A novel technology to produce microalgae biomass as feedstock for biofuel, food, feed and more

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A set of technologies enables reaching high biomass yield per square meter with low energy usage and demonstrates a potential biomass production cost of USD 1/Kg. The process comprises strain selection (a), cultivation in a patent-pending cultivation system (b), concentration in geo-textile bags (c), extraction and fractionation (d) that result in oil fractions rich in Triglycerides (TGs) or EPA (an Omega-3 type fatty acid) that can be commercialized in the biofuel or the food industries respectively (e) and the remaining biomass, which is rich in protein (f) can be commercialized in the feed industry. Credit: *TECHNOLOGY*

Novel and scalable technology and production process combining algal biomass cultivation, harvesting and concentration as well as extraction

and fractionation of fatty acids from the biomass results in ability to offer high quality feedstock for various industries in a highly competitive price.

UniVerve Ltd. (UniVerve), an Israeli company, has begun scaling-up its technological process, which is expected to change the feedstock market in various industries, such as food, feed and biofuel, which are forced to look for alternative feedstock due to the increasing price of their current raw materials. While microalgae-oil was perceived as the preferred feedstock to supply the inelastic global demand for biofuel, industry and academia attempts to create viable microalgae-oil production processes has not reach the desired goal yet. UniVerve developed an innovative technological process that provides a scalable, cost effective and sustainable solution for the production of microalgae-biomass. The oil, which can be extracted with off-the-shelf wet extraction technologies and used as an excellent feedstock for all kinds of biofuel, is expected to be produced at up to 50 dollars per barrel (equal to the current market price of crude fossil oil). As the biomass contains also omega-3, proteins and other valuable biomaterials that can be commercialized in the food and feed markets, a microalgae farm can serve the biofuel, food and feed industries, which face an increasing lack of quality feedstock at an affordable price.

The existing microalgae cultivation methods are either too expensive (phot-bioreactors) or in-efficient (race-way open ponds). In order to reach large volumes there is a need for very large areas, which results in high evaporation rate and high contamination risk. In addition, there are additional challenges such as minimizing the energy consumption in the process, prolongation of the production season and optimizing growth conditions (e.g. temperature control, light exposure etc. to increase photosynthesis) thus, maximizing income/m2 as well as system modularity and flexibility.

"The heart of our innovative process is the HAVP? cultivation system (Hanging Adjustable V-shaped Pond), a suspended, modular and scalable triangular structure with transparent walls that allows light to penetrate from all sides, thus increasing photosynthetic activity and enhancing biomass yield/m2" says Ohad Zuckerman, co-founder and CEO of UniVerve. "Mixing is done by bubbling air through a simple irrigation pipe at the bottom of the HAVPTM. Therefore, the unique pond design lowers water loss, energy consumption, operational costs and maintenance and in addition, enables modular scalability by prolonging the structure up to 100m, so it contains 100m3 of production medium. So far, 5 different strains were successfully grown in the HAVPTM", adds Zuckerman.

After acquiring off-take letters of intent for biomass, high TGs oil and high EPA oil from customers in Israel, Europe USA and China, UniVerve began constructing its 1st commercial site in Israel. The company negotiates the establishment of additional farms in Israel and China. There is a need to prepare for each farm a specific financial model, based on local climatic and economic conditions. Each farm will be located in a different location with specific climatic conditions and water quality that affect the growth cycle of the strain as well as different cost of material, labor, land and water. Moreover, each farm owner/client will look for specific biomass composition and the sale prices may differ as well. The income and consequently the profitability indicators (ROI - Return on Investment, IRR - Internal Rate of Return etc.) will depend on the final composition of the biomass, the goal products and their sale price.

"Microalgae hold a promise as the prime feedstock for biofuel. The key success factors for economic production of microalgae-oil for the biofuel industry are high yield per square meter, minimal use of energy and scalability on one hand, and selection of strains that contain both sufficient oil and high value materials that ensure high profitability due

to the commercialization of the entire biomass produced" says Ohad Zuckerman. "The second factor creates a dramatic insight: the major enabler for microalgae to compete with crude oil prices is the commerciality of the entire of the biomass i.e. the strain in use should contain high-value materials in addition to the triglycerides that feedstock for biofuel. The biomass should be fractionated and each fraction should be commercialized in the relevant industry - this way the project can be highly profitable" he adds. Additional co-authors of the paper are Ra'anan Herzog, Dr. Yoni Sharon and Dr. Elizabeth Yehuda, all from UniVerve Ltd.

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