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Scottish Seaweed Industry Association

Functional Ingredients from Seaweed using Supercritical CO_2

13th November 2025

Ray Marriott

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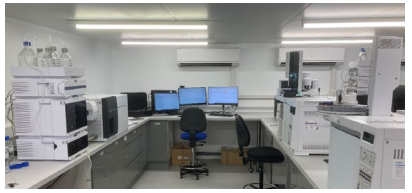
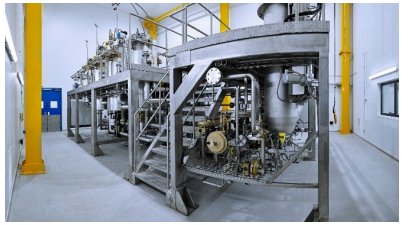
- Based in Spalding, Lincolnshire, UK we are a family owned business started in 1989
- Originally 100% horticulture supplying cut flowers, house plant and bedding plants to UK supermarkets
- Expanded into producing functional molecules from plants in 2018, using supercritical CO_2 as the core process technology
- Development of seaweed products for FMCG companies for 3 years focussed on hydrophobic molecules
- Applications in cosmetics, nutraceutical and pharmaceuticals



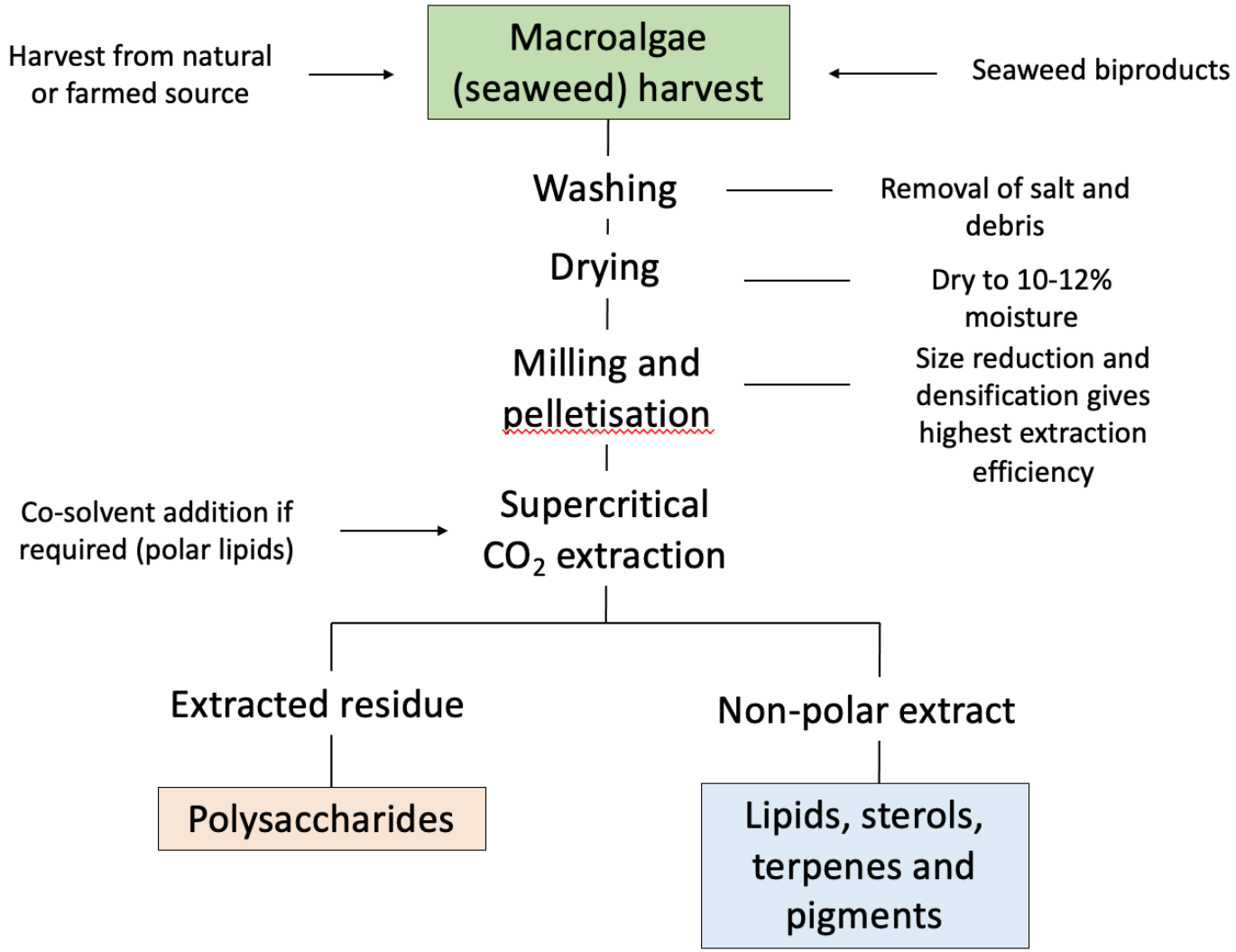




Why use carbon dioxide?

- CO_2 is internationally recognised as a green solvent and accepted globally as a clean solvent for cosmetic, pharmaceutical and nutraceutical ingredients
- CO_2 is a recovered and sustainable by-product from other processes in our case from anaerobic digestion
- Chemically stable, non-toxic, aprotic solvent
- Low cost and widely available from numerous suppliers
- CO_2 is purified, liquefied and can be supplied up to EP specification
- Processing with CO_2 is an organic process

  (Soil Association Revision 18.2, January 2020)

Functional molecules from macroalgae



Gan, A., & Baroutian, S. (2022). Current status and trends in extraction of bioactives from brown macroalgae using supercritical CO_2 and subcritical water. *Journal of Chemical Technology & Biotechnology*, *97*(8), 1929-1940.
Cikoš, A. M., Jokić, S., Šubarić, D., & Jerković, I. (2018). Overview on the application of modern methods for the extraction of bioactive compounds from marine macroalgae. *Marine drugs*, *16*(10), 348.
Sarkar, S., Gayen, K., & Bhowmick, T. K. (2022). Green extraction of biomolecules from algae using subcritical and supercritical fluids. *Biomass Conversion and Biorefinery*, 1-23.

Functional molecules from $scCO_2$ extraction

- Lipids
  - neutral and polar lipids, fatty acids including omega 3 and omega 6 fatty acids
- Sterols
  - composition depends on species but high levels of single sterols exist in some species
- Terpenes
  - limited range but present in some species and includes halogenated terpenes
- Tocopherols
  - natural antioxidants present in many species, dominated by α-tocopherol
- Pigments
  - fucoxanthin, carotenoids and keto-carotenoids

Lourenço-Lopes, C., Fraga-Corral, M., Jimenez-Lopez, C., Pereira, A. G., Garcia-Oliveira, P., Carpena, M. & Simal-Gandara, J. (2020). Metabolites from macroalgae and their applications in the cosmetic industry: A circular economy approach. *Resources*, 7. *9*(9), 101.
Bedoux, G.; Hardouin, K.; Burlot, A.S.; Bourgougnon, N. (2014) Bioactive compounds from seaweeds: Cosmetic applications and future development. *Adv. Bot. Res.*, *71*, 345–379.

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Conclusions

- Seaweed are a unique source of functional molecules that can be extracted using supercritical CO_2
- Many of these molecules have potential application in cosmetic formulation and would be available in commercial quantities
- The relatively low yield would make the ingredients more costly than mass produced ingredients
- Recovering the polysaccharide fraction would significantly mitigate this cost and there are growing applications for marine biopolymers
- Bridge Farm Bioscience welcomes academic and commercial collaboration to promote the extraction and purification of functional molecules from seaweed

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