

Sustainable Polymers for Advanced Applications: from controlled chemistry to unique properties

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ABSTRACT

The exponential growth of the worldwide population requires increasing amounts of water, food, and energy. For this reason, technological solutions are necessary to secure sustainable supply.

During this talk, I will discuss how the polymer industry faces challenges in directly responding to this reality and how researchers and scientists can respond by developing sustainable engineering products, designing energy-efficient processes, and developing an efficient supply chain and enterprise.

I will organize my talk into two sections. In the first one, I will emphasize the current challenges in the industry and a few sustainable technological solutions that are becoming relevant. Then, during the second part of my talk, I will discuss several sustainable products and technologies developed at Auburn University.

1) *New opportunities in the bioenergy arena to produce sustainable chemicals and fibers*

Wood biomass, particularly lignin, is one of the most promising bio-based raw material resources due to its abundance. Fast pyrolysis, as a thermochemical conversion process, can be transformed into a utilizable liquid fraction called fast pyrolysis bio-oil. Several attempts have been made to polymerize fast pyrolysis bio-oil. My current research focuses on developing polymeric networks from fast pyrolysis bio-oil and lignin-derived polymers.

2) *Engineered hydrogel networks for use in tissue engineering and drug delivery.*

Hydrogels are crosslinked polymers that reversibly absorb and release large amounts of water. Current hydrogel research primarily focuses on developing this technology for medical applications such as 3D printing artificial human tissue and controlled drug release fibers and coatings. Thus, the primary purpose of this project is to engineer hydrogel networks that are biocompatible, mechanically robust, electrically conductive and superabsorbent.

Biography

Dr. Maria L. Auad is a full professor of the Department of Chemical Engineering, former Director of the Center for Polymer and Advanced Composites, and current Associate Dean for Graduate Studies and Faculty Development of the College of Engineering at Auburn University. She has published over 100 technical papers in refereed journals. Her extramural support has come from a diverse set of sponsors such as the National Science Foundation (NSF), Department of Defense (DOD), Defense Threat Reduction Agency (DTRA), Department of the Army, USDA (US Department of Agriculture), NASA and 3M among others. For all her research activities, Dr. Auad received the Charles Gavin Distinguished Professorship in 2020 and the College of Engineering Senior Faculty Award in 2018. Her research interests include polymer material science, polymer nanocomposites, flow behavior of polymers, control of microstructures & nanostructure in materials, and polymers for structural & biomedical applications.