Dewatering and Drying for Global Food Security

The need:

Food and water are the most basic human needs. The desalination project addresses water, this project addresses food.

Within the last 100 years the supply of shellfish has declined while prices have grown. Once a relatively inexpensive and much sought after food, oysters now command near-caviar retail prices, a still desirable luxury for those who can afford such. The transition from wild harvesting to private farm leases was an early solution to the problem, but demand has out-run off-shore production capacity with little opportunity for expansion due to competition for space and environmental regulations. The problem is compounded by growing coastal populations and intensive agriculture that sometimes introduce pollution and disease. The obvious solution is to move shellfish production – starting with oyster species – onto land. Clearly the market exists if a high quality product can be farmed economically and sold at competitive prices. Fish waste is ideal fertilizer for culturing microalgae that in turn can serve as oyster feed. Large scale culture of algae translates to large scale culture of oysters to market size on-land, a paradigm change from traditional practice.

Algae dewatering serves several purposes. Cultured algae is relatively dilute when a given volume of water is first inoculated. Each algae cell goes through a growth phase before dividing and over time the culture density increases. An algae culture may take a week or more to reach maximum density and soon after the culture will "crash" and the algae's food value diminishes rapidly. By concentrating algae well beyond this natural "maximum density" it becomes economical to refrigerate algae and it's "shelf life" is greatly increased. Furthermore, dewatering the algae to a known, standard concentration, greatly simplifies rationing of food and the physical labor of handling, moving and feeding algae to animals. Finally, if cells can be concentrated without being damaged, the algae culture can be used as a bio-filter for removing nitrogenous wastes. Large volumes of water can pass through the culture, and nitrogen removed, while the algae cells are captured in the outflow and returned to the culture.

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The key project design objective:

The project will focus on the completion of a system which will be used for dewatering of algae which protecting the integrity of the cells.

1. Concentrate algae without damaging cells (maintain viability).

2. Make algae concentration consistent, predictable and adjustable.

Who is the final customer for this device;

The aquaculture industry is a cornerstone of the Maine economy. Three new startup companies are working in a range of applications related to dewatering and concentration of feed and seed for the algae industry.

Who will be supervising and evaluating the outcome of the project:

Project review will be done separately for the biological and the engineering portions of the project. Biologists, engineers and aquaculture experts will be available for technical assistance e and to review the work being done.

UMaine Mechanical Engineering technical contact point:

Professor Peterson will supervise the mechanics, materials and manufacturing issues related to the project evaluation of this project. Mr. Abbadassa will provide oversight on the testing and construction of the machines. Patrick Erbland will oversee the biologically related aspects of the project.

The core Mechanical Engineering classes required as background for the project:

Controls
Design I & II
Material Science
Fluids

Resources available:

Resources include not only the infrastructure in Crosby Lab but also expensive aquaculture growth and development facilities owned by the University of Maine. Financial support beyond the basic funding for the class is available from the industry partner.

End of year deliverables:

A complete system for high throughput drying of algae will be built and tested. The algae will be provided by the industry partners.