The Finnish Cultural Foundation grants a fund for a water research project

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Martin Romantschuk and the work group committee were awarded a grant of EUR 240,000 for a research into the utilization of waste from food streams.

The food industry has various wastewater streams with low concentration, such as residual wastewater from yeast production, which will be utilized by a novel type of separation process. Food should not be wasted. This is how we are taught, and so is the food industry trying to operate. The raw materials left over from the process are used for other products or for animal feed. The exception is low concentration by-products from the food industry.

-They contain valuable nutrients, but with current systems it is not profitable to recover those so they are treated as wastewater, says Martin Romantschuk, professor of environmental biotechnology at the University of Helsinki.

Now, a new technological innovation, a version of electroflotation, can change the situation and make the recovery of low concentration wastewater streams profitable. For example, when one equipment in the dairy industry is used for production of various types of cream, the dairy equipment must be cleaned in between batches. Small amounts of cream derivates are soluble in the cleaning water, which can be used as feed, algae medium or cosmetic products, but with current methods the extraction of valuable components is not profitable.

The idea for the project came up suddenly and a bit by a chance. In recent years, Romantschuk and his colleagues at the Lahti campus have been researching the cultivation and utilization of Euglena gracilis as a dietary supplement and cosmetic raw material. Axolot Solutions Finland Oy has developed its modified electro-flotation invention mainly for the pulp and paper industry, but last year, the university realized that this technology would be useful for the “Euglena gracilis”, and cooperation began.

The first test will be the wastewater of yeast cultivation, the broth where yeast is grown. This wastewater contains a large amount of betaine from sugar beet. It is a valuable component in the cosmetics industry and also improves the growth of algae and plants. The wastewater is concentrated to organic fertilizer by evaporation. "The evaporation separation process is expensive, so often nutrients are not recovered from the wastewater stream but, if possible, processed into biogas," Romantschuk says.

Axolot's innovation uses iron or aluminum as the consumable electrode in an electrochemical process called electroflotation. In this case, electrolysis does not produce oxygen but metal, hydrogen and hydroxide ions that form a metal cluster and hydrogen gas. The metal and hydroxide ions form a gel-like foam, and the hydrogen lifts this foam to the surface of the water. At the same time, the foam lifts all other substances to the water surface. From there they can be conveniently recovered.

An important modification in food solutions is the addition of microcrystallized cellulose to water. Even small amounts effectively increase the network formation.

- Microcrystallized cellulose is good for food. It is already used as an additive in capsules.

The researchers are also experimenting with electroflotation to separate the harvested algae from the broth.

- Nowadays a centrifuge is used, but the spinning breaks the structure of the algae. Electroflotation is more gentle, and separation can also be successful with lower energy costs.

One area of development is the water in fish farm pools. The fish fecal matter could be recovered from it and used as a growth medium or fertilizer for algae. On the other hand, once the water was separated from the sludge and purified, it could be recycled to the plant.

When electroflotation is studied and tested, it can prove to be an excellent tool for any situation where it is necessary to separate low concentration substances from the water. For example, in the bakery and brewing industry, such solutions are common. In fact, the benefits of electroflotation may also be more broadly related to less wastewater generation.

- In our project wastewater treatment is a by-product, but it can also have economic significance. It can lower industrial wastewater charges, Romantschuk says.

In addition to him, the Research Team includes researcher Marika Tossavainen from HAMK and Professor Olli Dahl from Aalto University. Tossavainen has explored the possibilities of utilizing microalgae in various applications. Dahl has a long history of utilizing industrial side streams and is an expert in the use of microcrystalline cellulose (MCC). The new production method is now known as AaltoCell ™.

In addition to Axolot Solutions Finland Oy, there are two other start-up companies involved. Algonomi Oy focuses on the production of microalgae, mainly for the needs of the cosmetics industry. Laponie Oy, which develops and markets natural cosmetics, is involved in production of raw materials for cosmetics and participates in the testing the products from the project.

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The Finnish Cultural Foundation is a private foundation dedicated to promoting art, science, and other fields of intellectual and cultural endeavor in Finland. The Foundation provides grants from a central fund and 17 regional funds.
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