APAG
Oleochemicals Europe

White Paper
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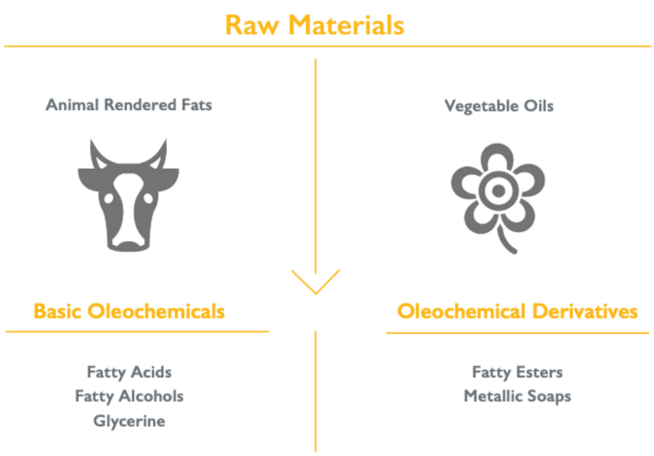
Oleochemicals: a bio-based alternative for fossil carbon

The European oleochemical industry is a well-established and innovative sector of the european bio-based economy and enables the move to safe and sustainable-by-design bio-based chemicals.

What are oleochemicals?

Oleochemicals are bio-based products derived from vegetable and animal oils and fats. They have unique and desirable functional properties (e.g. high temperature resistance), can be more sustainable as they derive from sustainably sourced renewable raw materials, and are more biodegradable than fossil-based products feedstocks which they (can) replace.



Oleochemicals are part of the formulation in a variety of daily-used products like detergents, soaps, cosmetics, pharmaceuticals and candles. But they can also be used in lubricants, surface coatings, additives for plastics, textiles, food and many others.

How can the oleochemistry contribute to fossil carbon substitution?

In the context of climate change, the oleochemical industry has a crucial role in not only supporting achieving climate neutrality but also support economic competitiveness, stimulate the market and provide a solution to current social and environmental challenges. According to the recent Communication on how to boost biotechnology and biomanufacturing in the EU, more than 90% of annual carbon demand (about 450 million tonnes CO_2) is supplied by fossil carbon. Alternative feedstocks, like sustainable biomass, recycled waste and CO_2 captured from biogenic sources could be used to contribute to emission reduction, resource efficiency and strategic autonomy.

Oleochemical processes thus play an important role in mitigating fossil carbon emissions by emitting lower greenhouse gas (GHG) emissions and thereby provide a sustainable alternative to fossil-derived products across various industries, especially through:

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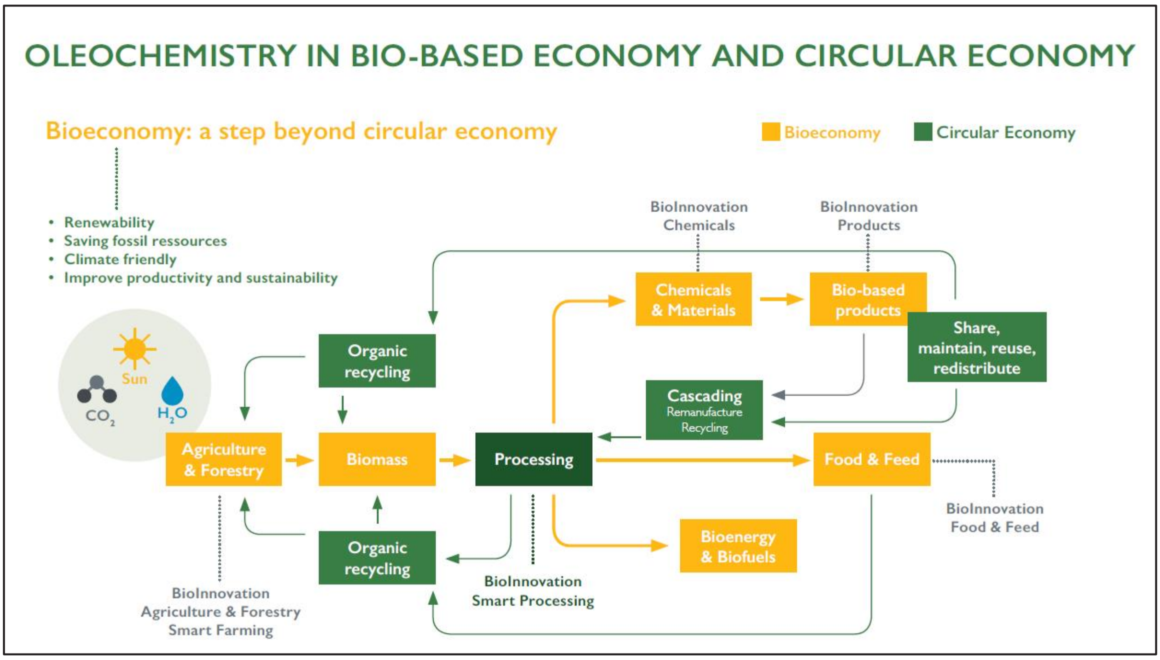
— Circular economy: by enabling the reuse of by-products from other industries such as food and meat processing, the oleochemical industry uses rendered animal fats cat. 3, which extends the lifecycle of these materials, rather than burning them for bioenergy purposes.
— Renewable feedstock: oleochemicals are derived from renewable feedstocks, reduce fossil carbon emissions by not bringing additional fossil carbon from the ground into the carbon cycle.
— Biodegradability: many oleochemical products are biodegradable, breaking down easily and naturally over a shorter and faster period of time reducing so the amount of waste, pollution and often methane emissions.
— Carbon capture: these bio-based chemicals can effectively capture carbon from the atmosphere offsetting so emissions.



Key oleochemical applications for sustainable transition

Home and personal care

Derived from natural fats and oils, oleochemicals provide several benefits for home and personal care products. From being more environmentally friendly and biodegradable to enabling the development of customised ingredients, their use has grown thanks to enhancing product efficacy and safety in many ways:

— Surfactants and Emulsifiers: essential in home and personal care products, their ability to lower the surface tension between two substances, such as oil and water enables the development of creams, soaps, shampoos, body washes, lotions and many more.

- Moisturisers and Emollients: derived from fatty acids, fatty alcohols and fatty esters, these can be used as moisturisers and emollients in personal care products.
- Thickeners and Stabilisers: while glycerine can act as a humectant and stabiliser, maintaining the moisture balance in products, fatty alcohols and fatty acids act as thickeners, giving products the desired consistency.
- Conditioning Agents: used largely in hair care products, oleochemicals are used in hair conditioners and detanglers to improve the manageability and feel of the hair.
- Preservatives: with antimicrobial properties, they can aid in extending the shelf-life of personal care products

Candles

Oleochemicals play a significant role in the production of candles being primarily used in the form of vegetable-based waxes and additives. Here are some key oleochemical components used in candles:

- Vegetable Waxes: It is one of the most common oleochemical used in candles. Extracted from various plant sources such as soybeans, palm, coconut, rapeseed, and others, vegetable waxes are favored over paraffin (fossil-based) waxes because they are biodegradable and non-toxic, resulting in a more environmentally friendly candle.
- Stearic Acid: It is an essential oleochemical used in candles as it helps increase the melting point of the wax, improve the candle's structure, and reduce dripping and sooting during burning
- Additives: Used to enhance various properties of candles, such as fragrance retention, color dispersion, and burning characteristics, these additives can be derived from natural sources and are less likely to emit harmful substances when the candle is burned.

The use of oleochemicals in candles has gained popularity due to the increasing demand for environmentally friendly and sustainable products. Consumers often prefer candles made with vegetable-based waxes and additives as they are considered safer for indoor use and have lower environmental impacts compared to traditional petroleum-based candles.

Lubricants

Often used to replace fossil-based oils, fatty acids and fatty esters are ideal for eco-friendly lubricants in applications like automotive, marine, construction, power generation, and forestry. Their functional properties enhance lubricant performance, promoting a sustainable and innovative approach with natural ingredients. Common oleochemicals used in lubricants include:

- Fatty Acids: used as base oils and additives in lubricant formulations

- Fatty Esters: used as base oils in biodegradable lubricants in applications where environmental concerns are crucial
- Glycerine: used as high-performance lubricants when synthesized
- Fatty Alcohols: used as emollients, solvents and viscosity modifiers in lubricants, enhancing the performance.

The use of oleochemicals in lubricants is driven by the increasing demand for sustainable and environmentally friendly products. Oleochemical-based lubricants often have better biodegradability and lower toxicity than their petrochemical counterparts, making them more suitable for certain applications, particularly when direct environmental exposure might occur (e.g., spills, leakage, decommissioning and disposal, and usage in environmental sensitive areas).

Polymers additives

Used to enhance or modify the properties, processing, and performance levels of polymers, these additives can improve mechanical strength, thermal stability, UV resistance, flexibility, color, and other characteristics of different applications (e.g., lubricants, packaging, plasticisers, construction, textile, consumer goods). With increasing concerns around sustainability, oleochemicals can provide a sustainable alternative for several reasons:

- Versatility and compatibility: Not only do they provide better compatibility with natural polymers and biopolymers, thet can create a wide range of additives including plasticisers, lubricants and stabilisers.
- Renewable and Biodegradable: Enhance the biodegradability and compostability making them more environmentally friendly, and suitable alternative to fossil-based plasticisers for certain applications.
- Non-Toxic and Safer: Often non-toxic, they pose fewer health risks compared to traditional plasticizers which have been linked to potential endocrine-disrupting effects.
- Regulatory Compliance: With increasing regulatory restrictions, they can help manufacturers ensure compliance with environmental and safety regulations.

Oleochemical-based polymers are a sustainable, environmentally friendly and often safer alternative. As research and technology we can expect further developments that contribute to better eco-friendly practices while maintaining the product quality and performance in various industries.

Paints and Coating

Oleochemicals play a vital role as a sustainable alternative to traditional fossil-based formulations in paintings and coats. Natural oils and fatty acids, along with their derivatives, allow for a sustainable source for other fossil-based chemicals that can compete in quality with the fossil-based variants. They offer a range of benefits that address environmental concerns and contribute to the reduction of fossil carbon emissions:

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- Low VOC Emissions: Incorporating oleochemicals into paint and coating formulations significantly reduces volatile organic compound (VOC) emissions, a major contributor to air pollution and climate change. The shift towards low-VOC or VOC-free coatings aligns with stringent environmental regulations and growing consumer demand for eco-friendly products.
- Enhanced Durability: Oleochemical-based paints and coatings exhibit improved durability and weather resistance compared to their petrochemical counterparts. This translates to longer service life and reduced need for frequent repainting or recoating, thereby lowering overall resource consumption and minimizing waste generation.

Current challenges faced by the Oleochemical Industry

Despite the different opportunities and benefits that the oleochemical industry can bring to current societal and environmental concerns, there are still several challenges faced by manufacturers:

Geopolitical challenges

Growing geopolitical tensions, trade disputes and introduction of new policies not only disrupt global supply chains but also market access for oleochemical producers. Hence, ensuring a consistent and sustainable supply of raw materials is crucial for the industry, whilst navigating geopolitical risks and trade barriers requires strategic planning and diversification of supply chains.

Complexity of the political landscape

The introduction of innovative bio-based products, requires not only investment in research, development, and innovation, but also support the transition to greener production processes. Yet, compliance with regulations like REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) involves costs for data generation, safety tests, registration fees, and providing information to downstream users. Combined with other regulations such as the Deforestation-free products puts the oleochemical sector at a disadvantage, lowering the access to feedstock and slowing down the defossilisation process.

Consumer Preferences

Shifting consumer preferences towards natural and sustainable products drive demand for oleochemical feedstocks in various industries, including personal care, food, and pharmaceuticals. However, meeting diverse market demands while ensuring cost-effectiveness and sustainability poses a challenge. On top of this, maintaining price competitiveness, while emphasising the environmental and performance benefits of oleochemicals is essential for market growth. Thereby strategic alignment and proactive engagement with consumers, customers, and supply chain partners is necessary.

What we need moving forward

As a way forward to support the oleochemical industry, APAG sees as outmost importance to boost the bioeconomy sector:

Fair Access to Feedstock

Securing access to feedstock is essential for a consistent and fair supply of bio-based raw materials. Emphasising on the importance of a robust cascading use principle and waste hierarchy is one way of achieving this, however, policies that hinder the access to feedstocks and incentives that push for bio-based material usage in other sectors (such as biofuels) pose significant challenges to the Oloechemical industry. EU policies, should align with current legilstaion and prioritise the use of waste-based feedstocks to prevent the displacement of valuable raw materials.

Market pull measures

To ensure fair competition and leverage in the bioeconomy sector, it is essential to stimulate the market for bio-based materials. Fair trading conditions and incentives, such as tax exemptions and product fee adjustments, are needed for bio-based products in the EU[1]. Moreover, recognising biogenic carbon in the Product Environmental Footprint (PEF) methodology will enable a better comparison with non-renewable products, highlighting the environmental benefits of bio-based options.

Policy Coherence

Regulatory measures can support the oleochemical industry in reducing fossil carbon by evaluating new legislation impacts on the bioeconomy and setting clear transparent targets based on impact assessments. Stronger institutional support and official commitment are crucial for funding, research, and policy frameworks that prioritise sustainability and innovation. These efforts will enhance public perception of bio-based products and influence consumer choices.

Certification & Standardisation

Certification and standardisation initiatives can significantly improve the oleochemical industry, when setting stronger legal requirements for quotas of bio-based materials within ecolabels or certifications. This encourages the use of bio-based feedstocks and drives the adoption of eco-friendly practices throughout the supply chain. Transparent science-based criteria is also essential to define the term bio-based accurately. Through robust frameworks, the oleochemical industry can meet evolving sustainability goals and contribute to a greener and more sustainable future.

[1] Read the Cefic Position Paper to know more about how to deliver the Bioeconomy Agenda for 2024 Bio-economy-Cefic-position-for-the-bioeconomy-2024-Delivering-the-bioeconomy-agenda-for-2024.pdf

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