Fish and algae oil are good sources of omega-3. Photo©:Shutterstock/526305043

Innovative refinement process for healthy and pure omega-3 fatty acids

Oils from fish, algae and vegetables are a potent source of omega-3, yet processing these unstable raw materials can be complex and challenging. That's why Nutriswiss AG has developed groundbreaking solutions.

Omega-3 fatty acids are essential for a healthy diet. And thanks to modern processing techniques, high-quality extracts can be consumed quickly and easily in the form of flavour-neutral food supplements. Food and drinks can also be enriched. However, unsaturated fatty acids oxidise quickly, thus degrading the quality of an oil, while lipids are highly susceptible to environmental pollutants. These can get into the raw oils despite careful sourcing, even with organic products. To negate this, Nutriswiss AG has devised gentle processes for the creation and refinement of taste-neutral, omega-3 oils that retain their valuable, health-promoting properties.

Preserving valuable fatty acids

Global demand for marine and plant-based omega-3 products is growing, from dietary supplements, functional foods and beverages to pharmaceuticals, infant formulas, pet food and feed. However, omega-3 oils require a completely different handling process and a higher degree of care than ordinary oils, as their high content of polyunsaturated fatty acids make them unstable and susceptible to oxidation. "Preserving these valuable fatty acids and ensuring that the product remains stable and free from contaminants can be quite challenging particularly in oils from marine sources" says Frank Möllering, Head of R&D at the Swiss refinery, Nutriswiss, which specialises in purifying, modifying and refining edible and specialty oils.

Omega-3 alternatives

While fish are still the dominant source of omega-3, alternatives such as nuts, seeds and oils are becoming more popular, as are microalgae which can be easily cultivated and reproduce quickly. "Fish get their omega-3 from algae, so why not start directly at the source?" says Möllering: "In addition, algae cultures are more environmentally friendly and protect fish stocks. The market is still in the

discovery phase but because we've been involved in the purification of algae oil for several years now, we process almost as much algae oil as fish oil."

Careful treatment and processing

Regardless of their derivation, all omega-3 oils require careful treatment and processing in order to preserve their essential fatty acids, micronutrients and vitamins. Nutriswiss therefore relies on a mild, multi-stage refining technology that minimises the formation of process contaminants. At the same time, free fatty acids, plasticisers, pesticides and mineral oil hydrocarbons are largely removed or greatly reduced. In further treatment steps, the company's experts optimise the sensory quality where necessary in order to produce an omega-3 oil that is entirely neutral in taste and odour.

However, a high proportion of polyunsaturated fatty acids makes oils unstable and susceptible to oxidation. Unlike vegetable oils, the oxidation reaction causes fish oil to develop a strong odour, darken in colour and rapidly become rancid. For sources with an extremely high omega-3 content, the oxidation potential is correspondingly high. To prevent these quality defects, both the raw material and the refined oil must be kept in a protective atmosphere until processed into the end product.

Nutriswiss uses mild refining technologies to remove or significantly reduce contaminants in fats and oils Photo®: Nutriswiss

High demand

At Nutriswiss, a comprehensive "key figure" profile is initially compiled in its analytical laboratory for each oil received, in order to determine how much "damage" has already occurred. Key factors such as the anisidine value, which measures the secondary degradation products of lipid-compound oxidation, provide information about the history of the raw material.

"Using various process steps, we can remove the secondary oxidation products and reduce the anisidine value to below 10. For a fish oil, this is premium quality. The refined oil is also neutral from a sensory point of view and almost the same light-yellow colour as rapeseed oil," explains Möllering.

Contaminants

Oxidation products are not the only compounds that have to be removed from a crude oil by refining. Owing to their apolar structure, lipids are especially susceptible to environmental contaminants. Oils from plants often accumulate the insecticides, fungicides and herbicides used in traditional cultivation. In addition, mineral oil saturated hydrocarbons (MOSH) and mineral oil aromatic hydrocarbons (MOAH) may have been transferred to the foodstuff during processing and packaging. Marine animals are particularly at risk: even pesticides that have been banned worldwide for decades, such as polychlorinated biphenyls (PCBs), are still present in waters around the world and accumulate in the fatty tissue of organisms.

For manufacturers who, due to their market positioning, require uncontaminated oils of the highest quality and purity for their formulations, Nutriswiss offers access to a self-developed supply chain. As is already the case with oil plants derived from certified contract cultivation, the Swiss also work with selected partners for marine sources who have committed to the highest standards in terms of catch methods, breeding and transport.

Optimal process parameters

As with almost all sensitive natural raw materials, the challenge is in implementing a gentle purification process to preserve the valuable polyunsaturated fatty acids. To remove the contaminants, high temperatures are required, which in turn favours the formation of other contaminants like trans fatty acids and chlorine-fatty acid esters such as 3-MCPD or glycidyl fatty acid esters. For 3-MCPD, in particular, more stringent regulations have been in force in the EU for infant foods since 2021. And tighter restrictions are also being considered for other residues and applications.