

Mowi Emerging Feed Raw Materials Policy

Mowi aims to produce robust, sustainable, high quality salmon using the widest available spectrum of raw materials in the most efficient way. Mowi's inhouse R&D activities are strongly focused on finding and developing a diverse and effective raw material pallet that optimizes salmon health, wellbeing and quality using the most sustainable options wherever possible. As such, emerging feed raw materials play an important role to increase raw material flexibility. Mowi has also in place a policy on sourcing feed raw materials sustainably which can be found at <https://mowi.com/sustainability/policies/>

Defining Emerging Feed Raw Materials

Emerging feed raw materials are those that have the potential to become part of the feed composition but require further development before full commercialization. For example elements of the risk-assessment (such as scalability, price, climate footprint etc.) are still a challenge by comparison to existing alternatives.

Target

By 2030, Mowi aims to achieve an inclusion of 10-15% ingredients from emerging feed raw materials¹.

Selection of Emerging Feed Raw Materials

We continuously search for improved feed formulation through R&D. The outcomes of R&D² and risk assessment guide our decisions regarding all feed raw materials. Suppliers of emerging feed raw materials are expected to comply with Mowi's Code of Conduct and be assessed by Mowi's Relationship Management Tool.

Today's list of emerging feed raw materials is as follows: krill and krill products; oil, oil-rich and non-oily biomass from heterotrophic and autotrophic microalgae; macroalgae e.g. seaweeds; insect meal and oil; single cell proteins derived from bacteria and yeasts; GM vegetable oils with traits for the production of LC omega-3 fatty acids e.g. those derived from canola or camelina; zooplankton e.g. Calanus; mesopelagic finfish species; pea protein concentrate and isolate; concentrates made from faba beans, sunflower seeds and guar products; barley protein concentrate; and protein enriched co-products from brewing and distilling. This list is not exhaustive and classifications of ingredients will change with time.

The following categories are used in Mowi's risk assessment based on a 5 years' timeline:

Nutritional value

Risk is assessed based on R&D and nutritional profile of emerging feed raw materials as compared to existing alternatives. A poorer nutrient profile will lead to poorer FCR, poorer fish performance, health and welfare which have a negative impact on sustainability.

Price competitiveness

Average price (when products are commercially available) of emerging feed raw materials is compared to existing alternatives. When products are not yet commercially available, price is estimated based on dialogue with potential suppliers or other relevant stakeholders. Mowi's formulation program is used to provide feedback on the commercial value of candidate raw materials using templates constructed with real data for new materials supplemented with tried and tested assumptions for the nearest equivalent ingredient to fill in any knowledge gaps.

Certification

Linked with the likelihood that new certification will need to be developed to ensure sustainable and safe sourcing. This risk assessment is based on dialogue with several stakeholders including scientists and potential suppliers.

Climate impact

Linked with the GHG emissions of emerging feed raw materials as compared to existing alternatives. It is important that emerging feed raw materials do not lead to an increase in the scope 3 emissions of Mowi's climate footprint.

Market readiness/availability/scalability

The scalability of emerging feed raw materials is assessed based on available knowledge of current production capacity

Reputation and market acceptance

Linked with market, including consumers and customers perception of emerging feed raw materials.

Our risk-assessment will be evaluated on a yearly basis.

Novel Feed Raw Materials	Price competitiveness to current alternatives	Certification risk	Climate impact compared with current alternatives	Nutritional value comparison with current alternatives	Reputational risk	Risk of Availability / Scalability	Market acceptance
Krill	Higher in comparison to fishmeal	Low if MSC certification is retained	Comparable to fishmeal	Comparable to fishmeal, better than veg-based solutions	Dependent on how stakeholders look at origin	High availability from scientific perspective	Dependent on how stakeholders look at origin
Heterotrophic, oil-rich algae	Higher in comparison to fish oil	Low	comparable with alternatives	Good	Low	Currently medium but, supply is limited	positive
Heterotrophic, non-oily algal biomass / meal	Tending to expensive	Low	comparable with alternatives	Poorer than most protein sources	Low	Low availability	positive
Autotrophic micro algae (oil)	Significantly more expensive in comparison to fish oil	Low	Should be lower but, depends on other inputs e.g. light, infrastructure, nutrients and processing	Unknown but likely to be acceptable	Low	Low availability	positive
Autotrophic micro algae (biomass / meal)	Significantly more expensive in comparison to fish meal	Low	Should be lower but, depends on other inputs e.g. light, infrastructure, nutrients and processing	Poorer than most protein sources	Low	Low availability	positive
Macro algae	Significantly more expensive in comparison to alternatives	Low	Neutral / low in production, could be high in processing / distribution	Very low	Depends where and how it is grown / harvested	Low availability	positive
Insect meal	Significantly more expensive in comparison to fish meal/SPC	Medium	comparable / not currently optimal in EU due to feedstock quality requirements	Poorer	Medium tending to low	Low availability	positive
Single cell proteins	Expect to be high / over priced	Medium	comparable	Poorer	Low	Low availability	neutral
GM veg oils (omega 3 canola or camelina)	Expect price to reflect fish oil price with scaling	NA for certification but regulatory approval in EU is key	comparable to vegetable oils	Comparable to fish oil / higher than vegetable oils	Medium-High	Unavailable in Europe today - huge potential in future	neutral
Calanus (Zooplankton)	Very expensive	No certification available	Possibly, a bit higher than ordinary fishmeal	Depends on processing but, probably a bit lower than FM & FO	Depends who is campaigning and when	Potentially very high availability	Tending to low without certification
Mesopelagic sp	Likely to be comparable with FM and FO	No certification available	Possibly, a bit higher than ordinary fishmeal	comparable to fishmeal and oil	High in absence of certification and negligible knowledge of ecosystem	Unknown but the potential biomass is large	Tending to low without certification
Pea Protein Concentrate (PPC)	Good	Low	Comparable to equivalent offerings	Comparable to equivalent offerings	Low	Available but, more needed	positive
Faba Nean Protein Concentrate (FBPC)	Potentially good	Low	Comparable to equivalent offerings	Comparable to equivalent offerings	Low	Not existing	positive
Sunflower Protein Concentrate (SUNPC)	Potentially good	Low	Comparable to equivalent offerings	Comparable to equivalent offerings	Low	Current product needs further development	positive

Footnotes:

- (1) In 2021, Mowi Feed included 4% emerging feed raw materials in its feed composition (which includes algal oils and pea protein concentrate).
- (2) Between 2015 and 2021, Mowi Feed has spent 4.23 MEUR directed towards research on emerging feed ingredients including insect meal, auto and heterotrophic algae, single cell proteins, krill and pea protein concentrate. Specifically, Mowi Feed spent MEUR 1.12 in 2021. These costs refer only to the purchase of out-sourced analysis and services and do not include expenditure on the running costs of our in-house assets e.g. field stations or researcher / technician remuneration.