Separation Technology for Algae Production
An Ocean Full of Possibilities

GEA Westfalia Separator has taken a close interest in biotechnology from the outset and contributed substantially to its industrial utilization. The possibilities this yields for industry are apparent in algae production.

The extraction of numerous substances from algae is based on biotechnology. From its first beginnings to modern, large-scale utilization, biotechnology has come a long way in the last hundred years. Today it makes use of higher organisms as well as microbes and is firmly established both in basic research and in the industrial application fields of agriculture and medicine as well as nutritional and environmental science.

Algae form polyunsaturated fatty acids, proteins, enzymes, vitamins, minerals and trace elements at high concentration. These valuable constituents mean that algae have definite future potential. Exploitation of this potential has barely begun, but very wide-ranging applications are already being realized thanks to biotechnological utilization of natural raw materials.
Several species are important among green algae. Astaxanthin, a natural carotenoid, is derived from *Haematococcus pluviales*. It is used to intensify the red color of salmon or caviar substitute. *Dunaliella salina* is a popular source of beta-carotene. The green alga *Chlorella* is in demand principally for its high vitamin and mineral content. Among the blue-green algae, the current star is *Spirulina*. This genus occurs in strongly alkaline salt lakes but also colonizes flat, subtropical to tropical water bodies with a high salt content, mainly in Central America, Africa and Asia. As a dried preparation *Spirulina* is rich in high-quality protein, beta-carotene, vitamin E and minerals such as calcium, iron, potassium, magnesium, manganese, phosphorus, selenium and zinc. Medical studies have shown that *Spirulina* and *Chlorella* can lower cholesterol level and blood pressure. As a nutritional additive in powder or tablet form, they are now commonly found in health-conscious households.
Algae Processing

Today, the rate of algae production worldwide is already between seven and eight million tonnes per year. To be able to satisfy this high demand and operate with maximum economic efficiency, more and more companies are turning to centrifugal technology from GEA Westfalia Separator.

The separators and decanters specifically developed for treating fermentation products are being used for concentrating, extracting and washing algae. The centrifuges are suitable for plants producing algae in open ponds and also for closed systems using photobioreactors, where improved light conditions and reduced risk of contamination are advantages over open ponds. For the concentration process there are separators of various models to choose from, each with its individual advantages according to algae type and cultivation conditions.

Which separator and which processing material provide the best possible performance in any particular case depends not just on the capacities to be handled, but also on numerous other factors. These include the product’s viscosity, the solids content, the pH value of the fermentation broth or the cell structure of the algae. Corrosion-resistant high-alloy special steels are used to meet the special requirements of salt algae. GEA Westfalia Separator also offers decanters for the concentration and dewatering of biomass as well as to classify micro algae.
Recovery of purified algae extract from photobioreactors

Micro algae classification
Algae form polyunsaturated fatty acids, proteins, enzymes, vitamins, minerals and trace elements at high concentration. These valuable constituents make algae a sought after raw material for numerous products. Applications range from cosmetics and pharmaceuticals through to nutritional additives, livestock feed, wastewater treatment and binding of heavy metals.
Centrifugal Technology
Specialized for Handling Algae

Whether clarifiers, nozzle separators or decanters, GEA Westfalia Separator has the right centrifuge for the various separation stages in algae processing.

SSD generation clarifiers are suitable for all concentration processes and are especially impressive because of the GEA Westfalia Separator hydrostop system, which makes very high solids concentrations (up to 30 percent) possible and thereby maximizes product yield. Product ejection is initiated at the ideal moment by the special photoelectric control system. These self-cleaning clarifiers already encompass a capacity range of 3 to 50 cubic meters an hour. They are surpassed only by the larger SSE series models which can handle capacities of up to 120 cubic meters. With its product-conserving hydrohermetic feed system this separator generation also lends itself to more sensitive cellular material. Whatever the customer’s needs are, GEA Westfalia Separator can provide an optimum system which fully meets individual product requirements.

Nozzle separators are often used for washing the algae or if a centrifuge is needed which can handle a high feed concentration or even pre-concentrated algae. The separators have special viscosity-controlled nozzles (GEA Westfalia Separator viscon®) in the bowl top. They automatically make a constant solids concentration in the discharge despite changing feed conditions. The concentrate under is discharged pressure.

Depending on the needs of the customer or the algae type, GEA Westfalia Separator can also offer nozzle separators with nozzles located on the circumference of the bowl. Special demands on the centrifuges due to high chlorine ion content in the culture solution are met by using corrosion-resistant high-alloy special steels.

Decanters from GEA Westfalia Separator are able to concentrate and dewater biomass as well as to classify green algae, thus obtaining the valuable pigment astaxanthin. This newly developed decanter technology for algae processing will in the future enable extremely small and light solids with a low density differences to be discharged under controlled conditions. The decanters are used to recover natural astaxanthin and also to remove unwanted algae cells from contaminated algae cultures.

The maximum capacities in algae production can be realized with the high-performance SSE series clarifiers. The largest model, the SSE 550 is rated for a capacity of up to 120 m³/h. The hydrohermetic feed simultaneously ensures gentle treatment of algae cells.
We live our values.
Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

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