

Almond Shell Plastic Composites

Location: California

In-Country Partner Organization/Client: US Department of Agriculture (USDA)

Project Background: While California produces 80% of the world's almonds and almost all of the U.S. domestic supply, almond growers and shellers must find an outlet for >1 billion pounds of shells each year. Using shells as fillers in polymer composites have multiple advantages over commercial additives (e.g. cost, energy consumption, biodegradability, landfilling); however, almond shells are hydrophilic, which limits their incorporation into most polymer matrices. Torrefaction is a thermal process whereby biomass is heated in the absence of air and oxygen. Composites derived from torrefied shells result in stiffer, stronger, and more heat resistant products, and provide the greatest benefit when used with recycled plastics. The purpose of this project is to determine techno-economic feasibility of bringing torrefied almond shell composites to market: what are the best applications, what products/industries may benefit from almond shell composites, what is the size of the market, what is the cost to manufacture almond shell plastic, what are obstacles to bringing product to market, what types of plastic are most suitable, what are disposal issues, are there any health or environmental issues with this product, etc. We have a material that is derived from waste materials, does it have value, how do we create a business around this product, and what issues do you foresee?

Project Problem Statement:

Recently, in collaboration with a California plastic manufacturing company, the USDA received a \$3M CalRecycle grant to take landfill diverted plastic (primarily polyethylene (PE) and polypropylene (PP) mix) and develop new products. Our proposal is to improve material properties of the degraded plastic by incorporating torrefied almond shells to create stronger, more heat tolerant composites. The project will first install a new facility at the start of the funding period, and then begin manufacturing composite pellets at a target rate of 2000 tons per year. The goal is to divert plastic and almond shell waste products from the landfill to create commercial products. The product is a plastic pellet that can be sold to plastic manufacturers to be used in place of other virgin or recycled plastic for manufacturing of various plastic parts.

Project Goals and Objectives:

1. Feasibility Study
 - a. Investigate existing almond shell plastic composite businesses and technologies
2. Conceptual Design
 - a. Conduct prior art research on technology and economic needs
 - b. Conduct a market analysis for plastic pellets
 - c. Work with the client to determine design criteria
 - d. Make recommendations for D-Lab II
3. Design; Build; Test (D-Lab II)

