BioMara

SUSTAINABLE FUELS FROM MARINE BIOMASS

THE BIOFUEL CHALLENGE

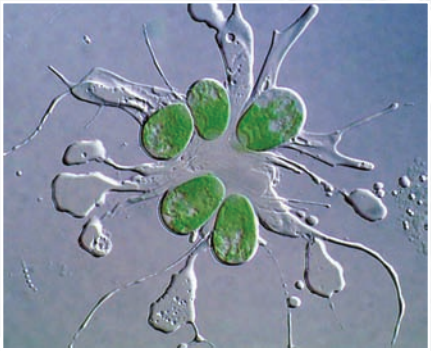
As global fossil fuel supplies dwindle and atmospheric carbon concentrations rise, pressure is on to find viable biofuel alternatives to petroleum products. The European Parliament is calling for 10% of road transport fuel to come from renewable sources by 2020, making this an urgent challenge.

90% of the world's biofuel production is currently bioethanol. Made largely from sugar cane and maize, it is used as a petrol additive. The remaining 10% of biofuel comes from plant oils such as rapeseed, soya and palm and is turned into biodiesel. These "first generation" biofuels or agri-fuels are a long way from meeting the world's need for energy security and reductions in CO_2 emissions, and their cultivation raises environmental and food security concerns.

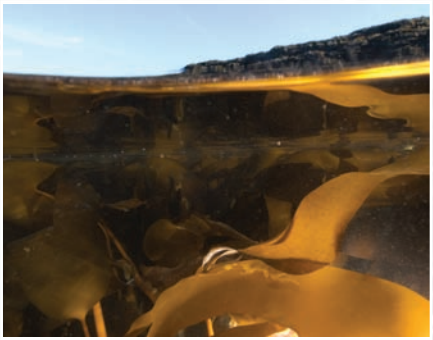
The oceans cover more than 70% of the world's surface and their extensive coastal regions are more efficient for growing biomass than the land. The marine environment therefore offers the planet's largest area for mass cultivation of biomass and opportunities are already being realised in countries like China.

BIOFUELS FROM ALGAE

One potential solution to the global problems associated with growing agri-fuel may be to cultivate aquatic plants: micro- and macro-algae. These are highly efficient converters of sunlight energy into biomass and in addition some types produce valuable oils.



- Microalgae are single-celled organisms that convert light directly into biomass and are capable of growing under a wide variety of conditions.
- Microalgae are more efficient converters of solar energy than terrestrial plants and many naturally produce oils, which can be converted to biodiesel.

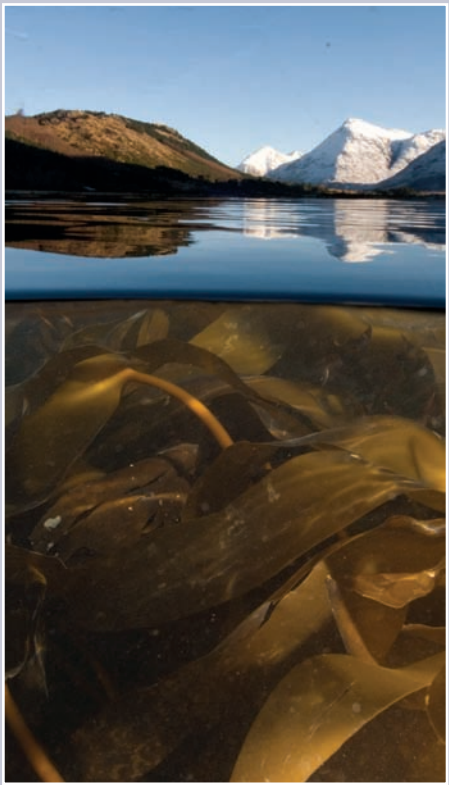


- Large brown macroalgae (seaweeds) naturally grow very fast in easily accessible coastal locations and are readily used as biofuel.
- Macroalgae and microalgal biomass can be anaerobically digested to produce methane and/or fermented to produce ethanol. With no lignin and little cellulose, they provide better material than land plants for complete biological degradation to methane.

THE BIOMARA PROJECT

The Sustainable Fuels from Marine Biomass project, BioMara, is a new UK and Irish joint project that aims to demonstrate the feasibility and viability of producing third generation biofuels from marine biomass. It will investigate the potential use of both macroalgae and microalgae as alternatives to terrestrial agri-fuel production. The practicalities of using algal biomass as a competitive, sustainable biofuel source will be considered in concert with wide stakeholder engagement, whilst environmental impacts of algal cultivation and extraction will be core considerations of the project.

High rainfall and poor agricultural land in areas of western Scotland, Northern Ireland and the Republic of Ireland severely limit cereal and oil seed cultivation, restricting the potential production of terrestrially derived biofuels. BioMara aims to provide the region with a sustainable fuel source by providing locally produced, renewable and relatively cheap low-impact fuel that may help to support traditional ways of life.



Macroalgae

Seaweed cultivation and harvest is now an established process in Scotland. Macroalgal spores are collected from ripe plants then seeded onto strings. Here the spores germinate to form tiny plants, which are transferred to sea after two months then harvested six to eight months later. The mature macroalgae can be used to generate methane via anaerobic digestion or to produce ethanol by fermentation.

Microalgae

The Culture Collection of Algae and Protozoa (CCAP) at the Scottish Association for Marine Science (SAMS) holds the largest algal culture collection in Europe, some 2700 strains. During the BioMara project, wild strains of microalgae characterised by high oil content and high stress resistance will be screened to identify those capable of sustained growth in outdoor conditions. Initially these will be grown on a small scale at SAMS. Additional work will focus both on industrial sites and on artificial blooms with fixed conditions.

Oil squeezed from the microalgae will be converted to biodiesel and the leftover biomass can either undergo anaerobic digestion to produce methane or be fermented to ethanol.

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