Research into marine plastic pollution reveals bacterial enzymes actively degrading plastic

February 23 2024

Credit: Magda Ehlers from Pexels

A new study led by researchers at the University of Stirling has uncovered the crucial roles of bacteria living on plastic debris. The research also identifies rare and understudied bacteria that could assist in

plastic biodegradation, offering new insights for tackling plastic pollution.

The research, titled "Novel functional insights into the microbiome inhabiting marine plastic debris: critical considerations to counteract the challenges of thin biofilms using multi-omics and comparative metaproteomics," was published in the journal *Microbiome*.

Plastic pollution is a worldwide problem, with up to 2 million metric tons estimated to enter oceans every year, damaging wildlife and ecosystems.

In a pioneering study, experts at the University of Stirling's Faculty of Natural Sciences and the University of Mons (Belgium) analyzed the proteins in plastic samples taken from Gullane Beach in Scotland.

Unlike previous studies carried out in warmer climates that focus on the genetic potential of biofilms inhabiting plastics, this research led by Dr. Sabine Matallana-Surget took a unique approach by analyzing the proteins expressed by active microorganisms.

Their findings have unveiled a remarkable discovery of enzymes actively engaged in degrading plastic. Moreover, the team has pioneered new methodologies for enhanced predictions in marine microbiology research.

Critical levels

Dr. Matallana-Surget said, "Plastic pollution has reached critical levels in the marine environment, with trillions of individual plastic pieces estimated to be distributed throughout the world's oceans.

"This plastic causes significant ecological and socioeconomic disruption

as it accumulates in oceanic gyres, coastal habitats, and is ingested by fish, sea birds, and marine mammals.

"Microorganisms rapidly colonize the surface of plastic pollution when it enters the environment, and their complex ecological interactions can shape the fate of plastic in marine systems.

"Understanding the function and ecology of microorganisms colonizing plastic pollution is therefore vital to adequately assess the risks of marine plastic pollution and to pave the way for biodiscovery beyond plastic biodegradation."

While this study has unveiled exciting new evidence that could determine the eventual degradation of plastics in situ, it underscores the necessity for further research to determine the function of microorganisms colonizing marine plastic pollution across larger geographic areas.

Driven by Dr. Matallana-Surget's ambition to comprehend and analyze diverse locations, future investigations hold promise in shaping the production of plastics toward greater environmental sustainability.

Critical gap

Dr. Matallana-Surget said, "Our study addresses a critical gap in our understanding of the ecological roles of the microorganisms colonizing marine plastic pollution.

"Few studies have determined which metabolic pathways are expressed by these microorganisms, especially within colder climates.

"Our approach used state-of-the-art comparative metaproteomics and multi-omics to resolve not only which microorganisms were present on

marine plastic pollution, but also which microorganisms were active.

"This is important because some microorganisms colonizing plastic pollution are known to degrade hydrocarbons and other pollutants."

More information: Lauren F. Messer et al, Novel functional insights into the microbiome inhabiting marine plastic debris: critical considerations to counteract the challenges of thin biofilms using multi-omics and comparative metaproteomics, *Microbiome* (2024). DOI: 10.1186/s40168-024-01751-x

Provided by University of Stirling