

## PROJECT TITLE: Eco-Friendly 3D Printing

*Professor Murali Sundaram  
Department of Mechanical and Materials Engineering  
631 Rhodes Hall  
Cincinnati, OH 45221-0072  
Tel: (513) 556-2791  
Email: murali.sundaram@uc.edu*

### Project Description

#### *Background*

While manufacturing processes improve, including the ever-popular emerging 3D printing process, a new issue arises – how do we deal with the material waste and pollution that results from the chemical processes to make products, the gases released in transportation, excess material not used in the process, or material from disposed products?

Ventures such as Growduce have made new sustainable processes where food waste can be used to make products in your own home, eliminating the need for transportation or large manufacturing facilities. The food waste is placed into 3D printed plastic molds, where it dries out into a sterile and leathery material and can be used as an alternative to conventional plastic products, such as tableware or gloves.

However, **this process is still limited to using plastic** for the template (manufactured using either 3D printing or a different process) for the food scraps to be molded in. This means that the previous issues of using non-biodegradable materials are still present.

#### Conventional Manufacturing and Plastic Waste



Image source: 3dprintingindustry.com/



Image source: treehugger.com

#### Biodegradable Alternatives



Image source: Techsmartt

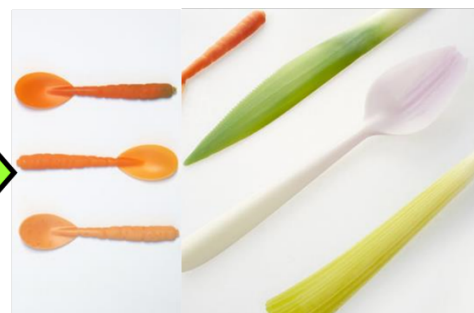


Image source: dornob.com

The goal of this project is two-fold: (1) to develop an extrusion-based 3D printing system that can directly print shapes out of biodegradable material without depending on an external mold or support system. This would require the students to design a way to store the biodegradable material and transport it to an extrusion system, as well as a timely way to solidify/dry the deposited material. (2) Then, to identify an item in daily life that could be made more sustainable by creating a biodegradable version, and use the system developed to print a functioning item that is biodegradable. The students will decide what parameters of the output part to evaluate and then test, re-design, and re-print as necessary. Some of the example parts under consideration are Gloves (Can they handle a task such as making a pizza or keeping your hands warm in the cold?) Shoes/Sandals – Can they withstand a walk from ERC circle to McMicken Commons? and Bags – What is the maximum weight it can withstand? For what amount of time until it breaks?

*Learning opportunities for students*

As this research is multidisciplinary in nature, it offers tremendous opportunity for undergraduate students to be exposed to **interdisciplinary research**. The project will also introduce students to the various aspects of academic research starting from literature review to report preparation. The simulation system development and experimentation involved will provide **hands-on** experience in research. Students will learn about 3D Printing, stepper motor control, use of biodegradable materials, and design of an extrusion system. The undergraduate student will also be encouraged to present the work at either a **conference** and/or prepare a **paper** for journal publication.