Zero-waste palm oil industry on the horizon with new technology

May 17 2018, by Emma Lowry

Credit: University of Nottingham

Engineers at the University of Nottingham Malaysia have developed new technology to help the global palm oil processing industry reduce CO2 emissions and create renewable energy from its waste.

Malaysia is the second-largest crude palm oil producer in the world and fulfils nearly half of all demand for the oil, which is now used in a huge variety of foodstuffs and household products.

Some 400 mills each produce huge amounts of waste, including kernels and husks from pressed fruits, discarded branches and waste water known as Palm Oil Mill Effluent (POME). All of which is environmentally-polluting.

Now University researchers, in collaboration with Malaysian industry partners, have built a unique integrated zero-waste management system

for the mills. The pilot plant, called an Integrated Waste Recovery and Regeneration System (REGEN), contains technology which converts all solid biomass waste and POME into valuable building materials and bio-energy.

Project lead, Professor Denny K. S. Ng from the University's Faculty of Engineering in Malaysia, said: "The by-products of palm oil production have long been a problem for the industry and the environment, so we hope our new technology will be a best practice example of what can be achieved in the drive for sustainability. In principle, there will be zero discharge from the entire mill process.

"Once it is commercialised, our technology will enable palm oil processing facilities to turn oil palm fronds, trunks and empty fruit bunches into dried long fibre for matting, pallets, briquettes and biofuels. We can also use the palm debris to make a bio-fertiliser that retains the nutrients from the palm tree, cutting chemical use and creating healthier soil. This in turn improves the palm fruit yield and the quality of the crude oil."

In tandem with the biomass processing technology, the project has also been investigating how to recycle POME. The raw effluent is a serious pollutant that requires effective treatment to meet government discharge limits before being released into the watercourse.

Professor Mei Fong Chong, from the University's Department of Chemical and Environmental Engineering in Malaysia, has developed a POME treatment system called the Integrated Anaerobic-Aerobic Bioreactor (IAAB) to solve the issue. This turns the liquid effluent into water for reuse in the palm oil milling process, which can be further purified into clean drinking water.

The IAAB is innovative because it integrates anaerobic and aerobic

bacteria to digest the organic matter in the POME to meet the discharge limit. This activity generates a methane bi-product, which the novel system simultaneously recovers and treats for use as a high-quality biofuel.

Professor Chong said: "Around 30 million tonnes of wastewater is produced annually in the palm oil production process. Up to now most mills use a conventional ponding system for the treatment of the effluent but this system is polluting to the environment. The biogas it releases contributes to our global CO2 emissions. Our new IAAB technology processes the effluent efficiently and cleanly, and harnesses a valuable renewable energy source into the bargain."

The REGEN system is part of the University's Centre of Sustainable Palm Oil Research (CESPOR) based at the Malaysia campus near Kuala Lumpur. CESPOR is a multi-disciplinary research centre which focuses on palm oil, from plantation to waste treatment. The centre is working in close collaboration with Malaysian companies, Eureka Synergy Sdn.Bhd. and Havys Oil Mill Sdn.Bhd.

Dr. David Lim Lian Keong, Managing Director of Eureka Synergy Sdn. Bhd., said "This collaboration is vital for sustainable palm oil research, particularly palm biomass. Malaysia's Government has set a national target to reduce 40 per cent of CO2 emissions by 2020. Moreover, the Department of Environment (DOE) has begun enforcing the mandate for proper waste disposal and treatment for all of Malaysia's 400 palm oil mills. So, we are well-placed to help individual palm oil mills to meet the DOE's regulatory parameters for appropriate waste treatment."

Datuk Michael Lim Lian Seng, Managing Director of Havys Oil Mill Sdn. Bhd., added: "With the knowledge and expertise of the parties involved in this collaboration, we aim to develop the means to convert renewable energy through various strategies which will subsequently

benefit the nation. From a national perspective, the implementation of more biomass and biogas projects will ultimately recover and prevent millions of tonnes of waste from polluting the environment."

Professor Graham Kendall, Provost at the University of Nottingham Malaysia Campus, said: "According to the National Biomass Strategy, Malaysia's output of palm biomass is expected to increase to 100 million dry tonnes by 2020. By combining resources, know-how and capabilities, this joint venture can fully undertake projects large and small to recover and optimise Malaysia's palm oil waste value."

Provided by University of Nottingham