Poster GC3

Presentation of MF Process and its Results as an Efficient Way for Valorizing Biomass Byproducts or Waste Into Biomass Reinforced Plastic Composites

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Several processes try to valorize the most available polymers in the world, the cellulose, either in energy, chemical products, or reinforced composites. Lignin is also very interesting as highly stable biopolymer. Recently an innovative method has emerged to process various lignocellulosic materials into biomass plastic compound. In Japan, a car parts maker includes kenaf in a poylpropylene (PP) composite up to 40% and observes a gain of 10% in weight and a reduction of 20% in CO_2 emissions in comparison with conventional air cleaners. Toyota Boshoku has designed a complete production chain, from the kenaf seeding to the final product in the car, which embodies the M&F Technology's to secure the blending phase. Valorizing biomass products with subcritical water processes is mainly seen as a way for extracting chemical components or as a potential bioethanol source. To process cellulose or lignin into compound, numerous possibilities exist: industries are often using acetic acid anhydride to modify lignocellulosic materials and optimize interface between hydrophobic polymer and hydrophilic biomass. According to scholars, biomass humidity rate and energy required to engage reactions or maintain conditions can be difficult. The MF machine tries to answer to those hurdles: water inside the biomass is used as subcritical water, energy is provided by the collisions inside the reactor due to the multidirectional shearing system, subcritical water optimizes the interface between the inputs. As calculated by Mr Morimoto, theoretically each collision of water molecules leads to a local rise of 42.7°C. Within the machine and according to measurements, 240°C is reached into 10 seconds. A batch of wood composites in a reactor of 40 L takes around 30 seconds to 1 minute to be processed (10% <= humidity rate of biomass <= 40%). All is monitored by the rotor frequency, the torque (moment of force) and the temperature. As results, addition of kenaf into a PLA matrix (ratio 50/50) increases the flexural strength and modulus (Mpa) compared to PLA: from 100 Mpa to 102 Mpa and 3300 Mpa to 8000 Mpa (Toyota). Compared to a 55% wood /45% polymer compound (made by company A), a 85% wood / 12% PP / 3% maleic anhydrite compound made with the MF machine has a 3 points Young's modulus of 55400 kgf/cm^2 versus 25100 kgf/cm^2 (75000 kgf/cm^2 for cedar).