

Sandalwood Seed Oil

Use of Plant Derived Oils in Personal Care Formulations

Introduction:

Plant oils are considered to be a vital ingredient in the formulation of personal care and cosmetic products as they offer a multitude of functional and sensorial benefits. The importance of plant oils is demonstrated by humankind relying upon these oils in their personal care and medicinal applications for many thousands of years (Patwardhan et al. 2005). A classic example is the use of olive oil as a cosmetic for hair as well as an emollient for skin in Ancient Rome (Girboux & Starch, 2005).

Plant derived oils can be classified into two groupings: essential oils and fixed oils (Shahidi, 2006). Essential oils are extracted from the leaves, branches, and/or wood of the plant, generally through steam (water) distillation techniques. Plant oils are typically expelled mechanically from the seed kernel of various plants however other extraction methods, such as supercritical CO₂ extraction, are becoming more common as the cost of these alternative production methods decrease. For the remainder of this paper, the term 'plant oils' will solely refer to the fixed oil component of plants.

Plant oils have similar physiochemical properties to human skin lipids. This means that plant derived oils are, naturally, more physiologically compatible with human skin than petro-chemical derived mineral oils.

Unfortunately during the late 20th Century, non-renewable resources such as petroleum (derived from crude oil) played a dominant role in personal care formulations. These ingredients were considered a cheaper and more consistent substitute. More recently as consumers have become equipped with better information, they have become more vocal in their demand for natural ingredients. This demand has also been attributed to rising awareness of the ethical and personal concerns over the procurement of mineral-based and animal-derived products (Aburjai and Natsheh, 2003).

Plant oils used in personal care applications are rich in fatty acids (Coupland et. al. 1987), yet may also have

other components which make up the whole oil. The non-fatty acid component of plant oils typically consist of phospholipids, sterols and tocopherols. These components also contribute to the physiochemical and biological characteristics of each plant oil (Hettiarachichi, 2014).

Fatty acids are simple hydrocarbon chain structures which are typically named by their chain length, degree of saturation and position of the saturated bonds on the carbon chain. The chain length can be defined by short, medium or long chain. This is particularly important for the formulation of personal care products as the length of the fatty acid molecule can impact the transdermal absorption rate; short to medium sized chains are more readily absorbed through the epidermis when supported by active lipid transportation through the cell wall. As an example Macadamia Oil, from the native Australian tree *Macadamia integrifolia*, is rich in a short chain fatty acid called palmitoleic acid (19%). Coincidentally, palmitoleic acid is also a component in natural human sebum; this commonality translates into Macadamia Oil offering excellent dermal absorption rates.

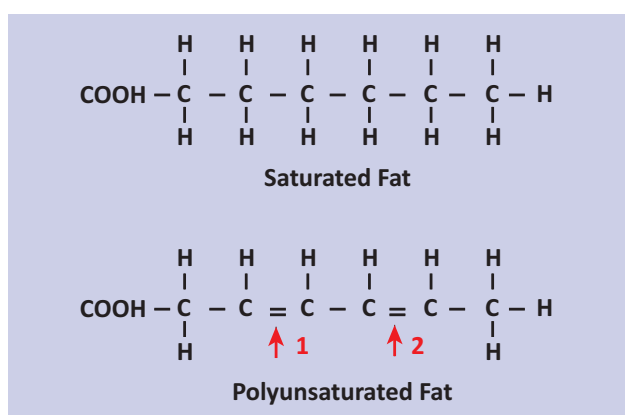


Figure 1: Representative images of saturated and poly unsaturated fatty acids. The "poly" means there are more than 1 site of unsaturation - in this case 2, as indicated by the red arrows

The degree of saturation of fatty acids refers to the relative completeness of hydrogen atoms binding to each carbon atom in the chain. Saturated fats have single bonds between their carbon atoms in the fatty acid chain. The other available positions on the carbon atom are connected to hydrogen atoms. Saturated fats are

usually solid at room temperature, presenting formulation and delivery considerations. Unsaturated fats exist when carbon atoms are not saturated by hydrogen atoms. This results in double or triple bonds occurring between the carbon atoms.

Monounsaturated fats have one carbon-carbon double bond (i.e. lacking a hydrogen atom on each of those two carbons) and are usually liquid at room temperature. These fats can be found in foods such as olive oil, avocados and almonds. Polyunsaturated fatty acids have two or more carbon-carbon double bonds. On rare occasions in the plant kingdom, some fatty acids have triple bonds instead of double bonds. These triple bond (unsaturated) fatty acids are called acetylenic fatty acids.

Fatty acids may be further categorized by the location of the saturated bonds from the end carbon (Omega carbon). This position can also confer important biochemical associations as it determines the interaction with other molecules. For example, Sandalwood Seed Oil's Ximenynic Acid has a triple bond at the 9th position. When Sandalwood Seed Oil is absorbed into the skin and releases free (hydrolysed) Ximenynic Acid, this fatty acid is able to bind Arachidonic acid, competitively inhibiting enzymes which catalyze the Arachidonic Acid Pathway. It is this binding that confers a well-studied anti-inflammatory benefit.

Fatty acid	Carbon chain length	Position of unsaturated bonds	Typical Source
Palmitic	16	NA	Palm
Oleic	18	9	Olive
Linoleic	18	9, 12	Linseed
Linolenic	18	9,12,15	Evening primrose
Ximenynic	18	9 (triple), 11 (double)	Sandalwood Seed

Table 1: Examples of fatty acids in plant lipids used in personal care formulation

Benefits of Plant Oils in Skin Care

Formulators in the personal care industry incorporate plant oils and their fatty acids into skin care preparations to support the natural physiologic functioning of the human body. The fatty acids in the plants are extremely

beneficial to the physical and biochemical properties of the skin.

The physical benefit of applying fatty acids to the skin is to support the skin's function as the body's primary barrier; it protects the organs from impurities while it also regulates temperature and fluid levels (Shukla, 2004; Aburjai & Natsheh, 2003). Topically applied plant seed oils rich in fatty acids act as an occlusive agent helping the skin to retain moisture inside by reducing transepidermal water loss. The biochemical benefits of applying plant seed oil include the provision of skin barrier functions and additional nourishment (Hettiarachchi, 2014).

Uses of Plant Oils in Skin Care:

- Plant Oils are used as carrier oils for many soluble active ingredients (barrier, moisturising, nutrition, and healing).
- Plant oils are easily formulated in liquid and semisolid emulsions; an emulsion is a good format to deliver both oil soluble (hydrophobic) and water soluble (hydrophilic) active ingredients in precise dosages.
- Plant Oils may be broken down (hydrolysed) to free fatty acids and used to derive products such as soap, fatty acid amides, solubilizers, emulsifiers, etc.

Speciality Oils

Speciality oils provide additional market appeal as the R&D Scientist and Marketer are able to capitalise on unique attributes when developing and promoting the product, respectively. Very often, extensive research is required to identify unique plants from which beneficial oils can be derived. While a discovery may be made about the oil's unique benefits, it is not nearly enough to begin commercialization activities. Much more work is involved, including an understanding of its functional mechanism, determining what other oils exist which offer similar benefits, and ultimately, whether the plant oil can be produced in commercially viable quantities and at acceptable price levels.

Recent examples of specialty oils already on the market include Jojoba, Argan, and Marula as well as a newcomer, Australian Sandalwood Seed Oil.

Oil:	Botanical Name:	Description:	High Concentration:	Uses:
Jojoba Oil	<i>Simmondsia chinensis</i>	A liquid wax that is structurally similar to the natural oil in human sebum	Oleic Acid (5-15%)	Used by formulators in the personal care industry as a natural emollient, occlusive agent as well as acting as a humectant (Aburjai and Natsheh, 2003).
Argan Oil	<i>Argania spinosa</i>	An oil extracted from the fruit of the Argan Tree (Guillaume, 2011).	Oleic Acid (43-49%) Linoleic (29-36%)	Little scientific research has been conducted on this oil. Traditionally it was used in Morocco to treat various ailments such as dry skin, acne, psoriasis, eczema, wrinkles and joint pain. (Guillaume, 2011).
Australian Sandalwood Seed Oil	<i>Santalum spicatum</i>	A fatty acid oil extracted by Green Chemistry CO2 super-critical extraction	Oleic Acid (48-56%) Ximenynic Acid (28-36.5%)	Extensive clinical and scientific research into the functional mechanism of Ximenynic Acid, a competitive inhibitor on Arachidonic Acid, blocking the development of downstream eicosanoids. Like "Aspirin for the Skin".

Summary

The use of plant oils in personal care formulations has a long and rich history. While there are some common and consistent fatty acids used in personal care, the search for new and exciting oils continues. It is clear from recent market trends and product introductions that consumers are looking for more natural, sustainable, and plant-based ingredients to improve their physical appearance. It is clear that the dominance of mineral/petroleum based ingredients is fading.

As such, the challenge and opportunity for ingredient suppliers and personal care product manufacturers alike is to find these novel, natural ingredients, conduct enough research to understand their functional mechanism(s), and assure a sound and consistent supply chain is available.

Australian Sandalwood Seed Oil presents personal care

product formulators and manufacturers just such an ingredient. With years of clinical and scientific study, published in numerous peer-reviewed journals, Ximenynic Acid (the active component of Sandalwood Seed Oil) has a clear mechanism of action.

In the past, the challenge for this unique fatty acid was in the commercial availability as the only source was from the Ximenia bush native to Africa. This bush is now an endangered species. An alternative source is Australian Sandalwood Seeds (*Santalum spicatum*). This has become possible with the growth of the Australian Sandalwood industry and the renewed awareness and popularity of Australian Sandalwood. With Australia now supplying over 85% of the world's sandalwood requirements through sustainably managed plantations and wild sources, sourcing a viable and consistent supply of Ximenynic fatty acid in an ideal format for personal care products may finally be a reality.

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About Us

Down Under Enterprises, with operations in the US and Australia, provides pure Australian essential oils to customers around the world. Our roots are in Tea Tree Oil (*Melaleuca alternifolia*), but we also offer a full range of 100% pure Australian Essential Oils, many of which are US Department of Agriculture (USDA) Certified Organic.

We only deal with Australian essential oils directly from the source - our family and friends - who own and operate plantations across Australia. When you work with Down Under, you're working with the direct link to the farmer, with access to our full distribution facilities in Australia and in North America.

Down Under Enterprises has always focused on providing clients with superior quality - always 100% - pure Australian essential oils, and we back it up with the best Customer Support in the industry.

Down Under Enterprises is accredited by the Australian Tea Tree Industry Association (ATTIA) Code of Practice (CoP), offering exclusively Pure Australian Tea Tree Oil®. This distinctive logo is the assurance you are getting the very best quality Tea Tree Oil - pure, true and unadulterated Australian Tea Tree Oil.



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