

Algae: the future sustainable super crop

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Research into algae makes it increasingly clear that these plants have huge potential for the sustainable production of everything from food to medicine.

Johan Andersen Ranberg won the Ph.D. Cup 2015 for his excellent research dissemination. (Video: DR2)

Imagine a crop that grows faster than most others and requires only sun, CO₂, and salt water.

This super-crop may be used in anything from food to medicines, vitamins, and food colorants.

This super-crop actually exists. It is algae, and intensive research is underway to figure out how algae can be exploited to its full potential.

One person behind such research is postdoc Johan Andersen Ranberg from the University of Copenhagen, Denmark, who has just been granted US\$313,000 from the Danish Council for Independent Research, to develop food colourings from algae.

"Development of biological food colorants is a major industry in Denmark and Danish companies are among the world's leading manufacturers. At the moment, a large part of this production is by chemical synthesis so Danish companies have shown great interest in using microorganisms to replace the use of chemicals," says Ranberg.

Algae: Huge potential and doesn't waste drinking water

Algae has huge farming potential as it happily grows in enclosed systems within greenhouses, says Ranberg,

Much like bacteria and yeast, algae can be used to produce virtually any biological product, such as food products where algae is an ingredient, or other biological substances that are a by-product of algae itself.

At the same time, algae need very few special conditions in which to thrive--just a little CO₂ and sunlight.

Unlike traditional farming, certain species of algae do not even require fresh water, but thrive in saline conditions. This is a huge advantage over traditional agriculture, which uses vast quantities of fresh drinking water.

Fast growing and ideal for sustainable production

Algae grow much faster than many traditional crops such as wheat and barley. According to Ranberg, all of these factors make algae an ideal product in the development of sustainable production practices.

"Denmark is a pioneer in biotechnology and the modification of organisms to produce various substances that are commercially interesting, such as medicine, proteins, food, detergent enzymes, and so on," he says.

According to Ranberg, Denmark also has the potential to be a pioneer in the sustainable production of natural substances from algae grown in greenhouses.

"It will greatly enhance the value of our agriculture to make high-value products with algae, compared to wheat and barley, which can be grown much more cheaply in many other countries," he says.

Algae used to produce orange colorants

As part of the newly launched project, Ranberg will help develop orange colorants from algae for use in the food industry.

Commercial orange food colorants are currently produced from so-called natural carotene--a substance produced by photosynthetic organisms to regulate the intake of solar radiation.

Carotene is also used in many other products such as vitamins.

The effect of carotene-containing algae can be seen already in nature. For example, the pink-orange flesh of Salmon is due to the salmon's diet of algae that is packed full of carotene.

Plants can convert the sun's energy more efficiently

Ranberg will start the research by taking genes responsible for making carotenes in mandarin oranges and inserting them into algae.

Once the algae are producing their own carotenes, Ranberg will then investigate to identify their preferred growing conditions. Eventually, Ranberg hopes to make algae an economically attractive crop that produces many carotenes.

Another object of the study is to learn more about carotenes themselves and how they help to regulate light uptake in plants. Ultimately, they hope to find out how they can alter the carotene composition in plants so that they grow faster.

"There is so much potential in this super-organism. If we can we seize the opportunities, then in a few years, we could have brand new climate-friendly production systems that are commercially interesting and can create new types of jobs in agriculture. I hope my research can help," says Ranberg.

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Fact box

The Danish Council for Independent Research has given a postdoctoral grant of approximately US\$313,000 to Johan Andersen Ranberg's project: 'CaroAlgae - Production of carotenoids in algae'.

The project will be carried out at the University of California, Berkeley, USA.

The focus is to show the potential of algae as a new and sustainable crop.

[Johan Andersen-Ranberg](#) [13]

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Catherine Jex

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