesses in both cosmetic and gastronomy field with a growth of 2% in volume and an increase in turnover of 107% in the past 6 years [2].

Grape seed oil

The first mention of the grape seed oil appeared in the 14th century during the reign of Ferdinand IV, King of Castile and León, independent state in the northwestern part of the Iberian Peninsula. An Arab doctor suggested the usage of grape seed oil as a treatment to skin problems. The curative effect of grape seed oil was so effective that Ferdinand IV decided to keep secret both the process and the formula; the elixir was named as royal oil or oil of the throne - from Spanish AceiteSolio [3].

According to the University Of Maryland Medical Center [4], the consumption of grapes in ancient Egypt goes back 6,000 years. Moreover, several ancient Greek philosophers praised the healing power of grapes, in the form of wine. European folk healers made an ointment from the sap of grapevines to treat skin and eye diseases. Grape leaves were also used to stop bleeding, inflammation and pain. Unripe grapes were used to treat sore throats and dried grapes (raisins) were used for constipation and thirst. Grapes were also used to treat a range of health problems including cholera, smallpox, nausea, eye and skin infections, kidney and liver diseases.

Grape production is considered to be one of the most important agro-economic activities in the world, with more than 67 million tons of grapes (*Vitis vinifera*) produced globally in 2012, about 22 million tons of them produced in the European Union [5].

Grape seeds are waste products of wineries and are often referred as important agricultural and industrial waste [6] with potentials to be used in pharmaceutical, food and cosmetic applications [7].

According to Codex Standard for named vegetable oils- Codex Stan 210-1999, grape seed oil is the oil which is produced from the grape seeds of *Vitis vinifera* L. [8].

Grape seed oil is produced in many countries throughout the world like Italy, Spain, Chile, United States, Australia and France [9]. There are few recent data on global production of grape seed oil but according to Casao [10] the production in Italy, France and Spain reached 42,000 tons.

Grape seed oil ingredients

Grapes seeds contain about 14-20% of oil [11]. The grape seed oil is rich in linoleic acid (65-72%), oleic acid (12-23%), palmitic acid (4-11%), stearic acid (8.5-15%). Linoleic acid found in grape seed oil plays an important role as it is not synthesized in the body itself and this is why products containing it have significant nutritional value [11]. Corresponding recommendations in linoleic acid has sunflower oil, soybean oil, safflower oil-safflower oil (plant family member of sunflower) seed oil, corn oil and oil from poppy. The oleic acid also contributes to nutritional value of oil as it affects the oxidative stability of oils [12].

Grape seed oil has also high concentration of tannins, oligomeric proanthocyanosides at 1000 times higher than the other oils [11] and that is the reason why it has high stability and resistant to oxidation reaction.

It is also rich in tocopherols, which are the most important natural antioxidants that are not biosynthesized from humans and other mammals, but must be taken exclusively by diet. Tocopherols occur in four forms; α -tocopherol, β -tocopherol, γ -tocopherol and δ -tocopherol. α -tocopherol has the highest activity as vitamin and low antioxidant activity compared to the δ -tocopherol [11].

Tocopherols are sensitive to light and air that is why it requires special attention during extraction but also during the analytical process [6]. As reported by Gliszczynska-Swiglo and Sikoenska [14], a large amount of α -tocopherol was found in grape seed oil compared with γ - and δ -tocopherol, and the content of which varies depending on the variety of grape. Their concentration in grape seed oil does not exceed that of the soybean oil (860mg / kg) and sunflower oil (880mg / kg) and it is almost similar to that of cottonseed oil (560mg / kg) [15].

Grape seed oil extraction

The method chosen for oil extraction depends on the nature of raw material [38]. The traditional way for extracting grape seed oil is cold pressing the whole seeds in discontinuous hydraulic press or milled and heated seeds in screw press. It is important that the seeds moisture content won't exceed 10% [16]. Cold pressing extraction is a mild process that allows obtaining a good quality of oil [39].

Recently, alternative methods are being suggested, without organic solvents like hot water extraction, supercritical fluid extraction (SFE) [21], supercritical CO₂ extraction [17,18], pressurized liquid extraction (PLE) [6] and ultrasound assisted extraction [21].

Grape seed oil's attributes to cosmetology

1. Acne Fighting: Acne is a skin condition that affects sweat glands and hair follicles, causing inflammation, black heads, white heads and pustules. If blemishes are deep they can leave scars and pitting, which can be distressing and disfiguring [1].

The skin needs a good supply of linoleic acid to help strengthen cell membranes and improve skin health in general. The oil also has a significant amount of the antioxidant capacity so as to prevent pores from clogging. The anti-inflammatory properties prevent the outbreak of acne but also help any existing acne problems.

2. Skin Tightening and healing: Grape seed oil has astringent properties, fighting free radicals and helping to firm the skin. It is medically useful for various purposes, especially to reduce swellings. For this reason there are many cosmetic companies that sell many products using this substance as a main ingredient.

Regular application of grape seed oil will deliver basically a good amount of astringent that is useful for stimulating the skin and tightening. For these purposes, people with oily skin will get more advantages using grape seed oil.

By applying grape seed oil, human body can accelerate the wound healing process and also can diminish scars [4, 19, 20]. Grape seed extract has been applied to wounds on the skin of animals and humans and found that wounds treated with grape seed extract healed more quickly than wounds that did not receive the extract. [19].

3. Reduction of dark circles eye: The black circles are common facial skin problems and the effects of sun exposure, dehydration, excessive alcohol consumption, etc. Fortunately, removing under eye circles is one of the largest capacities

grape seed oil skin. The compound would not be able to bear visible results overnight indeed, but regular application for a week can completely eliminate the occurrence of these cycles without harmful chemicals.

In order to analyze the safety and effectiveness of the grapeseed oil composition, clinical studies were conducted using six individuals, by applying topically to one-half of their face. Application of the composition was studied for a period of 10-30 days. One of the conditions that was evaluated was the presence of dark circles underneath the eyes. Using visual inspections in combination with patients acting as their own controls, they found that previously dark circles under patient's eyes appeared much lighter under the right eye following application of the composition [20].

4. Hydration: Most types of oils can be used as a skin moisturizer [20]. The most common problem is the residue and the oily coating on the skin after application. Grape seed oil is very light so easily absorbed by the skin and does not leave any residue. People with sensitive skin can apply the oil with no chance of an allergic reaction [20, 21, 22].

According to Spiers & Cleaves, following treatment with grape seed oil topically, patient showed no signs of allergic reaction after using it for 22 days [20].

Another advantage of grape seed oil is to stimulate skin tissue, namely the regeneration of cells. Clinical studies have shown that topical application of linoleic acid soothes the skin and reduces the trans-epidermal water loss [23]. According to Conti A. et al. [24] and Jimerez-Arnau A. [25] the properties of linoleic acid are confirmed. Moreover, dry skin has low linoleic acid, which can be restored by the topical application solutions rich in linoleic acid such as grape seed oil [26], which reduces the epidermal water loss within 48 hours [27].

5. Protection of the skin from aging: The antioxidant properties contained in grape seed oil is excellent to minimize skin aging [21, 31]. Fine lines and wrinkles are common signs of aging, but the oil can help reduce the appearance of these points, providing enough moisture and protect against free radicals [20].

According to the University Of Maryland Medical Center swallowing the oil is able to increase the amount of antioxidants in the blood. Other benefits to the skin include the abilities to sustain the presence of collagen and elastin [4].

6. Skin protection against UVB radiation: The primary environmental factor that causes human skin aging is UV irradiation from the sun [28].

The grape seed extract has the potential to protect human keratinocytes against the damages produced by UVB radiation due to their strong antioxidant activity that reduce in a significant level, the free radicals levels. The antioxidant activity is mainly caused from the high concentration of polyphenols, presented by proanthocyanidins, anthocyanidines, catechins [29]. Grape seed proanthocyanidins have been proved to exert skin cancer prevention effects by inhibiting oxidative stress and protecting the immune system [30].

7. Hair Treatment: Androgenetic alopecia (AGA) is the most common cause of hair loss in men and affects up to 70% of men in later life and especially those aged over 50 years [33, 34, 37]. Grape seed oil, have been shown to be possible alternative treatments, apart from pumpkin seed oil, for AGA due to improved scalp blood flow [35, 36, 37].

For best results in the treatment of hair, it may be required to combine grape seed oil with specific essential oils like rosemary and lavender. Essential oils when are incorporated in a hair care product will impact shine and conditioning effects. This helps provide not only hair conditioning and improvement in the hairs' texture, but also a longer lasting pleasant aroma, which eliminates negative odours [32].

References

1. Aburjai T., Natsheh F. M. Review Article: Plants used in cosmetics. *Phytotherapy Research*.17, 987–1000, (2003). DOI: 10.1002/ptr.1363
2. Yeomans M., Wine therapy: more cosmetics brands get in on the trend found in <http://www.cosmeticsdesign-europe.com/Market-Trends/Wine-therapy-more-cosmetics-brands-get-in-on-the-trend> (2015).
3. Azamet Group of Companies. <http://www.azamet.md/en.html> (2011)
4. University of Maryland Medical Center. <http://umm.edu/health/medical/altmed/herb/grape-seed#ixzz3QgPY3wMq> (2013).
5. FAOSTAT. <http://faostat.fao.org> (2010).
6. Freitas L., Jacques R., Richter M.F., Loviane da Silva A., Caramao E.B.: Pressurized liquid extraction of vitamin E from Brazilian grape seed oil. *Journal of Chromatography A*. 1200 80-83 (2008).
7. Bail.S., Stuebiger. G., Unterweger. H., & Buchbauer. G.: Characterisation of various grape seed oils by volatile compounds, triacylglycerol composition, total phenols. *Food Chemistry*. 108. 1122-1132. (2008).
8. Codex Alimentarius Commission Codex standard for named vegetable oils. Codex stan 210-1999. (1999).
9. Axtell,B.L.: Minor oil crops FAO agricultural services bulletin 94. (1992).
10. Casao, H.T.:Aceite de pepita de uva-presente, pasado y future, *Alimentaria* 141,17-31. (1983).
11. Yousafi. M., L.Nataghi., Gholamian., M.: Physicochemical properties of two type of shahrodi grape seed oil (Lal and Khalili). *European Journal of Experimental Biology*, 3 (5):115-118. (2013).
12. Aparicio R., Roda L., Albi M.A., Gutierrez F. Effect of various compounds on virgin olive oil stability measured by Rancimat. *J. Agric. Food Chem*. 47. 4150-4155. (1999).
13. Demirin. Y.: Phenotypic Variability and Correlation between Tocopherol Content and some Biochemical Characters in Sunflower Seeds. *Sci. Tech Bull. VKIIMK. Krasnodar*. 93:21-24. (1986).
14. Gliszczynska-Swiglo. A., Sikorska. E.: Simple reversed-phase liquid chromatography method for determination of tocopherols in edible plant oils. *J. Chromatogr. A*. 1048, 195-198. (2004).
15. Baydar. N., Akkupt., M.: Oil Content and Oil Quality Properties of Some Grape Seeds. *Turk J Agric*. 163-168. (2001).
16. Kurki A., Bachmann J.: Oilseed Processing for Small Scale Producers. ATTRA. (2006).
17. Duba, K. S, Fiori, L.: Supercritical CO₂ extraction of grape seed oil: Effect of process parameters on the extraction kinetics. *The Journal of Supercritical Fluids*. 98, 33-43 (2015).
18. Fiori, L.: Supercritical extraction of grape seed oil at industrial-scale: Plant and process design, modeling, economic feasibility. *Chemical Engineering and Processing: Process Intensification*. 49,8. 866-872. (2010).
19. Khanna S., Venojarvi M., Roy S., Sharma N., Trikha P. , Bagchi D., Bagchi M., SEN C. K.: Dermal Wound Healing Properties Of Redox -active Grape Seed Proanthocyanidins. *Free Radical Biology & Medicine*, Vol. 33, No. 8, 1089–1096. (2002).
20. Spiers, S.M., Cleaves, F.T.: Topical treatment of the skin with a grape seed oil composition. Google Patents. <https://www.google.com/patents/US5916573> (1999).

21. Luque-Rodríguez J.M., Luque de Castro M.D., Pérez-Juan P.: Extraction of fatty acids from grape seed by superheated hexane. *Talanta* 68 126–130. (2005).
22. Hojerova, J., Vinohrad, 2003, 41 (6), 6.
23. Wright S.: Essential fatty acids and the skin: Cosmetic application of research. *Br J Dermatol.*;125(6): 503-15 (1991).
24. Conti A., Rogers, J., Verdejo, P., Harding, L.R., Rawlings.A.V.: Seasonal influences on stratum corneum ceramide 1 fatty acids and the influence of topical essential fatty acids. *J Cosmet Sci.*;18: 1-12 (1995).
25. Jimenez-Arnau A.: Effects of Linoleic Acid Supplements on Atopic dermatitis. *Adv. Exp. Med.Biol.*433:285-9, (1997).
26. Härtel, B.: Essential Fatty Acids and Elicosanoids in the skin: Biosynthesis, Biological and Cosmetic importance. *SÖFW-Journal.*; 124: 889-900, (1998).
27. Rieger, M.M.: Skin Lipids and their importance to Cosmetic Science. *C&T.*;102:36-49. (1987).
28. Fisher GJ, Kang S, Varani J, et al.: Mechanisms of photoaging and chronological skin aging. *Arch Dermatol* 138: 1462–1470. (2002).
29. Perde-Schrepler M., Chereches G., Brie I. , Tatomir C., Postescu I.D., Soran L, Filip A.: Grape seed extract as photochemopreventive agent against UVB-induced skin cancer. *Journal of Photochemistry and Photobiology B: Biology* 118 16-21. (2013)
30. Katiyar S.: Grape seed proanthocyanidins and cancer prevention: inhibition of oxidative stress and protection of immune system, *Mol Nutr Food. Res* 52, 871-876. (2008).
31. Sharif A, Akhtar N, Khan MS, Mena A, Mena B, Khan BA, Mena F.: Formulation and evaluation on human skin of a water-in-oil emulsion containing Muscat hamburg black grape seed extract. *Int J Cosmet Sci* (2015) 37(2):253-258. doi: 10.1111/ics.12184.
32. Purohit P., Kapsner TR.: Natural essential oils. *Cosmet toilet.*:109:51-5. (1994).
33. Olsen E. A., Messenger A. G., Shapiro J. : Evaluation and treatment of male and female pattern hair loss. *Journal of the American Academy of Dermatology.* 52. 301–311 (2005).
34. Hoffmann R. :Male androgenetic alopecia. *Clinical and Experimental Dermatology.* 27, 373–382. (2002).
35. Takahashi T. ,Kamiya T, Hasegawa A.,Yokoo Y: Procyanidin oligomers selectively and intensively promote proliferation of mouse hair epithelial cells in vitro and activate hair follicle growth in vivo. *Journal of Investigative Dermatology.* 112. 310–316. (1999).
36. Al-Sereiti M. R., Abu-Amer K. M., Sen P.:Pharmacology of rosemary (*Rosmarinus officinalis* Linn.) and its therapeutic potentials. *Indian Journal of Experimental Biology.*37, 124–130. (1999).
37. Cho, Y. H., Lee, S. Y., Jeong, D. W., Choi, E. J., Kim, Y. J., Lee, J. G., Yi, Y. H., Cha, H. S.: Effect of pumpkin seed oil on hair growth in men with androgenetic alopecia: a randomized, double-blind, placebo-controlled trial. *Evid Based Complement Alternat Med.* (2014).
38. Fernandez C.M., Ramos M.J., Perez.A., Rodriguez., J.F.: Production of biodiesel from winery waste: Extraction, refining and transesterification of grape seed oil. *Bioresource Technology.*101 7030-7035. (2010).

39. Tobar P., Moure A., Soto C., Chamy R., Zuniga M.E.: Winery solid residue revalorization into oil and antioxidant with nutraceutical properties by an enzyme assisted process. *Water Science and Technology*. 51, 47-52. (2005).