7 Aug 2017 - The Herald (South Africa)

Highly versatile solution

Algae-to-energy project responds to eco-challenges

Coalgae® pyrolysis char is a virtually smokeless, smouldering fuel with very little harmful emissions … It actually burns more than 50% longer than coal

NELSON Mandela University's pioneering microalgae-to-energy project is proving to be a highly versatile eco-solution: besides cleaning up the atmosphere by mitigating carbon dioxide to grow the algae, and being a source of renewable energy, it is also an effective fertiliser, can clean up oil-soaked soil, and can even be used to produce a low-smoke, long-lasting fuel for households.

The university's internationally recognised institute for chemical technology, InnoVenton, started its microalgae project seven years ago, with the aim of using the algae to mitigate harmful carbon dioxide emissions from factory flue gas, and then harvesting the algal biomass for various renewable energy uses.

They also discovered that the biomass could bind with otherwise wasted coal dust to form coal briquettes trademarked as Coalgae®.

Each year, South Africa's mines produce about 70-million tons of coal waste, mainly in the form of very fine coal dust.

As the project progressed, the Department of Science and Technology approved funding for the construction of a small-scale technical demonstration facility at the Nelson Mandela University's on-campus microalgae facility in Port Elizabeth.

"Last year, we met our target – which was to produce five to six tons of Coalgae® – and sent samples to various external companies for testing," InnoVenton's Brian Tait said.

The ongoing test results were promising, attracting plenty of national and international interest. But apart from the use of microalgae for Coalgae® applications, Tait and his team were also asked by the Department of Science and Technology (DST) to focus on other potential uses for the microalgae biomass and Coalgae®.

In their research, they found that in South Africa, more than 7 000 industrial boilers, all burning coal, were being used by various companies to generate heat and steam.

They sent samples of Coalgae® to a leading international boiler manufacturer, whose tests showed that Coalgae® was an excellent alternative fuel for boilers, due to its exceptional combustion characteristics.

Other tests have shown that Coalgae® can be used for the production of a biofossil crude oil that can be further refined into transportation fuels such as jet fuel, gasoline and diesel, with a bio-component included in the fuel.

In addition, Tait – and his late colleague Prof Ben Zeelie, who founded the microalgae project – demonstrated how the solid product remaining after the production of a bio-crude oil from Coalgae® (through a process called pyrolysis, where decomposition of a material is brought about by high temperatures), can be used as low-smoke fuel for households.

"Coalgae® pyrolysis char is a virtually smokeless, smouldering fuel with very little harmful emissions. It actually burns more than 50% longer than coal," Tait said.

Apart from Coalgae®, the potential use of microalgae biomass for the production of a bio-fertiliser is also being tested.

Two specific properties of microalgae biomass make it an attractive component in a bio-fertiliser, namely, that it is rich in protein, which asnatural sists in building the soil structure, and that it encourages microbial life in soil, enhancing the bio-availability of nutrients.

"Yet another potential use of our microalgae is the remediation of contaminated soils. We have evaluated the use of our microalgae slurry [semi-liquid mixture] to treat diesel and process-oil contamination in soil, with good results," Tait said.

He said the DST had asked InnoVenton to expand their microalgae-to-energy project across three research themes:

The first is the actual microalgae cultivation on a large-scale basis for commercial purposes.

The second is renewable energy and;

The third is biomass processing for the downstream chemical industry.

For the first theme, 2 000m² of land has been made available at NMU to set up a R10-million open-air microalgae cultivation project.

"We want to show that we can do this in an outdoor environment, exposed to the elements, which is how the algae would be cultivated commercially."

InnoVenton's existing microalgae facility, which is 400m², is housed in a greenhouse.

"An open-air facility should give us a better yield … We do eventually envisage a commercial microalgae refinery tying into a power station or a coal mine. Ultimately, we would like to see this technology rolled out globally."

To date, DST together with the Technology Innovation Agency has provided more than R30-million worth of funding for the microalgae project, which is housed under InnoVenton's Microalgae Technologies Research Centre.

The microalgae project has four international and two local patents.