Los Alamos works to make better, more recyclable plastics with new BOTTLE consortium

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LOS ALAMOS, N.M., Nov. 9, 2020—Los Alamos National Laboratory is partnering with four other national laboratories and four academic institutions in a new program to tackle the problem of plastic pollution. The partnership has been dubbed the BOTTLE Consortium for “Bio-Optimized Technologies to keep Thermoplastics out of Landfills and the environment.”

“We are excited to apply LANL’s unique capabilities in advanced protein sensor technologies and high throughput screening to address this incredibly important global problem,” said Taraka Dale, BOTTLE program lead for Los Alamos. “This program gives LANL an opportunity to expand ongoing partnerships with fellow national labs, as well as develop new collaborations with top-notch researchers. The BOTTLE program is exceptionally suited to make a big impact in the degradation of existing plastics and the design of the plastics of the future, and we are pleased to be a part of it.”

The consortium will focus on two critical problems that are both essential to tackle the plastics pollution problem. The first challenge is how to degrade and upcycle today’s waste plastics in a way that incentivizes their reclamation. The second undertakes the challenge of wholly redesigning tomorrow’s plastics to be recyclable-by-design.

Among the tools Los Alamos brings to the program is the “Smart Microbial Cell Technology,” which just won an R&D 100 award (see video at this link). It will be used for two tasks as part of the consortium. First, it will be coupled with high-throughput screening to isolate top-performing versions of certain molecules like enzymes/ biocatalysts—this can accelerate the process of finding the best enzymes for specific purposes, such as the degradation of existing plastics.

Second, Smart Microbial Cell Technology at Los Alamos will be used to screen for additional enzymes and biochemical pathways that can take these building blocks and make new kinds of polymers that will be the basis of new, more degradable plastics.

A third Los Alamos capability, the split-GFP reporter technology, will also be used to help scientists gain even more information about the plastic-degrading activity of enzymes, such as pinpointing the levels of enzyme expression that correlates with degradation activity. Finally, the split-GFP reporter can help scientists identify the conditions under which an enzyme is properly folded and functioning. This folding analysis could ultimately be used to help make enzyme cocktails to enable screening without a microbe host.

Supported by the Bioenergy Technologies Office and the Advanced Manufacturing Office, both within DOE's Office of Energy Efficiency and Renewable Energy (EERE), this new effort currently includes four additional partner DOE research laboratories and four universities. Key participants in BOTTLE are the National Renewable Energy Laboratory, Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, SLAC National Accelerator Laboratory, Colorado State University, Massachusetts Institute of Technology, Montana State University, and Northwestern University. BOTTLE will also closely collaborate with the Centre for Enzyme Innovation at the University of Portsmouth in the UK.

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