

# More than just Greenwashing

The great new hope for biomass is coming from the sea. Algae are true jacks of all trades for the food industry, cosmetics and the energy sector. But the cost of harvest is still high. Intelligent separation technology can significantly reduce it, however.

It would be excusable to think that the primary uses of algae are to wrap sushi and keep teenagers out of the water. But recently, numerous discussions of biomass have been looking closely at these green exemplars of sea life as potential power plants. Not many people know that algae **have** been important **long** in far more areas than Japanese cuisine. It's also used as a stabilizer, a thickening agent and in cosmetics as a provider of active agents and nutrients. As a source of renewable energy, however, algae **have** never been convincing, due to the negative overall energy balance that has always plagued the manufacture of algae-based biofuels.

But now a new process specifically addresses the energy expenditure in algae harvesting, and additionally has a positive effect on the subsequent drying process. A combination of preliminary

thickening (e.g. flotation) and a special centrifuge, the Sedicanter, significantly augments the efficiency of the harvesting process. Experiments have already demonstrated the efficient function of the system. Processing volumes of up to 120 m<sup>3</sup> of algae suspension are possible in an hour – and also required to achieve practical total volumes.

In one example case, this throughput was used to make a quantitative comparison of the conventional process using three separators with the new system combining flotation and the Sedicanter. An algae suspension with an algae content of about 3 g/l was investigated. The final yield was 360 kg of dried algae. If the higher dry solids in the harvested suspension after the Sedicanter is considered, for the subsequent drying this means that the energy balance was positive. It also turned out that 40 percent savings are possible in the evaporation of the residual water.

To understand the high energy costs for manufacture of algae extract, the first thing to consider is the harvesting or thickening process. Due to the low algae concentration in the culture medium, it is necessary to process high volume flows. The cells of freshwater algae are also only about 2 to 10 µm in size.

Until now, separation from the culture medium was carried out with disk separators. **Theirs** high centrifugal force is needed in order to affect even the smallest of cells. With separators, a specific energy consumption of about 1 kWh per cubic meter of algae suspension can be anticipated. The harvested algal broth still reaches a dry solids content of 17 percent. To achieve the target quantity of 360 kg algae powder, in our example over 1,750 l of water per hour has to be evaporated by application of energy.

The two-phased system of flotation and the Sedicanter starts by prethickening the



Algae – biomass from the sea.  
Photo: Richard Carey/Fotolia.com



The Sedicanter®.  
Photo: Flottweg SE

Process	Single-phase harvesting process with three separators	Two-phase process with prethickening (e. g. flotation) and sedicanter
Processing volume	120 m <sup>3</sup> /h algae suspension with 3 g/l algae	
Specific power consumption	1 kWh/m <sup>3</sup>	e. g. Flotation: 0.13 kWh/m <sup>3</sup> Sedicanter: 2.5 kWh/m <sup>3</sup>
Power consumption total	120 kW	30 kW Savings of about 75 %
Dry solids in the harvested algae concentrate (to the dryer)	17 % by weight	24 % by weight
Evaporated remaining water volume	17 % by weight	24 % by weight
Evaporated remaining water volume	1 750 kg/h	1 125 kg/h Savings of about 35 %
Algae powder	360 kg	360 kg

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culture medium. Only after this phase is it separated in a special centrifuge called the Sedicanter. This machine has a centrifugal field much like that of a normal separator. But its special design allows significantly higher solid volumes to be processed in this centrifuge. This special construction allows it to be used with prethickening to significantly reduce the required through volume.



*The solid phase after separatin.*

*Photo: Flottweg SE*

### 75 Percent Energy Savings with the new Process

In a conventional process without prethickening, about three separators would have to be used to process the same volume of culture medium. If the energy consumption for three separators is compared to the combination of flotation and the Sedicanter, savings of up to 75 percent of the energy consumption are possible in this stage of the process. The cost of flotation is about 0.13 kWh per cubic meter of suspension. Only the intake into the Sedicanter, at 2.5 kWh per cubic meter, is higher than for a separator.

Since the Sedicanter can handle up to 45 percent algae solids by volume in its intake, however, only a twentieth of the total volume needs to be processed. Another advantage of the Sedicanter lies in the dry solids content it can achieve, up to 24 percent by weight. In our example, that means that only 600 l less water must be evaporated to dry the algae. If the two processes are

compared, and especially if the immense savings potential during drying is considered, the two-phase process of flotation and Sedicanter has the clear advantage.

The two-phase process is therefore an economically interesting alternative. In our example, the power consumption in comparison with conventional systems is up to 75 percent lower. The improved dry solids content of the harvested algae culture also has a beneficial effect on the downstream drying processes. The volume of water to be evaporated can be reduced by up to 40 percent.

The only downside: The example is based on calculating from the existing process conditions. Even in the ideal case described, »only« 360 kg of dried algae substance will be available after an hour. From a practical standpoint, this scale of capacity is simply not sufficient. Without efficient cultivation of algae, therefore, two-phase algae harvesting will not yet be able to reach its full potential. For the food and cosmetic industries, however, these volumes are already interesting. ■

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