



Patchouli Oil

A Case Study on Use of Synthetic Biology Replacements

Farmers Affected: Around 12,000 farm families involved in cultivation; a further 2,000 employed in distillation; 300 in the collection trade¹

Market Value: \$100 million US²

Uses: Perfumes, soaps, cosmetics, incense, scented products

Syn Bio Companies: Amyris in partnership with Firmenich, Isobionics

Hotspots: Indonesia

Also Grown In: China, India, Malaysia, Singapore, Philippines

Cultural Importance: Used for centuries in traditional medicine in Malaysia, China and Japan, also as a fumigant, insect repellent and to sooth snake / insect bites

Biodiversity Considerations:

Wild-grown, native perennial crop; good for intercropping

Quality Concerns: Natural patchouli oil has many constituents. Syn bio companies manufacture only a single molecule.

Patents: METHOD FOR PRODUCING PATCHOULOL AND 7-EPI-ALPHA-SELINENE

Patent number: EP2569427A1, US8927238, US20150099283, WO2011141855A1 (Firmenich)³

Products: Patchouli oil

Method: Synthetically engineered yeast

Commercialization: Firmenich's Clearwood™ is on the market. Isobionics' patchouli oil is still under development.⁴

Feedstock: Sugar cane

Brands, Identifiers: Clearwood™

Overview

Popularly associated with the hippie counterculture of the 1960s and as an iconic “Asian” scent, natural patchouli oil is extracted from a species of the mint family called *Pogostemon cablin*. It thrives in Indonesia, Malaysia, Philippines and South Asia and supports around 12,000 farm families. Besides perfumes, patchouli is commonly added to detergents, soaps, candles and other common household products.

Status: Syn bio patchouli is already on the market



R&D

Scale Up

Commercialization

The key constituent of the oil is patchoulol, which has now been produced using synthetically engineered yeast by California-based biotech company Amyris, in partnership with Firmenich, a Swiss purveyor of perfumes and flavours. Their patchouli ingredient is trademarked Clearwood™ and is already incorporated into leading fragrances. A Dutch synthetic biology (“syn bio”) company, Isobionics, is also threatening to soon commercialize a syn bio form of patchouli oil.

What is Patchouli Oil?

Patchouli (meaning “green leaf” in old Tamil) or *Pogostemon cablin* is a perennial species of the mint family that thrives in the wild in warm tropical climates, especially in Indonesia.



For more information on Synthetic Biology please visit the ETC Group website: www.etcgroup.org/synbio

Originally used as in eastern medicine and to protect cloth from insect damage, its distinct odour became closely associated with the “hippie” counterculture of the 1960s. Its fragrance was widely used by young people in perfumes and incense to invoke the mysterious East. Patchouli oil is key to a class of perfumes (the chypre fragrances) and is today widely used in laundry detergents, air fresheners, candles, soaps, baby wipes and other household scented products. It is also commonly used in pharmacy and cosmetics as a very efficient antimicrobial ingredient. Its principal component is called patchoulol.

Patchouli as a Natural Product

Although patchouli originates in the Philippines and India (Tamil Nadu), Indonesia is the world’s largest producer of patchouli, accounting for over 80% of the global market. Historically, Java and Sumatra were key growing regions for the oil, but these areas now account for only 20%, with almost no raw material coming from Java. Today Sulawesi (Indonesia) is the primary growing region. Patchouli crops cannot be grown on the same patch of land for long periods, so plantations need to be moved to different areas every 5 years.⁵

Current annual production of patchouli oil is volumes are around 1,000-1,200 metric tonnes, with market demand calculated to be around the same. Secondary suppliers are China, India and Malaysia. Patchouli oil can fetch \$40-70 US per kilogram. According to IFEAT (International Federation of Essential Oils and Aroma Trade), Indonesia produces around 1,200 tonnes per year, with a value of around \$70 to \$100 million US. According to IFEAT, a typical patchouli farm family in Indonesia owns in the range 0.25 to 1 ha of land and produces 25 to 100 kg of patchouli oil per year. Around 12,000 farming families are involved in cultivation (amounting to around 50,000 supported individuals). A further 2,000 people are employed in distillation and 300 in the collection trade.⁶

Cultural and Biodiversity Considerations

As mentioned, patchouli was used for centuries in traditional medicine in Malaysia, China and Japan, as well as a fumigant, insect repellent and remedy for snake and insect bites. It was added to cloth and textiles exported along the silk route to protect them against insect damage, and thereby gave these imports a distinctive “oriental” scent. This connection added to its popularity in the 1960s and 1970s with the hippie counterculture.

As a wild-grown crop as well as a perennial, patchouli is closely linked to biodiversity considerations. Long-term perennial crops provide the advantages of a stable environment partly because the cultivation of such crops is based on long-established traditional varieties, held in balance with the surrounding flora. Wildcrafted crops thus help support the maintenance of natural ecosystems and their complex flora and fauna.⁷ According to the United Nations Environment Programme (UNEP), patchouli is suitable for intercropping and diversification of crops. It is also important as alternative crops in areas taken over by monoculture production, as has been seen most recently with palm oil plantations and rubber production in Sumatra.⁸

Synthetic Biology Production

Following weather-related supply chain problems with sourcing patchouli, the fragrance industry took a strong interest in finding a synthetic version of this oil. Patchoulol, the key component of patchouli oil, has now been produced commercially through synthetically altered yeast developed by the California-based biotech company Amyris, in partnership with Firmenich, a Swiss purveyor of perfumes and flavours. The companies have already produced large volumes of patchouli oil fermented on sugarcane in Amyris’s facility in Brotas, Brazil. Firmenich sells this oil to perfumers and product manufacturers as the scent Clearwood™, which is described as a “woody ingredient with clean patchouli scents.”

The product is already in use in consumer goods and leading perfumes such as Tom Ford's "Patchouli Absolu." When the fragrance won a recent award, Firmenich's master perfumer Harry Fremont claimed, "This breakthrough ingredient is revolutionizing how perfumers play with the patchouli character, to create totally modern fragrance creations for men and women."⁹

A second synthetic biology company, Isobionics in the Netherlands, has also developed its own version of patchouli oil and claims it is scaling up production to bring it to market soon.¹⁰

Implications and the Future

While global agriculture is increasingly dominated by large-scale industrial production, the production of most essential oils is still dominated by small farmer production, and as such makes an important contribution to the incomes and livelihoods of relatively poor rural populations in developing countries.¹¹ The smallholders and small farmers of Indonesia, Malaysia, China, and Singapore will inevitably be affected by the introduction of Clearwood™ and forthcoming products from isobionics. With Clearwood™, Amyris is able to replace the lengthy cultivation and extraction process with a single manufacturing process that produces patchouli oil in about two weeks. Even if the resulting product is synthetically obtained and may not possess exactly the same qualities as the natural oil, the ease of production undercuts the farmer's efforts tremendously and will also impact the consumer's future ability to get true patchouli.

Endnotes

- 1 "The socio-economic importance of the essential oil production sector." International Trade Center. www.intracen.org/uploadedFiles/intracenorg/Content/Exporters/Market_Data_and_Information/Market_information/Market_Insider/Essential_Oils/The%20socio-economic%20importance%20of%20the%20essential%20oils%20production%20sector.pdf
- 2 *Ibid.*
- 3 www.google.com/patents/US20130102038
- 4 <http://isobionics.com/index-Patchouli%20Oil.html>
- 5 Jonpaul Howarth, In Indonesian Patchouli Supply Migration. Ultra International B.V. Market Report. Spring 2015. Perfumer & Flavorist Magazine January Edition, "Natural Product Supply Bulletin." www.researchgate.net/file.PostFileLoader.html?id=557693045f7f712f6a8b4569&assetKey=AS%3A273792952143882%401442288734667
- 6 See again www.intracen.org/uploadedFiles/intracenorg/Content/Exporters/Market_Data_and_Information/Market_information/Market_Insider/Essential_Oils/The%20socio-economic%20importance%20of%20the%20essential%20oils%20production%20sector.pdf
- 7 *Ibid.*
- 8 IFEAT WORLD, News from around the globe, May 2014. https://www.ifeat.org/sites/default/files/uploadedcontent/field_f_content_file/ifeat_world_may-2014-.pdf
- 9 www.perfumerflavorist.com/networking/news/company/Sepawa-2015-Awards-First-Prize-to-Firmenichs-Clearwood-360062321.html#sthash.ZWSKUbgG.dpuf
- 10 www.brightlands.com/news-events/isobionics-increases-its-capacity-scaling-production/
- 11 See again. www.intracen.org/uploadedFiles/int