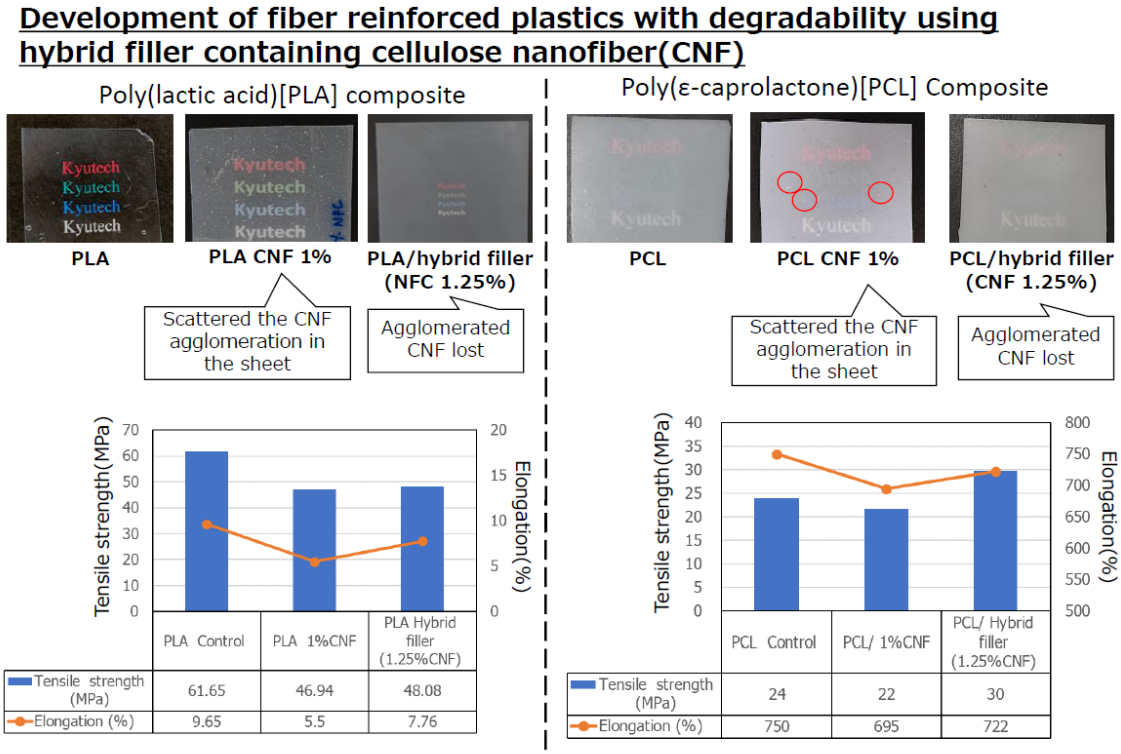
JST aXis (Accelerating Social Implementation for SDGs Achievement)

Commercialization of Biodegradable Nano-Composites in Malaysia

Kyushu Institute of Technology, Japan & University Putra Malaysia (UPM)

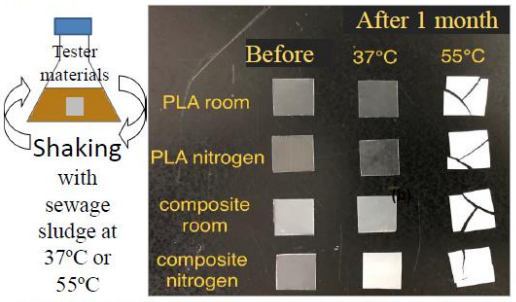
Yoshihito Shirai, Yoshito Andou, Toshinari Maeda, Hidayah Ariffin, & Mohd. Ali Hassan

We are pursuing a method to produce bio-degradable reinforced plastics to avoid the ocean plastic issues in Malaysia, which must be a show-case indicating that we can obtain strong as well as biodegradable plastics. We have successfully developed a method to produce biodegradable and reinforced plastics, using commercially available poly-lactic acid and caprolactone blended with cellulose nano fiber (CNF) which comes from Empty Fruit Bunch from Oil Palm. The CNF production method was developed in our SATREPS project 2014-2017. This was successfully commercialized by a spin-off company in UPM in 2018. Now we have successfully developed a method to blend CNF and resins by using a commercially available twin-screws extruder to disperse CNF evenly in the resin. Then the composite can be reinforced by evenly dispersed CNF inside the resin. This indicates that our method can be easily apply to industry. Moreover, we have developed a method to obtain green energy, methane when we treat the used plastics in dumping fields for treating any wastes and garbage from streets before they come to the ocean. We can successfully developed sludge to treat our CNF-composites to produce methane from CNF as well as such biodegradable plastics. Our results this year suggests that we may treat these plastic waste in any dumping field to obtain methane gas for any energy in the city from which the used CNF-composites are wasted.



Hybrid filler can be used as dry powders. The effect of hybrid filler for PCL composite was better than that of PLA. The fiber reinforced plastics with dried CNF as hybrid fillers will be optimized by a twin-screw extruder for mass production.

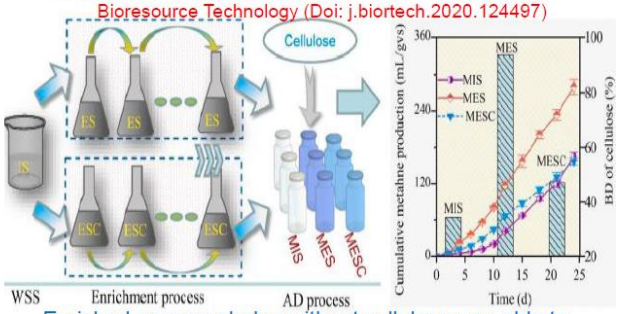
Microbial degradation of composite plastics using sewage sludge



A weaker structure of composite plastics was found after the degradation at 55°C for 1 month.

Enrichment of microbial community for more methane from cellulose

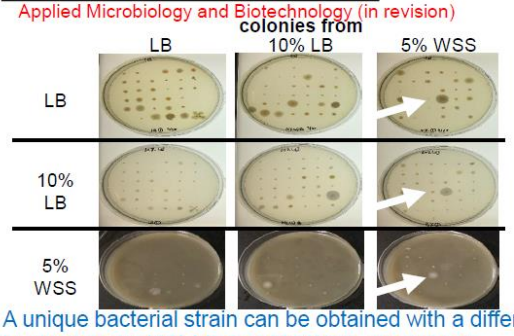
Bioresource Technology (Doi: j.biortech.2020.124497)



Enriched sewage sludge without cellulose was able to produce more methane from cellulose as a substrate.

Comparison of community diversity in the culturable bacteria

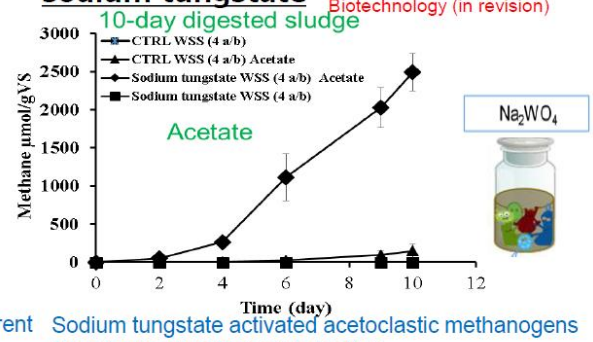
Applied Microbiology and Biotechnology (in revision)



A unique bacterial strain can be obtained with a different biodiversity in 10% LB and 5% WSS agar plates.

Enhanced anaerobic digestion by sodium tungstate

Applied Microbiology and Biotechnology (in revision)



Sodium tungstate activated acetoclastic methanogens for enhanced methane production.

ZOEPNANO Sdn Bhd

NANOCELLULOSE

Commercially available CNF produced by ZOEPNANO Sdn Bhd in Malaysia

A spin off company from UPM.

CEO is Prof Hidayah Ariffin.

Production of CNF/PLA Composite by Dr Yoshito Andou