

Does Jojoba Oil Contain Myristic Acid?

by Rob Stitt.

From <http://www.aromaconnection.org/2009/09/does-jojoba-oil-contain-myristic-acid.html> September 20, 2009, with permission.

Jojoba Oil or Wax from *Simmondsia chinensis* is claimed on several thousand web sites to contain Myristic Acid, but I have found no evidence that it is present in more than a trace amount. I began looking into this while researching Jojoba oil for Samara Botane's new website (still a work in progress). When I started looking into it (via Wikipedia—not necessarily a good source) and a variety of other sources, I found that things are somewhat confusing. This article reveals the sordid truth.

Note for the chemistry impaired: The naming conventions for **fatty acids** are somewhat confusing, with many different names often used for the same acid. To reduce the confusion factor, it has become a convention to refer to a fatty acid by a C followed by a two part number with a colon in between denoting the number of carbon atoms and the number of double or triple bonds, e.g. C14:0 is myristic acid which has 14 carbon atoms and no double or triple bonds. Monounsaturated acids have one double bond e.g. C18:1 oleic acid, and polyunsaturated acids have multiple double bonds e.g. C18:2 is linoleic acid and C18:3 is linolenic acid. An **Ester** consists of an acid and an alcohol connected into a single compound, but apparently when identified by MSGC, the two components show up as separate peaks.

Jojoba Oil

Jojoba Oil is a liquid wax produced from the seed of *Simmondsia chinensis*, a shrub native to the Southwestern US and Northern Mexico. According to Wikipedia, it is a mixture of long chain wax esters, 36 to 46 carbon atoms. It is liquid at room temperature, which is why it is called a liquid wax, or an oil—even though it is not an oil. The long chain esters consist of a fatty acid that is attached to an alcohol by an ester bond. What this means, apparently, is that jojoba oil can appear to be constituted of fatty acids and fatty acids as well as the fatty ester that it is actually made up of. Note that this particular chemical makeup appears to be unique to

jojoba, although it has some characteristics similar to human sebum and whale oil, which is one of the reasons that it is valued in the cosmetics industry.

Although as we shall see, the claims vary, the principle fatty acids in Jojoba wax according to Wikipedia are Eicosenoic C20:0 (66-71%), Docosanoic C22:0(14-20%) and Oleic C18:1 (10-13%). Price (1999) counts it up differently, with Saturated fatty acids palmitic C16:0 (11%), stearic C18:0 (71%), arachidic C20:0 (14%); monounsaturates oleic C18:1 (6.7%) and curiously not mentioning myristic acid at all in his Principal Constituents table on p. 85.

Myristic Acid

Myristic Acid is also called tetradecanoic acid or C14:0. It is classified as a medium chain fatty acid because it has 14 carbon atoms and it is a Saturated fatty acid because it has no double or triple bonds. It is named after the nutmeg (*Myristica fragrans*) where it was originally isolated, It is also found in palm oil, coconut oil, butter fat, and spermacetin, the crystallized fraction of oil from the sperm whale. Note that Wikipedia, the source for the above information, doesn't mention jojoba.

The Claims

Since Price didn't mention myristic acid in his table of Principal Constituents, I was curious as to why he stated on p. 86 that jojoba "contains myristic acid which is an antiinflammatory (sic) agent . . .". To find out I did a Google search on "Jojoba", "Myristic Acid" and to my amazement got 57,100 hits. Admittedly, just because these two terms occur in the same webpage doesn't mean they are actually connected, but browsing through the first 20-40 hits revealed they they all were connected, with statements like "It contains *myristic acid* which also has an anti-inflammatory action", "*Jojoba* also contains *myristic acid*, which has anti-inflammatory properties", "Organic *jojoba* contains a natural anti-inflammatory called *myristic acid*", all of which were clearly referring to jojoba. I added the term "anti-inflammatory" to my search and now got 2,190 hits.

Of course most of the top level hits were from commercial sites trying to sell jojoba oil and apparently not going beyond reading p. 86 in Price. About 50 hits down, I started getting into some books that I thought might reveal the truth. I'm not going to provide a complete list here, but suffice it to say that several supposedly

authoritative books are getting crossed off my list of sources. I eventually jumped ahead to 300 or more, and here I started getting a higher number of hits that listed ingredients or had several oils on one page and were not claiming myristic acid in jojoba—but there were still a number of the same old claims. Finally, after 626 hits, Google stopped delivering new stuff, so I gave up on that search phrase, and started to try to find something more authoritative. I added “MSGC” or “Composition” to my search.

The Facts

The first thing I found a table that showed the constituents of jojoba by chain length, starting with C16 and going up to C24 (Kleiman 1990). No C14 here.

Next, I found the original study from 1975 (National Academy of Sciences, 1975). Table 2 shows the Alcohol/Acid Structures of Jojoba Oil Determined by Gas Chromatography, Mass Spectrometry, and Ozonolysis. This should be an authoritative source! And it mentions C14:0 as well as C12:0 and C16:0. All three were found in “trace” amounts. Effectively, no C14:0 here.

OK, what about Wisniak’s book about Jojoba? Table 1-26 is the same table as the 1975 NAS study and Spencer et al, but “trace” is defined as 0.01-0.05%. Not much C14:0 here either. Table 1-27 looks at the Jojoba Oil Wax Ester Composition and breaks down the long chain esters by their Alcohol/acid combination. No C14 in the table, as would be expected. Table 1-28 looks at the Composition of Fatty Acid Methyl Esters and Fatty Alcohol Acetates Derived from Jojoba Wax. Again C12, C14, and C15 acids are only in trace quantities.

Here’s another without C14:

Triglyceride compounds isolated from jojoba seed oil by column chromatography were composed predominantly of C₁₈, C₂₀, C₂₂, and C₂₄ n-9 fatty acids with minor amounts of saturated C₁₆. (van Boven et al Abstract)

And another:

The results wax indicated that the main constituents in jojoba wax were various kinds of wax esters, namely eicosenyl octadecenoate (C20:1-C18:1)(I), eicosenyl directly, eicosenoate (C20:1-C20:1)(II), docosenyl eicosenoate (C22:1-

C20:1)(III), eicosenyl docosenoate (C20:1-C22:1)(IV) and tetracosenyl eicosenoate (C24:1-C20:1)(V). . . . The concentrations of the wax esters I, II and III, in jojoba wax were 5.5, 21.4 and 37.8%, respectively. (Tada *et al*)

Finally, I did find **one** curious document on the Internet (Simon, 2006) that possibly needs to be given some credence and which includes myristic acid among the constituents of Jojoba Oil. It has no documented sources so it's not clear where the information came from. It is a "Technical Memorandum" written for the Michigan Department of Environmental Quality (MDEQ) listing secondary Constituents of Interest (COI) for substances used or produced at the Dow Chemical Plant in Midland, Michigan. This list was to be used to identify pollutants in the nearby rivers that might have originated in the plant. The purpose of this document was to resolve discrepancies in their data base, and one of the entries is (in a table entitled CASE NARRATIVE – Multi-Compound Listings):

456	Jojoba Ester – High Internal Phase (Myristic Acid, Palmetic (sic) Acid, Oleic Acid, Eicosenic Acid, Erucic Acid, Nervonic Acid, Eiconsenol, Docosenol, Tetracosenol)	DOW RESOLVED. Multi-compound listing individual components are [544-63-8] myristic acid, (remainder of items omitted here – rs)
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The number in [] brackets is the CAS number of myristic acid.

Conclusion

Based on the studies referenced above, there are no appreciable amounts of myristic acid in jojoba oil. This doesn't necessarily mean that there isn't genetic or geographic variation (Busson-Breyse *et al*), but I haven't found any evidence that that has occurred. If anyone is to make a valid claim that there is C14:0 in jojoba, they need to present their proof. In the meantime, Internet vendors should stop making claims that Jojoba Oil contains Myristic Acid.

References:

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Article Feedback from Tony Burfield (publ. 11th Oct 2009)

Rob Stitt's feature on Jojoba oil (the pressed seed oil from *Simmondsia chinensis* (Link) C. Schneid) highlights the fact that there are no direct references in the scientific literature (that he can find), which would confirm the presence of myristic acid, despite widespread website claims that this is the case, and separate claims that myristic acid is a supposed anti-inflammatory principle (a prospect which Cropwatch finds unlikely). Standard texts such as Leung & Foster (1996) confirm Jojoba oil's use as a skin conditioning agent and as a moisturiser & emollient in cosmetics. As Rob mentions, Jojoba oil has been also been touted as a Sperm Whale oil replacement, ever since the Sperm Whale became a Threatened Species.

Without repeating too much of what Rob has researched, in spite of being fairly well-known amongst cosmeticians, Jojoba oil has been produced in relatively small amounts (around 30 tons/annum) from plants grown in S.W. regions of N. America, Mexico, S. America (Argentina), Israel, South Africa & Australia. The ingredient cost of the oil has historically been relatively expensive but the economics of increasing production have brought down the price to levels where its desirable stability properties & resistance to oxidation may yet see it put to use as a general machinery lubricant. The oil has little in the way of triacyl glycerols present and is almost completely composed of wax esters of C20 and C22 monounsaturated alcohols and acids. Of the saturated fatty acids, Toberas *et al.* (2003) list a mere 1.1% of hexadecanoic acid in the esterified fatty acids of cold-pressed (crude) jojoba oil, and no tetradecanoic acid (i.e. myristic acid) whatsoever. Slightly smaller amounts of esterified hexadecanoic acid are listed in the refined and bleached oils.

So what is going on here? Cropwatch has already noted how mis-information is copied from one source to another, especially amongst aromatherapy & health website authors, who fail to check up on the original source (or to examine the credibility of such information). We could speculate in this case that the original perpetrator of the mis-information had not understood the way that data on the ester composition of vegetable oils is presented, and mistook the listed acid components as freely available fatty acids. In fact the availability of unesterified free fatty acids in Jojoba oil is minute, as shown by the Acid Value of typical cold-pressed commercial oils (typical value being around 0.8 mg KOH/g). From the data that

Leung and Foster (1996) cite in their monograph on jojoba oil, it seems that any free fatty acids present might comprise trace amounts of oleic and palmitic acids. But since myristic acid is patently not present in freely available form, or esterified to an alcohol of any description in Jojoba oil either, the claims which Rob has identified on the web are even more unexplainable. As Rob has pointed out, a readily available source of esterified myristic acid is available in coconut, and palm kernel oil potentially represents a slightly richer source (provided you can find a truly sustainable supplier source for the latter).

Cropwatch has asked Rob if we can import the article for a new section on the Cropwatch website, where such myths are listed. Unsurprisingly perhaps, we have a number of other examples

Tony Burfield

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