Is seaweed the future of biofuel?

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As scientists continue the hunt for energy sources that are safer, cleaner alternatives to fossil fuel, an ever-increasing amount of valuable farmland is being used to produce bioethanol, a source of transportation fuel. And while land-bound sources are renewable, economists and ecologists fear that diverting crops to produce fuel will limit food resources and drive up costs.

Now, Prof. Avigdor Abelson of Tel Aviv University's Department of Zoology and the new Renewable Energy Center, and his colleagues Dr. Alvaro Israel of the Israel Oceanography Institute, Prof. Aharon Gedanken of Bar-Ilan University, Dr. Ariel Kushmaro of Ben-Gurion University, and their Ph.D. student Leor Korzen, have gone to the seas in the quest for a renewable energy source that doesn't endanger natural habitats, biodiversity, or human food sources.He says that marine macroalgae — common seaweed — can be grown more quickly than land-based crops and harvested as fuel without sacrificing usable land. It's a promising source of bioethanol that has remained virtually unexplored until now.

The researchers are now developing methods for growing and harvesting seaweed as a source of renewable energy. Not only can the macroalgae be grown unobtrusively along coastlines, Prof. Abelson notes, they can also clear the water of excessive nutrients — caused by human waste or aquaculture — which disturb the marine environment.

A man-made "ecosystem"

While biomasses grown on land have the potential to inflict damage on the environment, the researchers believe that producing biofuel from seaweed-based sources could even solve problems that already exist within the marine environment. Many coastal regions, including the Red Sea in the south of Israel, have suffered from eutrophication — pollution caused by human waste and fish farming, which leads to excessive amounts of nutrients and detrimental algae, ultimately harming endangered coral reefs.

Encouraging the growth of seaweed for eventual conversion into biofuel could solve these environmental problems. The system that the researchers are developing, called the "Combined Aquaculture Multi-Use Systems" (CAMUS), takes into account the realities of the marine environment and human activity in it. Ultimately, all of these factors function together to create a synthetic "man-made ecosystem," explains Prof. Abelson.

Man-made fish feeders, which produce pollution in the form of excess nutrients and are generally considered harmful to the marine environment, would become a positive link in this chain. Used alongside an increased population of filter feeders such as oysters, which suck in extra particles and convert them food that the microalgae can consume, this"pollution" could be used to sustain a much greater yield of seaweed, which is needed for seaweed to become a sustainable source of fuel.

"By employing multiple species, CAMUS can turn waste into productive resources such as biofuel, at the same time reducing pollution's impact on the local ecosystem," he says.

Turning waste into opportunity

The researchers are now working to increase the carbohydrate and sugar contents of the seaweed for efficient fermentation into bioethanol, and

they believe that macroalgae will be a major source for biofuel in the future. The CAMUS system could turn seaweed into a sustainable bioethanol source that is productive, efficient, and cost-effective.

Provided by Tel Aviv University