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Scientists developing clean energy systems from micro-algae

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An international consortium established by an Australian scientist is developing a clean source of energy that could see some of our future fuel and possibly water needs being generated by solar-powered bio-reactors and micro-algae while absorbing CO_2.

Associate Professor Ben Hankamer, from the Institute for Molecular Bioscience (IMB) at The University of Queensland, has established the Solar Bio-fuels Consortium which is engineering green algal cells and advanced bio-reactor systems to produce bio-fuels such as hydrogen in a CO_2-neutral process.

"The development of clean fuels to combat climate change and protect against oil price shocks is an urgent challenge facing our society," said Associate Professor Hankamer, who co-directs the Consortium with Professor Olaf Kruse from the University of Bielefeld in Germany.

"Many countries are already aiming to replace 10 to 20 percent of their existing energy production capacity with CO_2-neutral energy systems by 2020. But this is very likely not nearly enough.

"Some reports indicate that 50-66 percent of current energy production capacity may have to be CO_2-free by 2020 to avoid the worst effects of climate change. This will be very hard to achieve and we need new technologies to do so."

Fuels make up about two-thirds of the energy market, yet most low-CO_2

emission technologies, such as nuclear power and clean coal technology, target the electricity market. In contrast, the solar bio-hydrogen process uses solar-powered bioreactors filled with single-celled algae to produce hydrogen from water.

Algae naturally capture sunlight and use its energy to split water (H_2O) into hydrogen and oxygen, however this process is not efficient enough to make it commercially viable.

The Consortium uses this natural reaction, but is developing ways of enhancing its efficiency to a level where the process will be economically viable. This will be done with the help of a $286 000 Australian Research Council grant received last week.

“We have conducted detailed feasibility studies that show that, once key technical milestones are overcome, this technology could achieve economic viability, which will increase further with the introduction of carbon trading schemes and the predicted rise in the oil price,” Associate Professor Hankamer said.

“We have focused on micro-algae as a source of hydrogen because they have several advantages over traditional bio-fuel crops.”

One major advantage, especially in drought-stricken countries like Australia, is that hydrogen can be produced from salt water. Marine and salt-tolerant algae can extract hydrogen and oxygen from seawater and on combustion these gases produce fresh water and electricity, which can be fed into the national grid. Consequently, clean energy production can theoretically be coupled with desalination.

This is by no means the only advantage. One of the current concerns about traditional bio-fuel crops is that they will compete with food production for arable land and water. In contrast, algal bioreactors can be placed on non-arable land and use much less water than conventional bio-fuel crops.

“This opens up new economic opportunities for arid regions and eliminates competition with agricultural crops or rainforest regions which are increasingly being used to plant oil palms for bio-diesel production,” Associate Professor Hankamer said.

“Algae also have a very short life cycle and can be harvested every one to ten days rather than once or twice a year, increasing yield.”

One other major benefit of the hydrogen production process is that it absorbs CO_2.

“We are therefore starting to investigate whether our hydrogen producing systems can be linked to conventional power stations to sequester CO_2 which would otherwise be released into the atmosphere”, said Associate Prof Hankamer.

For more information on the Consortium please visit www.solarbiofuels.org .

Source: University of Queensland

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