Products from Waste Water - Algae biomass-

Need for EU End of Waste (EoW) status

Waste water has a huge potential for resource recovery. This factsheet, which is one of three on this subject, presents **algae biomass** that can be produced while treating **municipal waste water*** and their possible non-fertiliser applications**. We focus on algae grown on nutrients from municipal waste water.

A lack of End of Waste (EoW) status inhibits the marketability of these materials. Creating EoW criteria will increase the amount of reused waste in the EU. This can increase the self-sufficiency of the EU and decrease the need for waste disposal.

Waste water is a resource.

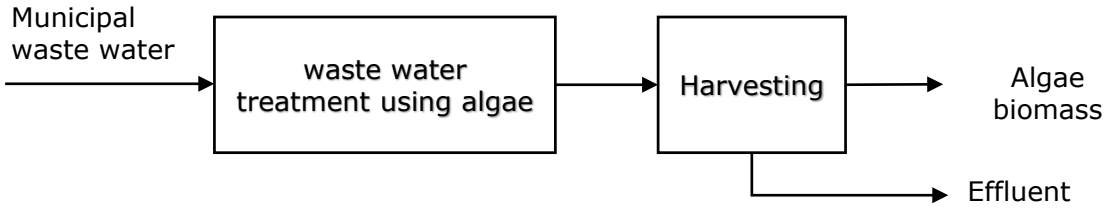
- Over **100 stakeholders** were consulted for this factsheet
- Technologies for the recovery of materials from algae biomass are already commercially available
- There are over **20 recent EU projects** on algae used for waste water treatment and resource recovery (Horizon 2020, Horizon Europe, LIFE, Interreg), with **hundreds of partner organisations**
- The estimated potential of recovered algae biomass in the EU **is 210 kt Dry Matter (DM) / year**

* Similar products can be recovered from other waste water sources such as from the food and dairy industries.

** Fertilising product applications are excluded, because the EU EoW procedure for these is covered by the new EU Fertilising Products Regulation (EU)2019/2009

Waste water treatment with algae

Algae growth leads to an uptake of the nutrients from municipal waste water and the production of oxygen which helps to degrade pollutants. Algal installations may be optimised for either waste water treatment (the objective is to have clean water with a small area footprint) OR for algae cultivation (the objective is to have high yields of quality biomass). With a separation step (settling, flotation or filtration) the algae biomass is harvested. Algae biomass is used to produce a variety of materials. The EoW status should therefore apply to the algae biomass rather than derived products thereof.



Market potential

	unit	Algae biomass
Price	€/tonne DM	1000-5000*
Full scale	-	Yes
Recovery potential	ktonne DM / year	210
	% of EU demand	**

* The price is highly dependent on the end use. For example, the price of algae biomass can be up to 2000 €/tonne DM for animal feed. It can be much higher for pharmaceuticals and cosmetics.

** The degree to which recovered algae biomass can cover the EU demand is uncertain. Currently there is a high demand for algae biomass for animal feed, agriculture and biomaterials applications, which is not met by current production capacity.

Extracted materials

With additional processing steps (e.g. drying, hydrolysis, extraction) several biomaterials can be produced from algae biomass. EU EoW status is required for algae biomass (as opposed to the biomaterials produced from algae biomass) to enable off-site downstream processing of the harvested algae. This would increase the possibilities for the production of biomaterials from algae biomass. Examples of these biomaterials are given in the table below.

Material	Possible applications (excl. Fertiliser)
Bioplastic (PHA and PLA)	Biodegradable plastics - Coatings - Input for composite material
Lipids	Biodiesel - Jet fuel – Animal feed additive
Proteins	Pharmaceuticals, Cosmetics, Animal feed
Fatty acids	Pharmaceuticals, Cosmetics, Animal feed
Pigments (carotenoids)	Neutraceuticals
Vitamins	Feed

Quality aspects

Algae biomass production from municipal waste water is demonstrated in several projects across the EU. In the SABANA project, algae were used to treat municipal waste water. The quality of the algae biomass was tested for – and met – the aquaculture feed standards. It can meet the heavy metal and pathogen regulations.

In another EU project - All-gas - biofuels were produced which could meet the requirements to be used for transportation. While biomethane from algae biomass digestion was validated in three vehicles for more than 70,000 km each, the lipids extracted from algae biomass can meet a quality sufficient for blending with other (bio)diesels.

Environmental aspects

Using algae for the treatment of waste water is a feasible technology that allows for the recovery of nutrients with a favourable energy balance.

Waste water treatment consumes around 1% of all electrical energy worldwide. This could be reduced when using micro algae.

Algae raceway pond, ESPP SCOPE Newsletter n°141

Algae processes can ensure nutrient removal from and disinfection of waste water (contributing to EU water policy objectives, such as reuse and eutrophication prevention), whilst converting secondary nutrients into valuable biomass and biochemicals. Additionally, carbon emissions can be reduced by using CO_2 as an input to accelerate algal growth.

Additional comments

- Exporting to other Member States is relevant for algae biomass
- There are no existing national EoW criteria

"Algae for waste water treatment is a market-ready technology and also applicable for smaller plants (<10,000 pe)"

- Gabriel Acien, Coordinator EABA -

"Using algae to treat waste water generates valuable products and fixes CO_2 without fertiliser inputs and without competing with food production"

- Robert Reinhardt, Founder and CEO Algen -

This factsheet was created by LeAF for EurEau

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This factsheet is reviewed and updated periodically, to present the most recent information. This is version 1 (October 2021).

Over one hundred stakeholders were consulted, see here.

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