Improvement and Characterization of Novel Energy-Efficient and Adaptable Bioplastic

Pejcinovic, Katarina (School: West Linn High School)

Bioplastic, or plastic made from sustainable and natural materials, is one of the ways of tackling the world's plastics problem. The acid-based bioplastic production process developed last year was improved, and the cost of production was cut in half (5.00$/g to around 2-2.50$/g). The bioplastic was made from different agro waste starting materials (soybean shell and apple peel). A new method of separation was discovered to separate the waste product from bioplastic without the need of extra equipment or energy, while also yielding a higher quality product. The Young's modulus,114.4 MPa, and the tensile strength, 2.31 MPa, of the bioplastic were closest to that of LDPE and PET plastic. A solubility parameter was measured by attempting to dissolve the bioplastic in a comprehensive spectrum of solutes. It was discovered that the bioplastic has a Hildebrand solubility parameter of around 48.0 J1/2 m-3/2. Biodegradation was tracked by massing samples over time, as well as using a scanning electron microscope, to image possible degradation. Electron dispersive spectroscopy was used to compare the elemental composition of the bioplastics. The soybean bioplastic contains many more elements (Ca, P, Mg, K, etc.), than the apple peel bioplastic. It is speculated that the difference in elements causes a change in mechanical properties. It is also speculated that the hydrophilic nature of the bioplastic can be remedied by reducing the percentage of acid used for acid degradation, the time spent reacting, and introducing cross-linking through citric acid.

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