

Bio-Cars: Where We are and Where We are Moving!

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The sky-rocketing price of crude-oil, national security, and environmental threats are daily headlines. The consumers' desire, government's push for green products, and energy conservation are some of the major factors that drive research towards the development of renewable resource-based new materials. Research and development has proved the ability of natural fiber composites and biobased materials to replace certain non-renewable materials in several auto-structures, especially for interior applications. Corn-based bioplastics such as polylactide (PLA), polyhydroxyalkanoates (PHAs), polytrimethyleneterephthalate (PTT) possess strong potential in auto-parts manufacturing. However, the search for renewable resources should go beyond corn and agricultural natural fibers. Corn is currently in high demand as food and animal feed as well as being a raw material for the production of ethanol, biochemicals and bioplastics. Besides agricultural natural fibers like kenaf, jute, flax, industrial hemp and sisal; inexpensive or waste biomass such as wheat straw, rice stalks, corn stovers, grasses and soy stalks have great potential for use in sustainable biobased materials for automotive parts. Natural fibers are lighter, less expensive, have superior specific strength, require comparatively less energy to produce, are good for the environment, biodegradable and have superior sound abatement characteristics as compared to synthetic glass fibers. All of these attributes are quite favorable, especially in the automotive sector where even a fractional weight saving can make a significant contribution to energy savings with reduced gasoline consumption with added advantages of eco-friendliness.

Multi-faced approach is the way in finding sustainable bio-cars for the 21st century. The use of biobased materials and biofuel, greener technology in manufacturing, reduced green house gas emission and reduced energy consumptions are the prime drivers for sustainable developments of bio-cars in our transportation sector. A biobased economy presents challenges to academia, industry, government and agriculture.

This presentation will highlight current status, opportunities and challenges of bioplastics, natural fiber composites and biobased materials in designing greener automotive parts. Biobased materials in conjunction with nanotechnology are poised to create major component of auto-parts. The use of nanotechnology in the development and application of biobased materials in auto-parts would broadly propel the drive towards petroleum independence and a sustainable bio-economy. Some of the important challenges in the design and engineer of biomaterials for automobiles are: 1). Steady supply and consistent nature of natural fibers, 2). High yield crops and biomass, 3. Engineered biobased plastics, 4. Intelligent uses of natural fiber composites, 5. Hybrid biocomposites, 6. Heirarchical nano-biocomposites; and 7. The improved processing that would encompass co-melt processing and design of light weight biomaterials.

Realistically, petroleum-based products are not going to be phased-out completely, but their use will taper-down. The goal is to use bioproducts containing the maximum possible amount of renewable biomass-based derivatives to have a sustainable future in automotive sector.

Short CV: <http://www.msu.edu/~mohantya/mohanty%20webpage1.htm>