201a Drivers, Standards, and Technology Exemplars for Biobased Products

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Biobased and biodegradable materials can form the basis for a portfolio of sustainable, environmentally responsible, ecoefficient materials. Biobased materials and products offer value in the sustainability/life-cycle equation by being part of the biological carbon cycle, especially as it relates to carbon-based polymeric materials such as plastics, water soluble polymers and other carbon-based products like lubricants, biodiesel, and detergents. Life Cycle Assessment (LCAs) of these biobased and biodegradable materials often show reduced environmental impact and energy use when compared to petroleum-based materials.

In this presentation, the global carbon cycle will be discussed vis-à-vis managing carbon efficiently and in an environmentally responsible manner by using biopolymer feedstocks. Thus, the use of renewable crop/biomass feedstock allows for:

• Sustainable development of carbon based polymer materials • Control and even reduce CO2 emissions and help meet global CO2 emissions standards – Kyoto protocol • Provide for an improved environmental profile.

New ASTM standards for biobased product and biobased content determinations will be discussed, as well as the method for evaluating and reporting on the environmental profile of biobased products using life cycle assessment (LCA) tools.

Direct extraction from biomass yields a series of natural polymer materials (cellulose, starch, and proteins), fibers, and vegetable oils that can form the platform on which polymer materials and products can be developed. Alternatively, the renewable resources/biomass feedstock can be converted to bio-monomers by fermentation or hydrolysis and then further converted by chemical synthesis to biodegradable polymers like polylactic acid. Bio-monomers can also be microbially transformed to biopolymers like the polyhydroxyalkanoates. Surfactants, detergents, adhesives, and water-soluble polymers can be engineered from biomass feedstocks. Vegetable oil based lubricants and urethane foams can be prepared.

Biobased polymers are synthesized by many types of living matter - plants, animals, and bacteria - and are an integral part of ecosystem function. Because they are synthesized by living matter, biopolymers are generally capable of being utilized by living matter (biodegraded), and so can be disposed in safe and ecologically sound ways through disposal processes (waste management) like composting, soil application, and biological wastewater treatment. Therefore, for single use, short-life, disposable, materials applications like packaging, and consumer articles, biobased materials can and should be engineered to retain its biodegradability functionality. For durable, long life articles biboased materials needs to be engineered for long-life and performance, and biodegradability may have to be criteria.

Two technology exemplars one from each category will be discussed – biobased biodegradable starch foams, and biobased durable soy urethane foams.