



“Gheorghe Asachi” Technical University of Iasi, Romania



DESIGN AND ENVIRONMENTAL ASSESSMENT OF BIOPLASTICS FROM *Hermetia illucens prepupae* PROTEINS

Silvia Barbi*, Rosangela Spinelli, Anna Maria Ferrari, Monia Montorsi

Department of Sciences and Methods for Engineering, University of Modena and Reggio Emilia,
Via Amendola 2, Reggio Emilia Italy

Abstract

Proteins from *Hermetia illucens* (or Black Soldier Fly, BSF) have been employed in this study as possible source for bioplastic formulation. This type of bioplastic can replace the actual materials employed in agriculture, avoiding the critical issues concerning the soil pollution due to conventional plastic end-life. Different plasticizing agents (glycerol and polyethylene glycol) have been tested and the ability to generate a homogenous film, through wet casting, has been evaluated. Characterizations on tensile properties and water absorbance have been performed to estimate the effect of different plasticizers employed. Bioplastic formed by proteins/glycerol ratio 50:50 has shown interesting properties, contributing to the formation of homogeneous and free-standing film with tensile stress at break near to 2.5MPa, almost constant during degradation profile test. At the same time the high degree of solubility in water has been verified for the same sample (~70%). The environmental impact of the laboratory scale production of bioplastics obtained from BSFs proteins has been evaluated through the Life Cycle Assessment (LCA) methodology. Inventory analysis has been conducted using primary data and Ecoinvent database. LCA analysis has been conducted using the SimaPro 8.3 software and the IMPACT 2002+ method of evaluation. The analysis show that the energy consumption is high (63%), but this can be mainly attributed to a laboratory-scale production process and related with the energy consumption of aspiration system (93%). Therefore, these results will help to the design of industrial production of innovative bioplastics in order to minimize these environmental issues.

Key words: bioplastics, glycerol, *Hermetia illucens*, LCA, waste bioconversion

Received: February, 2019; *Revised final:* April, 2019; *Accepted:* July, 2019; *Published in final edited form:* October, 2019

* Author to whom all correspondence should be addressed: e-mail: silvia.barbi@unimore.it, Phone: +39 059 2056281