65th JECFA - Chemical and Technical Assessment (CTA) 2005

CANDELILLA WAX

Chemical and Technical Assessment (CTA)

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1 Summary

Candelilla wax (INS No. 902; CAS No. 8006-44-8) is a yellowish-brown hard, brittle, lustrous solid with an aromatic odour when heated. It consists primarily of odd-numbered saturated straight-chain hydrocarbons (C_{29} to C_{33}), together with esters of acids and alcohols with even-numbered carbon chains (C_{28} to C_{34}). The most abundant n-alkane, C_{31}, comprises more than 80% of total n-alkanes. Free acids, free alcohols, sterols, neutral resins, and mineral matter (<1%) are also present.

Candelilla wax may be obtained from several species of *Euphorbiacea*; the primary source is *Euphorbia antisyphilitica.* The plant grows as a bush or shrub in dense stands, principally in the Chihuahuan desert in northeastern Mexico. The plant consists of numerous slender, leafless, cylindrical stalks covered with a powdery wax that gives the plant a blue-green colour.

Crude candelilla wax is obtained by first boiling the dried stalks of the candelilla plant in water acidified with sulfuric acid to release the wax. The molten wax, known as *cerote*, is then skimmed off and allowed to solidify. It is transferred to lead-lined tanks for refining by treatment with sulfuric acid and subsequent passage through filter-presses.

The principal food applications of candelilla wax include its uses as a glazing and surface-finishing agent, a component of chewing gum, and as a carrier for food additives (including flavours and colours).

2 Description

Candelilla wax (INS No. 902; CAS No. 8006-44-8) is a yellowish-brown hard, brittle, lustrous solid with an aromatic odour when heated.

Candelilla wax is insoluble in water, but soluble in chloroform and toluene. Candelilla wax has a specific gravity of about 0.98. The following physical properties are characteristic for food-grade quality candelilla wax:

Melting range (°C)	68.5-72.5[a,b]; 68-73[c]
Acid value	12-22[a,bc]
Saponification value	43-65[a,b]; 43-63[c]
Ester value	31-43[c]

[a] *Compendium of Food Additive Specifications, FNP 52, addendum 13*, FAO, Rome, 2006.
[b] *Food Chemicals Codex*, 5th ed, National Academies Press, Washington, DC, 2003.
[c] *Japan's Specifications and Standards for Food Additives,* 7th ed. (English translation), Ministry of Health and Welfare, Tokyo, 2000.

3 Method of manufacture

Candelilla wax may be obtained from several species of *Euphorbiacea*; the primary source is *Euphorbia antisyphilitica.* The plant grows as a bush or shrub in dense stands, principally in the Chihuahuan desert in northeastern Mexico. The plant consists of numerous slender, leafless, cylindrical stalks covered with a powdery wax that gives the plant a blue-green colour (Hackett, 1969; Rogers, 1978).

Crude candelilla wax is obtained by first boiling the dried stalks of the candelilla plant in water acidified with sulfuric acid to release the wax. The molten wax, known as *cerote*, is then skimmed off and allowed to solidify. It is transferred to lead-lined tanks for refining by treatment with sulfuric acid and subsequent passage through filter-presses (Wolfmeier *et al*., 1996).

4 Characterization

Candelilla wax consists primarily of odd-numbered saturated straight-chain hydrocarbons from C_{29} to $C_{33,}$ together with esters of acids and alcohols with even-numbered carbon chains from C_{28} to C_{34}. The most abundant n-alkane, C_{31}, comprises more than 80% of total n-alkanes. Free acids, free alcohols, sterols, neutral resins, and mineral matter (<1%) are also present (SCOGS, 1981). Wolfmeier *et al*. (1996) have reported the "average composition" of candelilla wax based on a "large" number of values found in the literature:

Hydrocarbons (ca. 98% paraffins and 2% alkenes)	42.0% (w/w)
Wax, resin, and sitosteroyl esters	39.0% (w/w)
Lactones	6.0% (w/w)
Free wax and resin acids	8.0% (w/w)
Free wax and resin alcohols (terpene alcohols)	5.0% (w/w)
Saponifiable components	23.0-29.0% (w/w)
Unsaponifiable components	71.0-77.0% (w/w)

Candelilla wax, which is often compared with carnauba wax, differs dramatically from the latter in its high hydrocarbon content (max. 45%) and resin content (ca. 20%). Carnauba wax contains about 1% saturated straight-chain hydrocarbons and less than 5% resins (Wolfmeier *et al*., 1996). In contrast to carnauba wax, which consists of greater than 80% esters of long-chain carboxylic acids and alcohols, not more than 35% of candelilla wax can be attributed to these esters and alcohols.

Specifications of identity and purity for candelilla wax were established by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in 1992 (FAO, 1992). More recent specification monographs have been published in Japan (Japan, 2000) and in the USA (FCC, 2003). A revision of the specifications established by FAO in 1992 is being considered at the 65th meeting (June 2005) of the Joint FAO/WHO Expert Committee on Food Additives.

5 Functional uses

The principal food applications of candelilla wax include its uses as a glazing and surface-finishing agent, a component of chewing gum, and as a carrier for food additives (including flavours and colours).

Glazing and surface-finishing agents

The EU permits the use of candelilla wax as a component of glazing agents for confectionery (including chocolate), small products of fine bakery ware coated with chocolate, snacks, nuts, coffee beans, dietary food supplements, and certain fresh fruits for surface treatment at *quantum satis* levels (EU, 1995). The use of wax-containing emulsions as a protective surface-treatment agent on citrus fruits in Mexico has also been reported (Lakshminarayana *et al*., 1974). In the USA, candelilla wax has been affirmed by the Food and Drug Administration (FDA) as generally recognized as safe (GRAS) as a surface-finishing agent for hard candies, at levels established by Good Manufacturing Practices (USA, 2004).

Chewing gum

The US-FDA has affirmed candelilla wax as GRAS as a component of chewing gum at levels established by Good Manufacturing Practices (USA, 2004). A 1981 report (SCOGS, 1981) indicates that candelilla wax may represent about 5% of the base; the base constitutes about 20-25% of the total weight of a stick of chewing gum.

Carrier for food additives and flavours

The use of candelilla wax as a carrier for flavourings in water-based drinks, including "sport," "electrolyte," and "particulated" drinks, has been proposed for entry into the Codex General Standard for Food Additives (Codex, 2004). Under this proposal, the wax would be limited to a maximum level of use of 200 mg/kg in water-based, flavored drinks. Industry information (IOFI, 2005) on the use levels of candelilla wax as a carrier for fruit flavourings in water-based drinks indicates that the wax may be mixed with flavour bases at levels ranging from 25-50 g wax/kg flavour base. The concentration of wax in the diluted beverage would be between 25 and 200 mg/kg. The use of the wax provides a cloudy appearance to the beverage, which, according to the new information, limits the use of the wax as a flavour carrier to cloudy beverages such as citrus-based soft drinks, some herbal-based drinks, and "sport" drinks.

Other uses

The US-FDA has affirmed candelilla wax as GRAS as a component of chewing gum and as a surface-finishing agent in hard candies (USA, 2004). The GRAS affirmation of these applications does not mean that other applications/levels are not also GRAS – only that the FDA has not affirmed their GRAS status. Substances that are GRAS for an intended use do not require government premarket approval or other government authorization prior to their introduction into the US market place.

Candelilla wax is also listed as a permitted additive in the legislation of Brazil, although additive functions and levels of use are not specified (Brasil, 2005). The listing relies on the JECFA evaluation of candelilla wax.

6 Reactions and fate in foods

Natural waxes are water-insoluble, solid mixtures of esters of long-chain fatty acids and long-chain alcohols (wax esters), hydrocarbons, and a variety of other lipophilic compounds including the free components of the wax esters, aldehydes, ketones and terpenoids. Waxes are widely distributed in nature, the commonest site of occurrence being in the surface lipid layer, where they help protect plants and animals against evaporative loss of moisture and noxious influences from the environment (Kolattukudy, 1976). It follows that in relation to food applications, the reactivity of waxes in general, and candelilla wax in particular, is likely to be negligible.

7 References

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