Beeswax

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Contributor: Ronald Marquez

Beeswax is one of the natural waxes that have been used as a support ingredient in cosmetic and pharmaceutical formulations. Although it has well-known healing properties, it remains a secondary and poorly valued product, particularly in South American countries' apiarian production. In Latin America, for example, the apiarian activity can be traced back to stingless bees in pre-Columbian times. Then, with the arrival of the Spaniards in the 16th century, honey bees (*Apis mellifera iberian* and *A. m. mellifera*) were introduced, which were joined afterward by other breeds such as *A. m. ligustica* and *A. m. scutellata*. Over the years, honey has been the main product from the apiarian farmers, being beeswax a secondary product, mainly used for the regular renewal procedure of the hives. Nowadays, beeswax's cosmetic and pharmaceutical use is found at the level of small laboratories and small businesses.

beeswax wax biomaterials bee natural product

1. Beeswax

The term "wax" refers to mixtures of compounds such as esters, long-chain hydrocarbons, and ketones, which form materials with high melting points and excellent water resistance. In addition, there are waxes of animal, vegetable, and microorganism origin [1]. Beeswax is a fat produced by bees to build their honeycombs. The bees secrete the wax in the form of small rounded scales in the four ventral glands in the lower part of the abdomen, and it is synthesized as a reduction of sugars of food origin. The beeswax-making process phases are: bees eat honey and sugars (6 carbons molecules), which are absorbed in the intestine. From there, they pass to the interior of their body, where they are transformed into small fragments (2 carbons). Then, in the wax glands, they recombine differently to form, on the one hand, the fatty acids and hydrocarbons (between 18 and 36 carbons), and on the other, the wax esters and alcohols (between 24 and 33 carbons). The mixture of these products is known as beeswax [2][3][4][5].

2. Uses and applications

Beeswax has played an essential role in history and popular tradition for many years. Historically, beeswax has been used for candle manufacture; it also was used in letter envelopes seals, sculpture making, and sealing coffins, among other applications. Due to beeswax characteristics, properties and benefits, it is used in both handcrafted and industrial products[6][7][8][9][10]. Industry uses beeswax as an insulating and hydrophobic component of numerous products. For example, it is used in electrical cables to isolate copper from moisture, in

electronic circuits, to protect leather, in the preparation of varnishes, inks, matches, and protective waxes for cuttings [11][12].

Beeswax goes into the composition of ointments and creams as a fat base and thickener. The major use in this field is depilating wax, a mixture of beeswax and resins. Beeswax has anti-inflammatory and healing properties and is thus widely used in cosmetic and pharmaceutical products [13][14]. It is used to cover sewing cords in shoe production, paperboards, and even in some cultures to produce dried meat. It is also used in shoe polishes and creams to protect cans from acidic attacks from fruit juices and other corrosive agents. It is used to make models for pieces in jewelry and sculpture modeling due to its malleability[3][15]. Beeswax in some Asia and African countries is used to create batik fabrics and manufacture small metal ornaments through the molten wax method[16]. Companies such as Stockmar and Filana use beeswax to make wax crayons. Additionally, candelilla wax has been proposed in beeswax crayon formulations[17]. Stockmar also manufactures modeling beeswax.

3. Beeswax physical properties

Beeswax is an inert material with high plasticity at a relatively low temperature (around 32ºC)[12]. Its melting point is not constant since the composition varies slightly depending on its origin. Typical values are between (62 °C to 65 °C)[18]. Its relative density at 15 ºC is reported between 0.958 g/cm^3 to 0.970 g/cm^3, while its thermal conductivity is approximately 0.25 W/m.K[19]. It is also known that the viscosity at 100 °C is less than 20 mPa. The boiling point is unknown and has a flash point at temperatures higher than 180 °C[20].

4. Pharmaceutical properties

Sterols present in beeswax are therapeutically beneficial compounds effective in lowering cholesterol levels. The incorporation of sterols into different foods may be convenient[21]. It is used for delicate skin care in cosmetology, especially when it is dry. It cleans the epidermis and softens and nourishes the dermis, thus preventing skin aging. Products that contain beeswax soften the skin. White wax typically enters the composition of nourishing, astringent, cleansing creams and skin masks. The therapeutic properties of beeswax were already known in antiquity. In his famous "Canon of medicine," Avicenna cites several medicine formulas whose composition includes beeswax. In addition, archeological evidence of beeswax ointments has been found from as early as the 16th century[22].

Nowadays, beeswax continues to occupy a prominent place in medicine preparations[14]. According to Pharmacopoeia, plasters, ointments and creams should be prepared in pharmacies with a beeswax base. In addition, the white wax is included in the composition of creams, astringents, cleaning, whitening, and facial masks. In the United States, chewing gum (combs wax) is attributed to have specific valuable properties, among others, to activate the secretion of saliva and gastric juice, eliminate dental stones, and reduce nicotine concentrations in smokers[23]. Recently, beeswax has been used to encapsulate drugs and flavors[24][25].

5. Beeswax chemical composition

Beeswax comprises at least 284 different compounds, of which 21 major compounds represent 56% of the total composition of the wax. The average composition of beeswax is presented in Table 1 [2].

Table 1. Beeswax composition

Components	Percentage (%)
Hydrocarbons	14
Monoesters	35
Diesters	14
Triesters	3
Hydroxy monoesters	4
Hydroxy polyester	8
Monoester acids	1
Polyester acids	2
Free fatty acids	12
Unidentified material	7

6. Beeswax purification

As found in combs, beeswax is yellow and has a particular smell similar to honey. Its purification is carried out through several procedures reported in the literature. The purification procedure consists in melting beeswax in a water bath at a temperature higher than 60 ºC. Then it is bleached through a variety of methods, among them:

exposition to the sun[26], through diatomaceous earth and activated carbon[27], or with sulfuric acid [23]. The molten beeswax is then poured on a vessel and partially submerged in temperate water while slowly mixing, and the impurities are scraped off the surface. The purified beeswax is white and translucent and has thin edges.

7. Beeswax formulation for creams and ointments

In general, to obtain a dermo-cosmetic cream, the components of each phase must be mixed separately at a temperature close to 60 ºC, then incorporated one phase into the other under mixing, cool, and homogenize. However, the preparation is more straightforward for ointments as a single phase. The procedure consists basically in melting the beeswax at a temperature higher than 65 ºC and adding the formulation components. In this sense, the cream or ointment components must be chosen according to the objective pursued with the application on the skin. Thus, beeswax can be used as a component in moisturizing creams for burns, stretch marks, wrinkles, cellulite, lip balms, and even sunscreen formulations[28][29][30][31].

This entry is from: Technological use of beeswax for obtaining organic products, non-toxic for the human being.

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