

POLY (LACTIC ACID)/POLY (HYDROXYALKANOATE) NONWOVENS AS BIODEGRADABLE AGRICULTURAL MULCHES

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Plastic agricultural mulches provide many benefits to the cultivation of specialty fruits and vegetables, including weed prevention, water conservation, and increased soil temperature, leading to increased crop yield, hence to their expanded use worldwide. Most mulches are prepared from polyethylene (PE), a polymer that poorly biodegrades. The fate of PE mulches after their use is a major environmental concern. The ideal plastic mulch would be plowed into the soil at the end of the growing season, and undergo microbial assimilation within a few months. Polylactic acid (PLA) and polyhydroxyalkanoate (PHA), biobased polymers that can readily be produced in the biorefinery, are potentially valuable "biodegradable" mulch materials. Nonwovens prepared PLA and PLA / PHA blends, materials with high strength and low weight, have been prepared and analyzed through several experimental platforms: soil burial studies conducted in greenhouses, long-term studies conducted in open fields and high tunnels at three diverse U.S locations, weatherometry, and inherent biodegradability analyzed by standardized tests. PLA/PHA mulches prepared via meltblown nonwovens processing undergo extensive degradation, resulting in a decrease of molecular weight (~25%) due to the cleavage of ester bonds (FTIR spectroscopy) and a loss of > 50% tensile strength during a 30 week period, as observed in soil burial studies. Soil temperature, moisture, and ultraviolet light intensity are the most important environmental parameters to induce biodegradation in the soil burial studies.