Power farmING - students group for developing algae reactors

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Power farmING was originally created as a project of TUHH's Centre for Teaching and Learning as part of their Interdisciplinary Bachelor Project. In this project, freshmen students were tasked with creating both a viable concept for a lab-sized algae reactor and implementing it for test purposes. Limitations were set by maximum dimensions and operating weight as well as a preconfigured light source.

Previous Concept

Power farmING developed a redundant dual chamber system with the goal to maintain maximum reliability. As such, the two chambers did not interexchange any fluids or microalgae and were circulated by two separate rotary pumps. Exterior hull elements were built from polymethylacrylate (PMMA). A combination of compressed air and carbon dioxide was diffused into the system via a tube at the bottom of each container, thereby creating a countercurrent. Light was emitted from outside the chambers with a split line of LED lights mounted on the side of both chambers. While the lights were facing away from the surface they are mounted on, the lights were shining into the other container, illuminating the culture in that container. Curved boards were horizontally integrated into the hull. These were limiting the movement of the culture inside the reactor and stimulate vortices in between the boards. In combination with the pumps the boards guided the culture in a "zig-zag" course from top to bottom whilst being fed carbon dioxide from below. Temperature and pH were measured via external probes and fed into a regulator controlling the stream of carbon dioxide, while air was permanently introduced into the reactors to maintain the countercurrent.

Future Ideas

The reactor described above was tested for two weeks with a culture of Acutodesmus Obliquus. The biggest problem was heat induced into the system by the pumps. Moving away from electrically powered pumps to systems like hydraulic rams would drastically reduce temperature inside the chambers as well as reduce the initial energy consumption and thereby operating cost. The curved boards can also be optimized in terms of shape and size to reach optimal vortices and mixing in the spaces between the boards and prevent residue on the boards.