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Using mealworms to digest styrofoam!

Over the past couple of years, I have been experimenting with common mealworms (Tenebrio molitor), and their larger tropical cousins, (Zophobas morio), both of which have the remarkable ability to digest styrofoam. Styrofoam is a ubiquitous and difficult-to-recycle component of the solid waste stream and constitutes a significant portion of the flotsam and microplastic pollution of marine ecosystems. The breaking down (depolymerization) of styrofoam is accomplished through the help of symbiotic bacteria that live in the mealworm's gut. The worms burrow into the plastic using

their jaws and thus make a perfect delivery system for the powerful enzymes the bacteria secrete.Based on this, I designed a simple science lab for my Sustainable Systems (PUFY1100) students, who were tasked with keeping mealworms in small containers, adding styrofoam and recording how much was consumed over a month-long period. Even in these less than ideal conditions, our results were encouraging and showed that on average 50 mealworms living in standard plastic sandwich container could consume between 15 and 45% of the styrofoam they were given in a month-long period. The tropical 'super' worms were even more efficient, though we had to modify the protocol somewhat when they began gnawing their way through the nylon screens we had glued over the vent holes. This added a certain frisson to the experiment and indicated that these insects might have the ability to digest a much wider range of synthetic materials than we first suspected.As my practice is primarily that of an artist, I began to explore aesthetic dimensions of styrofoam digestion. In Chinese and Japanese cultures, there has been a long-standing appreciation for objects eroded by the forces of nature. I have always been drawn to the 'philosopher's' or 'scholar's' stones (Chinese: 贡石;

pinyin: gōngshí), highly eroded rocks, often of limestone origin that are put on display in gardens and temples as objects of contemplation, their aesthetically weathered state reminding us of Buddhist notions of impermanence and the transience of existence.To my mind, pieces of styrofoam trash, riddled by tunneling mealworms, offered an analogous aesthetic opportunity in which to contemplate transience within the material conditions of the Anthropocene. Even our most banal and artificial discards might be made beautiful in their decay as they are subsumed by humble insects.These objects under the moniker of 'Plastivore' were included this year (2018) in an exhibition called 'Life at the Edges' at the Science Gallery in Dublin. Next year they will be shown at the Wellcome Trust in London.But what about real-world applications? Could mealworms be used to significantly reduce the amount of styrofoam going into the landfill in a city like New York? I was determined to find out. With the generous support of a TEDC grant, I am working with the staff of the Lower East Side Ecology Center's composting program to design trials to scale the process to a level that could make a real impact on the large quantities of styrofoam trash that are piled up on the sidewalks on garbage day or as flotsam along the

foreshore of the East River after a high tide. Together we will test large, purpose-built containers filled with bulk quantities of styrofoam and mealworms to determine best practices under indoor and outdoor conditions. A key part of this research will be to investigate secondary processing methods to further remediate any microplastics left behind in the compost after the mealworms have finished digesting. One promising technique utilizes fungal mycelium. Certain fungi can break down hydrocarbons such as diesel and plastic into a compost that can be safely released into the environment or incorporated into bioplastics to a sustainable alternative to fossil fuel-based packaging and insulating materials. I have already completed some promising preliminary experiments using sawdust contaminated with glues and resins from the Parsons Making Center, as a feedstock for mycelial growth. We have high hopes for using this methodology as a secondary stage after the mealworms have done their amazing work!

My website is www.oliverk.org.

Pages of note:

http://www.oliverk.org/art-projects/installations/plastivore

http://www.oliverk.org/art-projects/research/styrofoam-composting

LESEC is:
https://www.lesecologycenter.org/

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