This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 817992.

MARIGREEN

February, 2023

E-Newsletter Nº4

Contact: marigreen.project@gmail.com

In this issue:

Can we upgrade seaweed residues by composting?

Seaweed as fertilizer

In coastal areas, seaweed has always been applied as mulch, fertilizer, or as a feed product in agriculture. Seaweeds contain many essential nutrients, and there is a significant industry e.g., in Norway and Ireland that utilizes wild rockweed (*Ascophyllum nodosum*) to produce dried meals for animal feed or liquid fertilizer extracts.

The solid remains, left after extraction, are rich in carbon (30%) and may be applied as a soil amendment, but often have a high water content (70-75%), thus making transport and storage costly. In Norway, the residues are incinerated, wasting valuable nutrients and energy to evaporate the water.

Composting seaweed residues

One option for better utilization of the seaweed extraction residue, commonly called algae fiber or filter cake, could be to compost it before application as fertilizer. Composting reduces water content and volume and, if mixed with appropriate additional substrates, produces a more balanced fertilizer. However, successful composting is not straightforward and requires the right balance between carbon, nitrogen, water, and air. At the Norwegian Centre for Organic Agriculture (NORSØK) in Tingvoll, Norway, we have been working with compost from algae fiber outdoors, and in controlled experiments with Dewar flasks. We have also made batches of compost with a 200 liter insulated rotating drum.

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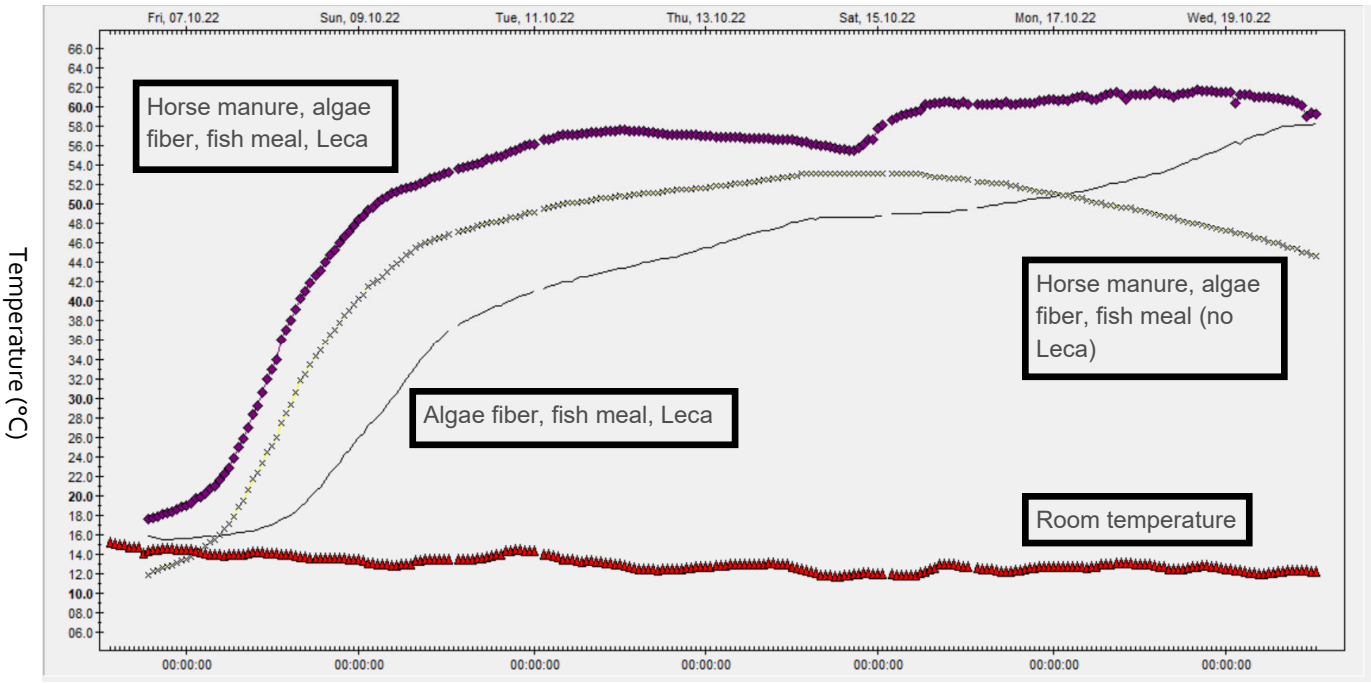
Expanded clay for compost aeration

One challenge, when composting algae fiber, is that it is very compact, almost clay-like, thus preventing aerobic conditions. We tested expanded clay aggregates ("Leca®") as an alternative bulking agent mixed with algae fiber.

Algae fiber mixed with Leca® clay aggregates.

Leca has several potential benefits, but our rationale for using it is because it is a very stable material and will not add anything other than structure to our composting experiments. Other bulking agents, such as wood chips and straw, add carbon and contain cellulose and lignin, both of which are known building blocks of humic substances. Normally, this is positive, but in our case we want to eliminate non-marine sources of these. Another benefit of Leca is that it provides a porous surface area for bacteria and other microorganisms on which to live. Applying compost containing Leca to soil adds structure, porosity, and contributes to regulating soil moisture content.

The figure below shows the temperature curves from an informal experiment testing Leca as a bulking agent. The red curve shows the room temperature; the black line is a mix of algae fiber, fish meal, and Leca; the yellow curve is a mix of horse manure, algae fiber, and fish meal (no Leca); and the purple curve is the same mix with Leca. Evidently, the two mixtures with Leca achieve a higher temperature and maintain it longer. Further experiments showed that 1/3-1/2 of the volume as Leca is ideal.



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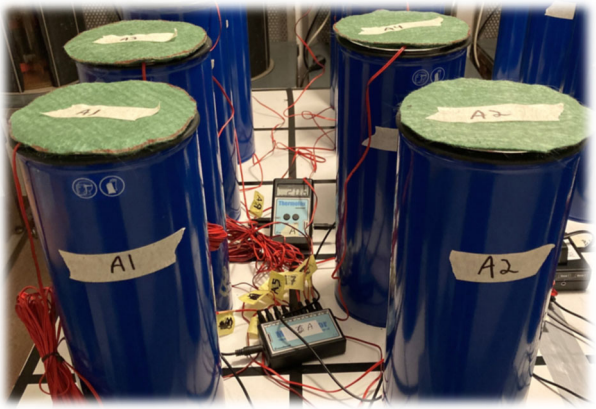
Dewar flask experiment

Liquid fertilizers are extracted from Ascophyllum meal using different formulations, leading to algae fiber with different ratios between carbon and nitrogen (N). To perform as a complete fertilizer, covering all nutritional needs of crop plants, algae fiber needs to be enriched with nutrients, such as N and phosphorus (P). That may be achieved by utilizing other waste products from the marine sector, such as residues form captured fish or mussels. Fishbones are rich in P, and also contain significant amounts of N.



Dewar flasks are extremely well insulated. They are used to estimate the degradability of fresh materials and assess the maturity of finished compost.

One of the mixes being tested in the Dewar experiment: (l-r) fish meal from whole cod, algae fiber, Leca. Final mix at the bottom.

How will mixing of N from fish residues affect degradation of algae fiber by composting? Is humic acid produced during composting of exclusively marine residues? What is the quality of the final compost? These questions and more are currently being tested in an experiment with Dewar flasks at NORSØK, where aerobic degradation and the humification process will be thoroughly studied as part of a PhD project funded by MARIGREEN.

You can read more about the effects of algae fiber as a soil amendment in the open archive Organic E-prints: https://orgprints.org/id/eprint/44040/ and https://orgprints.org/id/eprint/45330/

www.marigreen-project.eu.

www.twitter.com/MariGre04385907

https://www.researchgate.net/project/MARIGREEN-Sustainable-utilization-of-

www.linkedin.com/company/marigreeneu

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Who we are and contact information

	University "Politehnica" of Bucharest (UPB) **Chemical and Biochemical Engineering Department** Gheorghe POLIZU, 1-7, 011061, Bucharest Romania www.upb.ro/en/	Consortium Coordinator: Professor Oana Cristina PARVULESCU oana.parvulescu@yahoo.com
	Norwegian Centre for Organic Agriculture (NORSØK) Gunnars veg 6, NO-6630 TINGVOLL Norway www.norsok.no	Dr. Anne-Kristin Løes anne-kristin.loes@norsok.no PhD. student Joshua Cabell joshua.cabell@norsok.no
	Aristotle University of Thessaloniki (AUTh) **Chemistry Division of the School of Chemical Engineering** Thessaloniki 546 36 Greece www.cheng.auth.gr	Professor Athanasios (Thanos) Salifoglou salif@auth.gr
	University of Agronomic Sciences and Veterinary Medicine (USAMV) Bulevardul Mărăști 59, București 011464 Romania www.usamv.ro	Dr. Violeta Alexandra ION violeta.ion.phd@gmail.com
	Technical University of Denmark (DTU) Willemoesvej 2, 9850 Hirtshals Denmark www.aqua.dtu.dk	Dr. Carlos Letelier Gordo colg@aqua.dtu.dk
	University of Copenhagen (KU) Nørregade 10, 1165 København Denmark www.ku.dk	Associated Professor Max Nielsen max@ifro.ku.dk
	Norwegian Research Centre (NORCE) Nygårdsgaten 112, 5008 Bergen, Norway www.norceresearch.no	Professor Sigbjørn Tveteras sigbjorn.tveteras@uis.no
	Alumichem (Alum) Blokken 38, 3460 Birkrød, Denmark www.alumichem.com	Iván Liviano ivl@alumichem.com

The Research Council of Norway
InnovationsFonden
GENERAL SECRETARIAT FOR RESEARCH AND INNOVATION
MINISTERUL EDUCAȚIEI