MiAlgae Grangemouth Non-Technical Summary

Company Context

MiAlgae uses cutting edge patented biotechnology to turn co-products produced from the whisky distillation process into an omega-3 oil rich product. MiAlgae is working to end reliance on wild-caught fish as a primary source of omega-3 through the sustainable production of omega-3-rich algae.

The Challenge

Marine omega-3s are vital for both human and animal health but are traditionally sourced from fish oil. The demand for these oils outstrips supply, with an estimated 1 million tonnes shortfall annually worldwide.

Every year, 16 million wild fish are caught just for their omega-3 and 20% of all wild caught fish are used to feed farmed fish. With demand for fishmeal and fish oil expected to exceed the supply of small fish by 2037, wild fish are no longer a sustainable option.

Our Solution

To meet the growing demands of a rising human and pet population, alternative sources of omega 3's are urgently required to enable the responsible growth of our food and feed systems.

MiAlgae's process offers a sustainable, plant based alternative to fish oil, addressing the need for eco-friendly omega-3 sources – ultimately improving food security and reducing the impact of humanity on the planet.

Fish do not produce omega-3s themselves, they acquire them by consuming algae. MiAlgae's innovative model bypasses the "middle fish" providing a more efficient, low carbon and sustainable source of marine omega-3s, reducing dependence on dwindling wild fish stocks.

Environmental Impact

MiAlgae is differentiated from other industry suppliers due to its roots in circular economy. Utilising notoriously difficult to dispose of co-products from distillation,

MiAlgae targets distillery partners pain points (environmental and economic) and re-purposes these into something beneficial for the environment and food security.

Each single tonne of algal product created by MiAlgae replaces the equivalent of 30 tonnes of caught fish requirement, significantly reducing humanities impact on our oceans. In the past six months, MiAlgae have:

- Made enough powder to save 2.4 million fish from being caught.
- Recycled enough wastewater in a year to fill nearly 300 Olympic-sized swimming pools.
- Prevented the release of 150,000 kg of CO2 — equivalent to taking about 500 round-trip flights between London and Edinburgh.

By 2030, MiAlgae expects to save billions of fish every year, prevent millions of tonnes of CO2 emissions, and conserve hundreds of million litres of water.

The Proposed Development

Process Overview

The MiAlgae process begins with receipt of co-product from a whisky distillery, delivered in large volume tankers into holding vessels on the plant. The raw 'pot-ale' media undergoes processes and additions, bespoke to each whisky distillery co-product, allowing each to be used to grow omega-3 rich algae. These recipes for pot ale are developed within the company within the Research and Development teams, turning any co-product into a media capable of supporting and promoting algal growth at scale.

Once the pot ale media is prepared and processed using MiAlgae's technology, it is then hygienically transferred into a cleaned 30,000L bioreactor at scale. The cleaning of these bioreactors is doing using a semi-automated CIP/SIP system. Resultant effluents from this process are collected and recycled for re-use or collected within an effluent storage tank. This resulting effluent is then taken off site for disposal. This bioreactor is then seeded with a controlled algal culture, which begins the fermentation process within the vessel. This seed algal culture is grown within a laboratory environment and associated pollution risks are negligible. Stock cultures are maintained within sterile conditions, which are then seeded into a 10L growth media and monitored until grown to a set density. Throughout this process, stringent quality control testing is carried out to ensure

a pure culture before its transfer across to the production plant. Once this 10L algal culture is inoculated into the 30,000L scale vessels, the algae consume the nutrients within both the raw pot ale and the added compounds, to produce an omega-3 oil rich wet product over a set number of days.

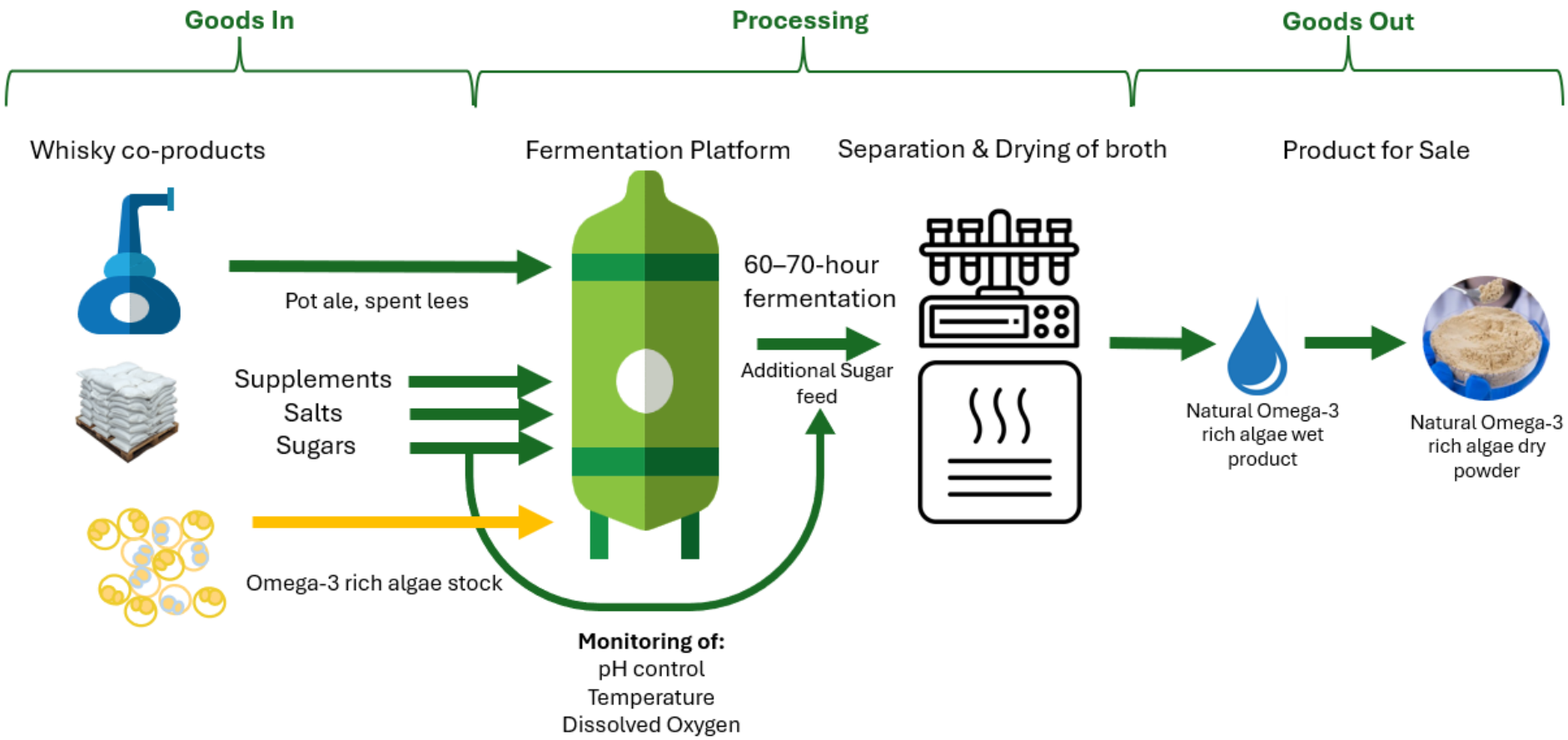
Following this process, a proportion of the water within the resulting fermentation broth (containing the algae rich in omega-3 oils) is removed, which results in a wet paste final product. The liquid removed (centrate) is stored and transferred off site for treatment. The resulting algae product is rigorously assessed for quality at many stages throughout the process, before being finally either directly shipped to customers or dried further to result in a powder. The drying systems required will also be on location within the plant boundaries, equipped with odour abatement systems. The plant, once fully commissioned, will have a capacity to produce 220 tonnes of wet product per week, or 46 tonnes of dried product (generally a mix of both options).

The production process requires constant control of aeration, temperature control and pH, alongside feeding of consumables. To enable this, MiAlgae's patented technology systems do this via automation, customised to our production plant. Data and outputs are constantly monitored by staff to control and achieve high standard of the product for customers. Throughout the process, quality control and food safety protocols ensure high quality product at all stages.

Inputs of the plant generally fall under – pot ale, raw goods (sugars, powdered materials) and cleaning chemicals. Outputs of the plant are algal product, recycle or stored chemical wastes, centrates and condensate liquids from steam, and foul waste to drain from offices. The entirety of which is processed by direct drainage connections to an effluent treatment plant, or tankered off site to a contracted waste management location.

Once at full scale the plant itself will be manned by shift patterns, running 7 days a week, 24 hours a day.

Diagram of MiAlgae Process



MiAlgae