



# Beeswax: History, Uses and Trade

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## BEESWAX USE IN THE PAST

### History of beeswax use

The old Egyptians used beeswax when embalming, for mummification of their pharaohs and for retaining the permanency of wig curls, for preserving the papyrus scrolls and to protect paintings. The wrappings of Egyptian mummies contained beeswax<sup>9</sup>. Beeswax was mentioned in 32 prescriptions, given in a papyrus, compiled in Egypt about 1550 BC<sup>20</sup>

The ancient Persians used wax to embalm the dead, while the ancient Romans modelled death masks and life-size effigies from beeswax. The world mummy derives from a Persian word meaning wax



In ancient times beeswax was used as an adhesive to join two surfaces together.

The ancient Greek legend of the Athenian, the architect Daedalus (Dedalos), is remembered because he and his son Icarus tried to escape from the island Crete, made themselves wings of bird feathers, which they fastened to their bodies with beeswax. Flying too high, Icarus had the wax which held its wings to his body, melt, and he plunged into the Aegean Sea, drowning. His father flew at a lower height and made it safely to Athens, where he built a temple to honour Apollo.

The ancient god, Pan, guardian of bees, invented a musical instrument, Pan's Pipes, by joining reeds together with beeswax, and blowing through them to make music. The great Greek physician, Discorides, wrote of rolling beeswax into sheets which was then used to make artificial flowers. Ancient jewellers and artisans knew how to form delicate objects from wax and cast them later in precious metals. Colours of ancient wall paintings and icons contain beeswax which has remained unchanged for more than 2000 years<sup>11</sup> (Birshtein et al., 1976).

The Greek-Roman doctor Galen, 2<sup>nd</sup> AC used beeswax in a cooling ointment. The famous Iranian physician Avicenne, 10<sup>th</sup> century AC, recommended beeswax for medicine.

According to<sup>47</sup> “in China’s most famous medicine book “The Shen Nong Book of Herbs”, 1-2<sup>nd</sup> century BC, beeswax was recognised as a top medicinal ingredient. It is praised for its beneficial influence on blood and energy systems and the overall balance of the body. The author attributes beauty enhancement and anti-aging properties to beeswax. Combined with other ingredients it is applied on the skin for treating wounds and as a health food for dieting. Many recipes are given in this authoritative source of traditional Chinese medicine. Ge Hong (about 284-364, Jin dynasty) and Sun Simiao (581-682) recommend 'beeswax therapy', i.e. a heat treatment of skin areas with cloths impregnated with molten beeswax. Liu Yuxi in 841 gives a detailed description of beeswax therapy more than 1000 years earlier than the paraffin wax therapy from the Frenchman Barthe de Sandford (1909). "The Sages Prescriptions", edited by the Song Dynasty Imperial Hospital (992), mentions diet therapy, health-improvement and anti-aging prescriptions containing honey, beeswax and honeycomb”.

Candles of beeswax were used already by the ancient Egyptians, ancient Greece, Rome and in old China<sup>21</sup> It was introduced in churches since the beginning of Christianity in Europe. Since 4AC it is required by the Roman Catholic Church that only beeswax candle should be used in the church. This law is still valid but no longer 100 % beeswax is required, the percentage varies according to the local Episcopal instruction between 5 and 50 %.



Beeswax was used for making of figures and cult objects in ancient Egypt. In regions with stingless bees stingless-beeswax figures were made in different South American countries and in Australia<sup>21</sup>.

Beeswax was an important ingredient of ancient seals<sup>21</sup>. At the beginning pure beeswax was used and only later resin and colour were added.

In ancient Egypt beeswax was used for writing tablets, the oldest known being from around 1300 BC<sup>21</sup>. The use of writing tablets continued until after the Middle Ages in Europe.

The production and selling of beeswax and beeswax candles was a good business until the introduction of paraffin wax in the 19<sup>th</sup> century. Nowadays beeswax has lost its exclusiveness, but it remains the most expensive of all natural waxes.

### Theories about the origin of beeswax during the ages

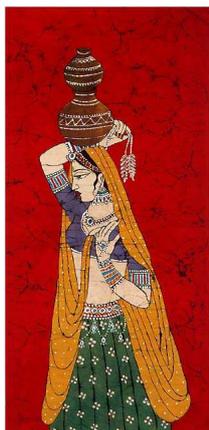


The Greek philosopher Aristoteles wrote between 344 and 342 B.C. that beeswax originates in the flowers. This theory which was supported by the Roman apiculturists and writers Varro (116 to 27 B.C.) and Pliny, the Elder (23 to 79 A.D.). This theory predominated until the Renaissance.

Swammerdam wrote in 1673 that wax was prepared by bees from pollen. In 1684 Martin John observed for the first time wax scales. In 1744 the German scientist Hornbostel<sup>28</sup> reported that bees themselves produce the wax. This report was not considered by the scientific community until the publications by Hunter in 1792<sup>30</sup> and in 1814 by Huber<sup>29</sup>. Hunter noted and that bees secrete wax and build combs, and also, that newly built combs are

white. He observed that bees do not need pollen to make wax. The views of Hunter were expanded by Huber, who proposed that sugar is needed to produce wax. In 1903 the process of wax synthesis was described in detail by Dreyling<sup>23</sup>.

While in early times beeswax was the only available wax, with time man learned to produce other waxes from plant animal and lately also of synthetic origin.



### Beeswax as ingredient of artistic materials

#### Batik art

Beeswax is used in the batik art. The word "batik" is of Indonesian origin, where batik art was invented. Evidence of early examples of batik have been found in the Far East, Middle East, Central Asia and India from over 2000 years ago. It is conceivable that these areas developed independently, without the influence from trade or cultural exchanges. However, it is more likely that the craft spread from Asia to the islands of the Malay Archipelago and west to the Middle East through the caravan route. Batik was

practised in China as early as the Sui Dynasty (AD 581-618). These were silk batiks and these have also been discovered in Nara, Japan in the form of screens and ascribed to the Nara period (AD 710-794). It is probable that these were made by Chinese artists. They are decorated with trees, animals, flute players, hunting scenes and stylised mountains. Indonesia, most particularly the island of Java, is the area where batik has reached the greatest peak of accomplishment. The Dutch brought Indonesian craftsmen to teach the craft to Dutch warders in several factories in Holland from 1835. With this method colour is introduced into fabric. Portions of the cloth, covered with wax resist the dyes. When the dyeing process is complete the wax is removed by heat. Batik is still used all over the world. Different books on batik can be found on the market.



Ancient Indonesian batik



Ancient Chinese batik

### Lost wax casting

Figures containing beeswax survived in royal Egyptian tombs dating from 3400 BC<sup>18</sup>. Throughout history it has been used in commerce and business as a document seal. One of the most important uses of beeswax was in “cire-perdue”, or lost wax casting<sup>17, 22</sup>. This method is very old and was known in different old high cultures as the Summerians, India, China, Egypt. Many of the world’s most famous statues were produced using the lost-wax casting process. The object to be cast in metal is first sculptured in wax. It was then coated with clay and hardened by heat, thus melting the wax. Molten metal is then poured into the clay model. This technique requires a lot of metal. Less metal is required if a core of removable material is coated heavily with wax in which the image is engraved. The whole is then coated with clay, dried, the wax melted out and the metal poured in.



Ancient India



Ancient Nepal



Africa, 17 C



Ancient Peru



Charles V



Fountain lion, old Italy

### Old lost wax sculptures and figures

#### *Bronze preservation*

Bronze statues should be coated twice a year with a solution consisting of 1/3 pound of pure beeswax dissolved in one quart of pure pine turpentine. This solution is to be brushed over the statue in a swirling motion, using round semi-stiff hair brushes. Let solution dry for 24 hours, then rub lightly with a felt, velvet or wool pad, to paint only the high points of the statue so as to leave the depressions with a shadow effect. Care must be taken to apply the solution to the statue only when the statue is dry.

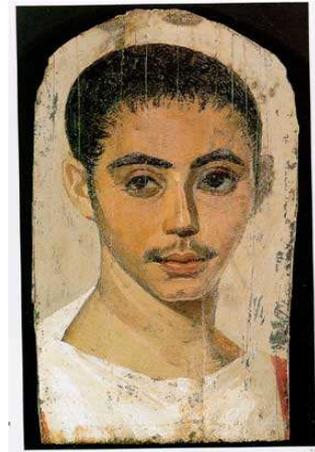
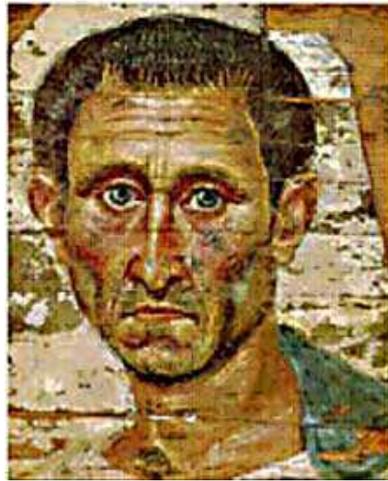
#### **The sculptures of Madam Tussaud's**

The sculptures of Madam Tussaud's in London and now in other countries, too, are widely known and copied in many countries. In the museum, famous people are copied in wax and dressed as life-sized figures. A mixture of three parts beeswax and one part of a harder wax are used<sup>48</sup> Modelling in wax, or ceroplasty is a well developed art used also for scientific models in important collections around the world<sup>6</sup> During the last century, wax flower modelling was apparently popular in Europe. A bibliography on wax modellers, collections and history<sup>45</sup> by a handbook on sculpting with wax and plaster<sup>40</sup> have been published.



#### **Encaustic painting**

Beeswax is used also in encaustic painting. In this painting technique beeswax is a chief ingredient of the colour, used by the artist. Encaustic painting was very popular with the ancient Greeks and Romans. Beeswax is melted with a resin and pigment and is then applied by heatable pallet. The colour application should have been very quick, because dallying would lead to the wax re-solidifying on the brush, making it impossible to apply as a paint. The finished paintings is durable and does not attract dust. Ancient encaustic paintings can still be admired in museums, e.g. in the British museum. Encaustic painting was practiced by Greek artists as far back as the 5th century B. C. Most of our knowledge of this early use comes from the Roman historian Pliny, who wrote in the 1st century A. D.. Pliny seems to have had very little direct knowledge about studio methods, so his account of techniques and materials is sketchy. According to Pliny, encaustic was used in a variety of applications: the painting of portraits and scenes of mythology on panels, the colouring of marble and terra cotta, and work on ivory (probably the tinting of incised lines). For more informations, consult [www.encausticart.com](http://www.encausticart.com), <http://beetree.se>



Roman encaustic painting 2-4 AC

**Further reading:** <sup>14, 18, 21, 22, 26</sup>

## BEESWAX USE AT PRESENT

Besides its use for foundations, which is probably the main use, wax is also used for following purposes: cosmetics 25-30, pharmacy 25-30 %, candles: 20 % and other purposes: 10-20 % <sup>19</sup>.

Beeswax is often preserved in archaeological deposits and thus there are many witnesses for its early use <sup>17</sup>. More details concerning the different uses of beeswax in past and present are given elsewhere <sup>10 15, 16, 19, 22, 26, 27, 35, 37</sup>.

Beeswax has been used in a variety of products and processes from packaging to processing and preservation. It was used as a component of numerous applications in industrial technology: as components of insulating materials, but all of the descriptions being published before 1981 <sup>51</sup>. Many of these applications could be accomplished with other, cheaper waxes. Since most of these processes involve large scale and complicated production procedures, they are not described here.

The different uses of beeswax are summarised in the table below.

### Application of beeswax for different product categories

after CBI, EU Market Survey, Honey and Beeswax, 2002, www.cbi.eu

Product category	Products	Characteristics
Candles	Candles (poured into moulds or dipped)	Solidity, slow burning, therapeutic effect
Wax foundation	Rolled and poured wax foundation sheets	Production increase of honey
Art	Wax figures and statues	Melting and moulding properties, solidity and resistance against melting
Sculptures	Metal castings, modelling, jewellery, lost wax casting	Plasticity, mouldability, melting properties
Engraving	Glass and metal engraving	Protection against etching acid, resist technique
Processed food	Confectionery, bakery, packaging, Coating of jellied sweets and liquorice	Separation agent, preservation, anti-sticking agent

Product category	Products	Characteristics
Pharmaceuticals	Drugs, pills, capsules, salve and ointments	Consistency, binding agent, time release mechanism, carrier of drug
Physiotherapy	Compresses	Warmth retaining capacity
Natural therapy	Ear plugs	Softness, impermeability
Cosmetics	Creams, lotions, lipstick, mascara, eye shadows, deodorants, hair creams, depilatories, hair conditioners	Emollient and emulsifier. Improvement of appearance, consistency and sensitivity to melting
Textiles	Batik	Waterproofing, paint resistant, resist technique
Handicrafts	Eco design	Plastering agent for artisans
Musical instruments	Flutes, didgeridoo, violins, drums	Softness of mouth parts and reduction of porosity
Varnishes and polishes	Paintings, art restoration, metal, wood and leather treatment	Protection, impermeability for air, humidity and pests
Industrial products	Anti-corrosion rust inhibitor, lubricants	Decrease viscosity, drawing agent, prevention of corrosion

Beeswax can be used as a thickener of bio-degradable lubrication greases<sup>34</sup>

## Candles

Candles made of beeswax have been used by mankind in religious ceremonies since a very long time<sup>22</sup>. Beeswax candles can be made by different methods: pouring, dipping, rolling, extruding, drawing and pressing. The different methods of candle making are described in detail elsewhere<sup>16</sup>. Since beeswax has a higher melting point than most paraffin waxes (most of which melt between 48 and 68<sup>0</sup>C) beeswax candles remain straight at higher ambient temperatures.. Waxes with a melting point above 88<sup>0</sup>C do not perform well during burning.

There are three methods of making candles: molding, dipping and rolling. Explanation of these techniques are found elsewhere<sup>15, 16</sup>:



rolled candle



molded candles



dipped candles



molded beeswax figures with a rolled candle in the middle and molded candles on the sides

### Molding

Beeswax is molded in different shapes, modern ones are made of silicon. Many different shapes are supplied with instructions how to make the candles under home conditions. Candles molded in silicon forms are easily made. The candles can be taken out of the forms after hardening of the wax. Wax is liquefied easily by placing the wax in a pot, situated in a water bath heated at 70 to 80 °C. Making the candles before Christmas when it is cold, forms can be placed in the open to speed up hardening. An alternative is placing the candles for about half an hour in a freezer.

### Dipping

Dipped candles are very appealing, but the technique is more difficult and labour intensive. It is great fun to dip candles in a group or within the family.

### Rolling

Rolling is a very easy way of making candles. Comb foundations are mostly rolled around a wick. Foundations should be softened at about 25-30 °C to increase plasticity.

### Tips for optimal burning of a candle:

- beeswax candles burn significantly longer than paraffin candles <sup>10</sup>
- For optimal and long duration of burning beeswax should be stored for at least an year in the freezer
- *Thinner candles* (until 24 mm) burn more constantly than thicker ones and build less smoke and soot.
- *Thicker candles* can begin to soot after a certain time. In this case the wick should be shortened by cutting it off with scissors. After extinguishing the fire the wick should be carefully placed in the liquid wax, without damaging the edge of the candle. Before lightning these candles again cut off the already burned part of the wick. These candles should burn for a longer time in order to prevent worsening of the ration between the burnt wax and the burnt wick
- The first time you line burn your candle for one hour for every 2.5 cm of candle diameter. This will allow the pool of wax to be extended and will prevent the building of a tunnel in the centre
- If wick size is correctly proportioned with respect to the diameter of the candle (information supplied by the trading company), the beeswax candle is less likely to drip than candles made from other materials.

## Homemade beeswax furnishes and polishes



**Beeswax furniture furnish**



**Beeswax floor furnish**

### Leather furnish

5-6 parts of beeswax, 8 parts tallow and 8 parts neatsfoot oil

This is not a polish. It is a lotion that conditions and waterproofs smooth leather superbly. Heat ingredients together to 160 degrees F. Mix thoroughly and pour into containers.

### Wood polish (liquid or paste like)

a) 1.5 parts turpentine and 1 part beeswax or b) 4 parts beeswax, 2 parts turpentine, 1 part of orange, lemon, coconut or linseed oil. Grate beeswax into the turpentine. Add one of the oils and mix. Store in labelled tins or bottles with tight fitting lids.

The ratio of solvent to beeswax determines whether this is a paste wax or a liquid polish. Other ingredients are often added such as pigments, lemon oil, linseed oil, or tung oil. More volatile solvents can be added or substituted to make a faster-drying, thinner polish. Carnauba wax is often added to make a harder, shinier finish.

Classically, on "raw" wood the paste polish is applied warm, so the turpentine soaks into the pores of the wood and pulls some beeswax with it. Excess polish is brushed or scraped off. When dry, the resultant wax film is polished with brisk rubbing.

### Artists' varnish

3 parts turpentine and 1 part beeswax. Mix thoroughly. Wax varnish has a beautiful non-glossy sheen. It is easy to remove from a painting or plaque without damaging the paint, though it yellows a little faster than most other varnishes so you will have to clean your painting sooner (after ten to fifteen years). However, it gives a period effect that is hard to duplicate with modern materials.

Detailed discussions and recipes for preparations with synthetic wax are presented by Jones<sup>32</sup> who also lists reasons such as the formation of soft, easily marred films and a lack of availability, why natural beeswax is increasingly being replaced by other waxes in polishes.

There is a variation in recipes, thus it is obvious that there are many ways of preparing a wood polish suitable for particular application. Turpentine is the most commonly available natural solvent for wax, but other oils may be substituted to avoid the rather strong odour of turpentine. Suitable alternatives are orange, lemon or linseed oil, or other refined vegetable oils. The wax content can range from 5 to 50% and occasionally even more. The consistency of the paste or oil may change, but can be corrected with appropriate adjustments in the proportions of each ingredient, e.g. less oil or more wax if it is too liquid.

## FOOD AND HEALTH

### Cosmetics

Since ancient times, the basic recipe for creams and ointments has consisted of a mixture of beeswax and oil in various proportions according to the desired consistency. Beeswax has an irritation potential of zero, and a comedogenicity rating of 0 - 2, which means that when formulated and used correctly in cosmetic

formulations, beeswax will not cause a problem or clog the pores, but brings a host of very positive attributes, such as general healing and softening, as an antiseptic, and an emollient to cosmetic products. Beeswax has unique characteristics, making it an ideal material for cosmetics:

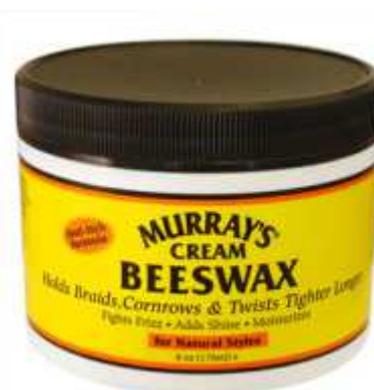
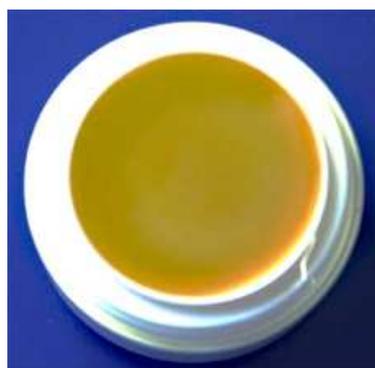
- ❖ *Builds stable emulsions, improves water binding of ointments and creams*
- ❖ *gives the skin a protective layer of a non-occlusive type, increasing the protective action of sun creams, its elasticity and plasticity improve allow thinner films and provide a greater permanence on skin and lips*
- ❖ *Improves soap function, gives a protective film on skin and improves its elasticity.*
- ❖ *Improves protective action of sun creams, does not provoke allergy.*
- ❖ *Has antibiotic and thermo-storing properties*
- ❖ *Does not provoke allergic reaction*
- ❖ *Desired effect can be achieved often by as little as 1 to 3 % beeswax<sup>16</sup>*
- ❖ *It not only improves the appearance and consistency of creams and lotions but is also a preferred ingredient for lipsticks, because it contributes to sheen, consistency and colour stabilization*

Other cosmetic applications are found in cold creams (8-12% beeswax content by weight), deodorants (up to 35 %), depilatories (hair removers, up to 50%), hair creams (5-10%), hair conditioners (1-3%), mascara (6-12%), rouge (10-15%), eye shadows (6-20%) and others.

Traditionally, vegetable oils were used but they become rancid and limit the period for which such creams can be used. Today, most plant oils have been replaced by mineral oils such as liquid paraffin or preservatives are added. Selective use of vegetable oils from olives, corn, peanuts, jojoba, cacao, palms, coconuts and others still continues, since many of their beneficial effects cannot be provided by synthetic mineral oils.

In order to mix the otherwise incompatible beeswax and oils with water, all of which are essential ingredients of any cream or lotion, an emulsifier has to be added. Borax is the classic emulsifier, available in most pharmacies. Today's "high-chemistry" cosmetics use a large array of other synthetic emulsifiers. The chemical process on which the emulsification is based is the saponification of the acids in beeswax, i.e. the result is technically a soap. The associated cleansing effect is exploited in so-called cleansing creams, which are very much like simple skin creams.

To remove the free acids from beeswax so that it no longer needs an emulsifier and can be easily mixed with pigments and mineral products, a special process was developed and patented<sup>13</sup>



Beeswax cosmetic products

## Recipes for home made cosmetics

### Skin cold creams

- ❖ *Add 5 parts of beeswax to 3 parts of coconut oil. Melt ingredients in separate heat-resistant wide-mouth jars in a simmering pan of water, heated at about 70 ° C. Mix thoroughly. Place the mixture jar in a pan of cool water and continue stirring. Transfer the cool cream into final containers. The cream that is fairly solid when cold but will "melt" onto your hands as you rub it in. Ingredients other than coconut oil may be used. It is in this formula because it melts at skin temperature. Olive oil is often mixed with beeswax to make a skin lotion.*

- ❖ *1 part beeswax, 2 parts water, 3 parts oil, borax (5% to 6% of the beeswax used). Heat beeswax and oil to 160 degrees F. Heat the borax and water to 70 ° C. Mix and stir. Perfumes or essential oils should be added at 60 ° C, and the mixture should be stirred until it is 49 degrees hot when it should be poured in jars and allowed to cool. The borax emulsifies the beeswax, sort of like making soap. Borax is alkali and it neutralizes the fatty acids in beeswax when mixed, producing an oil-water emulsion cream-like in consistency.*

### **Cream against rough skin**

*Roughly equal parts of beeswax and olive oil melted together is all that has been needed for centuries to make a salve that helps prevent and heal chapping and rough skin. Olive oil has been mixed with beeswax for centuries, and is good for dry skin that needs to be softened. In modern times odourless/colorless mineral oil has been mixed with beeswax to make a soft, flexible coating that is not absorbed by the skin and repels water yet is removed easily with soap and water.*

### **Lip balm**

*2 part shredded beeswax, 4 parts of coconut oil, 1 part glycerine (optional)  
2 parts liquid honey, 4 drops of essential oil such as almond, peppermint, orange or lemon. Heat the beeswax, coconut oil and glycerine to 70 degrees ° C. Remove from heat. Add the honey and stir until the mixture starts to thicken (about 60 ° C), then evenly add the essential oil while stirring and continue to stir the mixture until cool. Pour into final containers (small screw-top balm jars) at about 49 degrees and let set until completely cool.*

### **Natural lip gloss**

*1 part of shredded beeswax, 2 parts oil of your choice, natural colouring as needed. Heat the beeswax and oil to 70 ° C. For colour, add a natural vegetable colouring (like beet powder, raspberry or blackberry juice). You will have to experiment with the right combination of wax oil and colour. Pour into final containers and let set until completely cool. Package with a lipstick brush.*

The part measures are mostly by weight. If mixtures are heated use hot water watch out: **hot wax is inflammable!**

### **Food processing**

Beeswax is considered safe for human consumption and has been approved as an ingredient in human food in the USA <sup>50</sup> It is inert, i.e. it does not interact with the human digestive system at all and passes through the body unaltered. However, substances dissolved or encapsulated in wax are slowly released. This property is exploited in many medicinal preparations. At the same time these properties can create a problem when wax is stored near toxic chemicals and pesticides or after treatment with various drugs inside the hive. Any fat soluble toxins can be absorbed and then released much later when the wax is consumed as food, used in cosmetics or given to bees in the form of foundation sheets.

Beeswax is an authorised food preservative in the European Union under the name of E 901 <sup>24</sup> as a glazing agent on confectionery (excluding chocolate), small products of fine bakery wares coated with chocolate, snacks, nuts, coffee beans, salami, cheese, for surface coating only.

For citation purposes: Scientific Opinion of the Panel on Food additives, Flavourings, Processing aids and fruits (fresh citrus fruits, melons, apples, pears, peaches and pineapples). It is also permitted in food supplements as a carrier for colours. Consumption of 1290 g beeswax per person and day are permitted.

A common, simple and small scale application for beeswax is the protection of containers against the effects of acids from fruit juices or honey. Indeed, steel drums for storage and shipment of honey have to be treated to prevent corrosion and dissolution of iron. The treatment may involve an expensive food grade paint, a plastic liner made from a food grade plastic film or a thin coat of beeswax, beeswax being the most environmental-friendly and non toxic alternative.



### Beeswax coating of different foods

## HEALTH APPLICATIONS

### Uses according to the ancient Perso-Arabic medicine (Unani medicine)

According to the ancient **Perso-Arabic** medicine beeswax (in Persian Mom Zard) has following pharmacological effects<sup>33</sup> :

- Muhallil-e-Waram (Anti-inflammatory)
- Musakkin-e-Auja'a (Pain Sedative)
- Mulayyin-e-A'asab (nerves aperient)
- Mundamil-e-Qurooh (Wounds Healer)
- Mujaffif-e-Qurooh (Ciccative)
- Kasir-e-Riyah (Carminative)
- Dafey-e-Hikkah (Anti-pruritic)
- Dafey-e-Jarab (Anti-scabies)
- Nafey-e-Bawaseer (Piles Reliever)
- Nafey-e-Zaheer (Dysentry Reliever)
- Nafey-e-Kasrat-e-Tamas (Menorrhagia Reliever)
- Nafey-e-Waj-ul-Mafasil (Arthritis Reliever)
- Nafey-e-Waj-us-Sadar (Thoracic Pain Reliever)
- Nafey-e-Waj-ul-Meda (Stomach ache Reliever) [
- Nafey-e-Khushoonat-e-Halaq (Sore Throat Reliever)
- Dafey-e-Jaraseem (Anti-bacterial)

According to Ibn-e-Sina (Avicenna) Mom Zard has mainly talyeen (aperient), tahleel-e-auram (resolution of inflammations) and indemal (healing) properties. It is specially recommended in the treatment of waj-ul-Mafasil (arthritis), waj-us-sadar (thoracic pain), waj-ul-meda (Stomach ache) and bawaseer (hemorrhoid) [8-

13, 17]. It is also recommended in suaal-e-yabis (dry cough), bahwat-us-saut (horseness of voice), qarha-e-medi (peptic ulcer) and kasrat-e-tamas (Menorrhagia)

## Biological properties

Beeswax is the least allergenic bee product. There is only one report on skin allergy caused by beeswax<sup>39</sup> For pharmaceutical purposes beeswax is used in drugs, pills, capsules, salve and ointments as consistency, binding agent, time release mechanism and carrier of drug.

## Antimicrobial properties

Beeswax has antibacterial properties e.g.<sup>16, 29, 34</sup>, These studies showed an antimicrobial effectiveness of beeswax against pathogens such as *Staphylococcus aureus*, *Salmonella enterica*, *Proteus vulgaris*, *Salmonella gallinarum*, *Aspergillus niger*, *Candida albicans* and other *Candida* species. Honey, beeswax and olive oil mixture inhibits the growth of *S. aureus* and *C. albicans*, isolated from humans<sup>2</sup>

The antimicrobial are summarised in a 2016 review<sup>25</sup>:

## Diameter in mm of inhibition zone of inhibition arising from beeswax against pathogenic bacteria, fungi and yeasts

Bacterial strains	WMeh	WMel	WEh	WEI
<i>Listeria monocytogenes</i> CCM 4699	0.33 ± 0.58	2.67 ± 2.31	0.33 ± 0.57	4.33 ± 3.79
<i>P. aeruginosa</i> CCM 1960	1.67 ± 1.54	2.33 ± 2.08	1.67 ± 1.53	2.67 ± 2.31
<i>S. aureus</i> CCM 3953	2.00 ± 0.00	1.67 ± 1.53	1.67 ± 2.08	1.00 ± 1.00
<i>S. enterica</i> CCM 4420	2.67 ± 0.58	2.67 ± 0.58	2.17 ± 1.89	3.67 ± 0.58
<i>E. coli</i> CCM 3988	1.50 ± 1.32	4.67 ± 2.52	1.67 ± 1.53	4.67 ± 0.58
<i>Aspergillus fumigatus</i>	2.33 ± 0.58	2.67 ± 1.15	2.00 ± 2.00	2.50 ± 1.32
<i>Aspergillus flavus</i>	0.67 ± 1.15	1.67 ± 0.58	1.67 ± 0.58	2.00 ± 1.00
<i>A. niger</i>	2.33 ± 0.58	3.00 ± 0.00	3.00 ± 1.73	4.00 ± 1.73
<i>Candida krusei</i>	2.00 ± 1.00	1.83 ± 1.76	2.50 ± 2.18	4.00 ± 3.46
<i>C. albicans</i>	2.33 ± 2.08	3.67 ± 1.15	2.67 ± 1.15	3.33 ± 0.58
<i>C. glabrata</i>	2.00 ± 1.73	2.67 ± 2.08	2.67 ± 1.53	4.83 ± 1.26
<i>Candida parapsilosis</i>	2.00 ± 1.00	2.67 ± 1.15	1.33 ± 1.15	3.00 ± 3.61
<i>C. tropicalis</i>	3.00 ± 1.00	4.67 ± 0.58	2.00 ± 0.00	3.67 ± 0.58
<i>Geotrichum candidum</i>	2.33 ± 0.58	2.67 ± 2.31	2.33 ± 1.53	4.17 ± 2.47
<i>Rhodotorula mucilaginosa</i>	2.33 ± 0.58	2.50 ± 1.32	1.67 ± 0.58	2.33 ± 0.58

WMeh: 99.9% metanolic extract; WMel. 70% methanol extract; WEh: 96% of ethanol extract; WEI: 70% ethanol extract.

## Other biological activities

Anilkumar et al (2007) studied that the polyphenols from beeswax exhibit hepatoprotective and antioxidative properties in rats. In this study the polyphenols extracted by 80% methanol from bee wax (PBW) were fed to Wistar rats with CCl<sub>4</sub> (1.5 ml/kg body weight) -induced stress, at 100 mg/kg body weight and 200 mg/kg body weight for 14 days. On 15th day all the rats were sacrificed, blood was collected for serum and organs/tissues were excised for biochemical analysis. The results showed a significant decrease in hepatic antioxidant enzyme activities viz. catalase, glucose-6-phosphatedehydrogenase (G-6-PDH), glutathione peroxidase (GSH-Px), glutathione reductase, superoxide dismutase (SOD) and a significant increase in glutathione S-transferase (GST) and  $\gamma$ -glutamyl transpeptidase (GGT) by CCl<sub>4</sub>, probably due to the peroxidative effects. The prophylactic use of PBW at 200 mg/kg level resulted in a significant increase in CCl<sub>4</sub>-induced reduction in catalase, G-6-PDH, GSSGR and SOD. The hepatic levels of lipid peroxides viz. malondialdehyde, conjugated dienes and lipid hydroperoxides, enhanced by the administration of CCl<sub>4</sub> were

brought down by the ingestion of PBW at a level of 200 mg/kg. The hepatotoxicity caused by the administration of CCl<sub>4</sub> was reduced significantly<sup>3</sup>.

## Apitherapy

### Skin problems

When applied to the skin improves its elasticity and makes it look fresh and smooth. It is used for coating of drugs and pills, facilitates ingestion, but retards dissolution. Beeswax can be mixed with the drug, thus retarding drug releasing. Beeswax can be chewed for strengthening the gingival and to increasing saliva and stomach juices page 94 from <sup>43</sup>.

A mixture of beeswax, honey and olive oil can be successfully used against dermatitis, psoriasis<sup>3</sup>, against pityriasis versicolor, tinea cruris, tinea corporis and tinea faciei<sup>4</sup> against anal fissures and hemorrhoids<sup>5</sup> and against burns<sup>42</sup>. This mixture containing also propolis was successfully used against oral human mucositis<sup>2</sup>

### Other applications

It was found that oral administration of a mixture of 6 beeswax alcohols called D-002 (50 to 100 mg/day) for 6 weeks may ameliorate arthritic symptoms meanwhile improve clinical evolution in patients with osteoarthritis as reported in a 2015 review by Molina et al: The mixture was reported also to have effects both in joint health and in gastroprotection,, tested both in animals and in clinical experiments with humans. These activities are due to antioxidant and anti-inflammatory effects of this mixture<sup>41</sup>. An addition of D-003, a mixture of sugar cane fatty acids with D-002 is even more successful in treating of human osteoarthritis<sup>44</sup>

Warm beeswax has excellent warming properties when applied against inflammations of muscles, nerves and joints. For this reason the Bulgarian medical doctor Pochinkova suggests that beeswax is the main bee product to be used for thermo-therapy, see page 140 from <sup>43</sup>. For this purpose following application is suggested applied after muscle, nerve and tendon inflammation due to colds, lumbago, neuritis, mialgitis, arthosis, arthritis:

*Dip a piece of soft cotton cloth, cut according to the size of the applied body part, into liquid beeswax. Lay down to cool at an even place. Before use warm up, e.g. at a maximum of 50 ° C in an oven, and place on body part, mostly overnight, cover with a scarf for insulation. The wax cloth can be used many times. Such wax cloths are available at chemists or drug stores in some countries.*



Beeswax packing against small children's cold are commercially available in some countries (e.g. Germany and Switzerland)

## ECONOMY AND TRADE

Beeswax economy and trade date from very early age Beeswax was traded already in old Greece and Rome. The Romans demanded beeswax when they conquered Corsica in 181 BC<sup>14</sup>. In Medieval European times wax was a unit of trade for taxes or other.

Different grades of wax are traded. The colour of beeswax will vary from light to medium and dark. Light yellow beeswax, mild in odour is preferable. Bennet<sup>8</sup> divides wax into three grades. The first of these is “crude, bleachable and non-bleachable, available in lumps and blocks”. The other two grades are white and yellow waxes, both of which described in the Pharmacopoe<sup>7</sup>. Today, mainly two basic types of beeswax are traded: pharmaceutical and cosmetic grade and a general application grade. Strahl and Pitch, the leading wax refiners in the USA trade at present 6 cosmetic/pharmaceutical grades and 5 general use beeswax grades. Beeswax from different countries has different properties, especially its readiness to bleach<sup>16</sup>. Nearly all commercial wax produced is by *Apis mellifera*, while a substantial part of the wax in China is produced by *A. cerana*.

It is difficult to obtain reliable figures on wax production, as the greater part of beeswax is used in beekeeping for producing comb foundations. Of all bee products the economic importance of beeswax is second after that of honey. It is estimated that its production is about 1.5 to 2.5 % of that of honey<sup>19</sup>. On the basis of the assumption by FAO Comtrade statistics, that 1.19 million tons of honey were produced in 1991, between 17,850 to 29,750 tons of wax was produced during the same period<sup>31</sup>. The major world producer is China with an annual production of 6000 tons<sup>38</sup>.

According to Faostat in 2011 64,000 tons were produced in the world, Asia (mainly India) being the major producer with 31,000 tons.

The same source cites following figures on the trade of beeswax: “*In world trade statistics beeswax is grouped with other insect waxes. Nevertheless, beeswax is a major component of insect waxes, and the trade value can be safely assumed to be that of beeswax. Based on the information derived from COMTRADE data base, total value of the insect waxes traded internationally during 1988, 1989, 1990 and 1991 was 23.63, 23.27, 26.08 and 23.35 million US\$, respectively. During 1992, major exporting countries were China (14.9%), United Republic of Tanzania (11.4%), Germany (11.1%), Canada (7.0%), the Netherlands (6.3%), Brazil (6.1%), Japan (5.7%), USA (4.8%) and Ethiopia (3.7%); collectively accounting for 71% of the total trade volume in insect waxes. Australia, France, Chile, UK, Dominion Republic and New Zealand were some of the minor origins*”

While China is the main beeswax exporter according to FAOSTAT it does not appear on the same statistics as a main beeswax producer.

According to a 2015 statistical report China as the main beeswax exporter, exported in 2014 11 000 tons, Germany being the main buyer with 24 % of this production. During the same year the main beeswax buyers were USA 21 %, Germany 27 % and France 10 % of the beeswax world imports<sup>1</sup>

**World trade in beeswax for 2003, after <sup>12</sup>**

<b>World trade in beeswax</b>	<b>Export tons</b>	<b>Import tons</b>
World	10'336	11'949
Asia	5'213	1'995
Africa	795	258
Europe	2167	6'873
<b>Biggest exporters and importers</b>		
China	4'814	127
Dominican Republic	39	1
Ethiopia	402	1
France	495	1'243
Germany	919	2'363
Japan	89	713
Mexico	14	71
Portugal	10	32
Spain	113	336
United Kingdom	102	731
USA	1'097	2'195

Source: All data FAOSTAT, 2005, unless stated otherwise.

**Top beeswax producing countries according to FAOSTAT (2014)**

<b>Rank</b>	<b>Area</b>	<b>Production (MT)</b>
1	India	22500
2	Ethiopia	5340
3	Argentina	4960
4	Turkey	4053
5	Republic of Korea	4018
6	Kenya	2500
7	Angola	2300
8	Mexico	1862
9	United Republic of Tanzania	1869
10	Brazil	1700

**Top beeswax exporting countries according to FAOSTAT (2011)**

<b>Rank</b>	<b>Area</b>	<b>Quantity (tonnes)</b>
1	China, mainland	8754
2	Germany	1294
3	United States of America	1743
4	France	585
5	Brazil	43
6	Netherlands	618
7	South Africa	473
8	Malaysia	2806
9	Canada	524
10	Ethiopia	358

**Top beeswax importing countries**

according to FAOSTAT (2011)

Rank	Area	Quantity (tonnes)
1	Germany	3922
2	United States of America	2340
3	France	2873
4	Japan	846
5	United Kingdom	597
6	Turkey	774
7	Spain	668
8	Italy	439
9	Greece	652
10	Canada	585

Comtrade statistics have mixed refined/bleached wax and raw wax production data. However, there are no other statistics sources which do this separation. The major exporting countries of raw beeswax for the same year, and probably still at present are: China, Tanzania, Canada, Brazil and Ethiopia, together with Australia, France, Chile, New Zealand and the Central African Republic <sup>46</sup>. In the main, beeswax exported from Germany, the Netherlands, UK and USA is re-exported refined/bleached wax, produced out of the raw wax of the above exporting countries <sup>46</sup>. The USA is a major raw beeswax supplier, consuming most of its own production, being also a worldwide supplier of refined wax <sup>46</sup>.

According to the Comtrade statistics the price per ton beeswax in 1991 was 3,300 to 3600 \$ <sup>31</sup> There are no new figures on wax trade. Other earlier figures on wax production and trade are given elsewhere <sup>19</sup>.

**Fair trade beeswax**

Fair trade beeswax is traded by some companies. This beeswax collected from Fair Trade organizations is less likely to be in contact from by-products of industrialized societies.

**Organic beeswax**

As a major part of the commercial beeswax is now contaminated by acaricides <sup>49</sup>, there is an increased need on the market for residue-free organic beeswax, and such beeswax quality is offered by beeswax companies. African beeswax, which is free of acaricides is a good candidate for the near future. Indeed African bees are tolerant to varroa and no acaricides have to be used.

**Further Reading:** <sup>14, 16, 36</sup>

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