Corbion
8250 Flint Street
Lenexa, Kansas 66214
USA

T +1 (800) 669 4092
www.corbion.com

MEMO

TO Cameron Plese
CC Diana Visser
FROM Margaret E Walsh

DATE April 9, 2021
REFERENCE Reference

SUBJECT Why choose Palm Oil as source for Derivatives?

FROM Margaret E Walsh
Senior Scientist
Emulsifiers

margaret.walsh@corbion.com
T +1 (800) 669 4092 x1239
M +1 (913) 638 0041

Why would a supplier choose Palm Oil or Palm Kernel Oil to create an oleoderivative? What are some of the technological reasons to use raw materials from these sources?

According to information from Conservation International & WWF, Palm is[1]:

Versatile	•Found in half of the products on grocery shelves
Trans-Fat Free	•Long shelf life and does not require hydrogenation (which can result in trans-fats)
Inexpensive	•Compared to other vegetable oils it is inexpensive to produce
Efficient	•Oil palm can grow year round on a range of soils with few inputs
Highly Productive	•Oil palm can produce 4 – 10 times more oil per hectare than other veg. oil crops
Economic Driver	•Provides millions of jobs and generates billions in exports for producing countries

[1] https://www.conservation.org/publications/documents/ci_palm-oil-sourcing-guide.pdf

Corbion

MEMO

In addition, standard Palm Oil is also one of the few common vegetable oils that mimic characteristics of animal fats such as lard and tallow. Therefore, it is often used as a vegetarian- or vegan-friendly option in foods and cosmetics.

For Palm Kernel, it has characteristics similar to Coconut Oil. Again, there may be an advantage to using Palm Kernel because Coconut can be considered an allergen. Both oils are seen as less expensive alternatives to fats sourced from Cacao and are often used in place of Coco Butter or Chocolate in some food and personal care applications.

For those markets concerned about Genetic Modification, Palm-sourced oils are a widely available Non-GMO alternative. In the United States, it is still the most common Non-GMO option.

These same attributes make them attractive for manufacturers of oleoderivatives. When used as-is or after modifications and/or blending of other vegetable oils sources, they can produce a large variety of value-added ingredients. The functionality of these ingredients can be tailored to meet the application needs through careful selection of the raw materials. For example, if a food product contains palm oil as the main fat source, then a manufacturer may select a palm-based derivative to guarantee a certain degree of compatibility. Likewise, a palm-base derivative may be used with non-palm ingredients because it can help maintain desired qualities such as preventing separation in a sauce application, allow for flavor or aroma release at the right time point for a beverage, or improve the feel of a lotion on one's skin.

In conclusion, without palm oil and palm kernel oil as sources for oleoderivatives, it would be more difficult for derivative manufacturers to meet price points while maintaining the quality standards consumers have come to expect.

Regards,

Margaret E Walsh
Senior Scientist

Corbion
Arkelsedijk 46
Gorinchem, 4206 AC • PO Box 21
4200 AA Gorinchem
The Netherlands

T +31183 695 695
www.corbion.com

MEMO

TO Cameron Plese
CC Margaret Walsh, Diana Visser
FROM Ivana Dencic

DATE August 12, 2021
REFERENCE Reference

SUBJECT Carbon footrpint of glycerol

FROM Ivana Dencic
Sr LCA Specialist

cnl@corbion.com
T +31183 695 695

Glycerol can be produced from fossil-based or bio-based sources:

1. Fossil route:
    a. The most common fossil route is glycerol production from epichlorohydrin (made in reaction of propylene and allyl chloride and hydrolyzed with calcium hydroxide).
    b. This process contributes to 15% of total glycerol production outside of Europe, and 34 % in Europe.
2. Bio-based routes:
    a. Based on transesterification or fat-splitting (steam or chemical) of vegetable oils, typically soy or palm.
    b. Animal fats are also potential sources, but are not as common since many industries prefer vegan or vegetarian sourcing

Carbon footprint

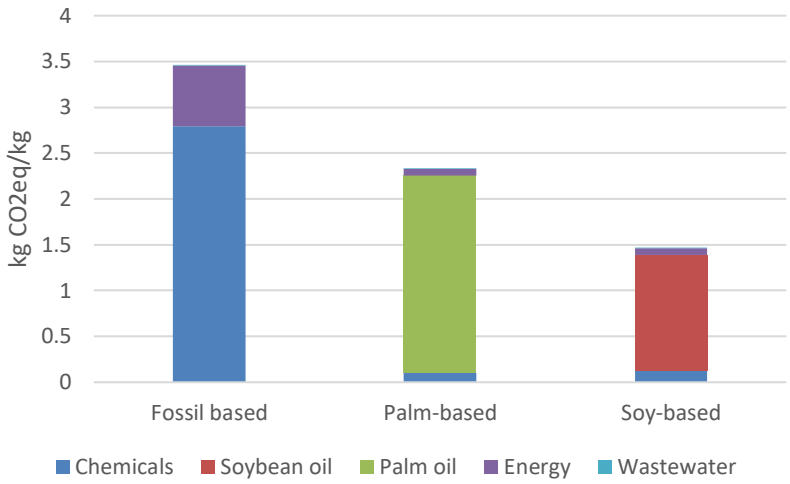
Table 1 summarizes carbon footprint of glycerol production from different sources. The term "cradle-to-gate" means all upstream processes are considered, starting from the extraction of fossil-based material or agricultural phase for biobased materials through the manufacturing process until it reaches the factory gate, not taking into account product use and disposal. This is quite common for comparative studies as well as other carbon footprint representation when we are not sure how and where the product is used and disposed.

Table 1. Cradle to gate carbon footprint of glycerol production in US and RoW (rest of the world), based on Ecoinvent 3.6

Production route	Carbon footprint (kg $CO_{2,eq}$/kg)
Fossil-based	3.46
Palm-based	2.33 (based on RoW dataset)
Soy-based	1.46

MEMO

- CO_2 footprint is the highest when fossil-based route is used.
    - Main contribution to the carbon footprint of the fossil-based routes is from chemicals, as shown in the figure below.
    - Main contribution to the carbon footprint of the plant-based routes is in the growing phase of palm or soy, mainly energy used in farming and fertilizers emissions, as well land use change in case of palm source.



Considerations

1. Ecoinvent is a life cycle inventory database.
    a. It contains process data for various products and enables characterization of their environmental impacts.
    b. Calculation is done in SimaPro software, it takes into account glycerol production data from Ecoinvent 3.6 and cradle to gate carbon footprint impact of all inputs
    c. Carbon footprint is characterized with globally accepted IPCC 2013 characterization method.
2. Impacts are accounted for in case deforestation took place in the last 20 years.
    a. Most farmland for soybean were cleared 50+ years ago and does not have an impact on the above CO2 calculations.
    b. For the palm scenario deforestation has occurred in the last 20 years so Ecoinvent takes that into consideration.
    c. The Roundtable on Sustainable Palm Oil (RSPO) forbids deforestation of High Conservation Value areas after 2005 and deforestation of High Carbon Stock areas after 2018. To find more information on how the RSPO defines deforestation from palm oil, visit the RSPO website.

Conclusion

Glycerol produced via esterification of plant-based oils has 33 – 60 % lower cradle to gate carbon footprint than fossil-based glycerol.