

Renewable Materials Conference, 11-13. June 2024, Siegburg

Workshop/Seminar 13. June 2024 from 13: 00 to 14:30

## **The Science behind Biodegradation – Implications for testing, certification, policy, and communication**

Every year, millions of tons of plastic end up in the environment - with drastic consequences. Although the public focus is on littering, there are many other sources of plastic in the environment. Abrasion from paint, outdoor gear, tires and shoes, wear and tear on fibers and textiles, loss from agricultural, aquaculture and fisheries use, and intentional release of plastics are in addition to the systematic input of plastic waste into soils, rivers, lakes and the ocean from the lack of proper waste management in some markets. While some of these pathways can and must be stopped at the source, others will continue to contribute to the accumulation of plastic in nature. Environmental biodegradability must be considered as part of the solution to reduce pollution and must be based on reliable data derived from trustworthy, environmentally relevant testing. Only then can the entire life cycle of a new material be comprehensively assessed, its sustainability measured and compared with conventional materials in an unbiased manner. Existing test schemes still have gaps, and depending on the perspective, for example from the manufacturer's side, the legal side or the consumer's side, a different focus is set. This means that it is still unclear for users and legislators how exactly to deal with materials and products that biodegrade in the environment. This leads to uncertainty and misunderstandings and further work is needed to fill these gaps. This raises various questions such as which conditions are relevant, which tests are comparable, what role do standard tests play, do they cover all scenarios, which ones are missing, how can gaps be closed, etc.? And it reveals the need to incorporate further scientific findings and methods. In this workshop presentations, followed by Q&A and a discussion round, we offer space to get up to date with the current science behind biodegradation, its implications for testing, certification, policy and communication, and to discuss and debate thoughts, suggestions, concerns, and ideas on these topics together.

Presentation, Q&A 1 (20' + 5'), Christian Lott / HYDRA

Terminology, definitions, materials, facts and myths

Biodegradability, biodegradation, biodegradation rate, hydrolysis, mineralization, etc.

Timeframe and degradation mechanisms

Environmental Biodegradation: disintegration as proxy, mass loss, weight loss, area loss, residues

Environmental variability and limits of standard tests and certificates (see also P3)

Intermediates: molecular degradation, solubility, particle formation, bulk vs. surface erosion, micro-nano plastic

Microbes rule! - but not everything. Who does what: the microbiology part of biodegradation

Presentation, Q&A 2 (20' + 5'), Prof. Michael Sander / ETH (to be confirmed)

Assessing biodegradation for innovation and environment

From the classical test approach to new technologies to close the full carbon budget (polymer-biomass-residuals-mineralization products CO<sub>2</sub>/CH<sub>4</sub>)

Analytical methods, what they can tell, what they will not tell.

Inherent Biodegradability: ‚Respirometry‘ with pressure sensor, open system, gas chromatography etc.

New technologies in biodegradation research and what we learn from it in terms of material development, end-of-life options environmental impact, innovation and policy

Closing the full carbon budget with SIP (1H-NMR, 13C respirometry)

The microhabitat of the plastisphere, conditions the plastic really sees:

- Biogeochemistry with Microsensors
- Meta-metabolomics

Biodegradability screening for material development with enzymes

Presentation, Q&A 3 (20' + 5'), Dr. Miriam Weber / HYDRA

Biodegradable or not? – Also a question of definition

Biodegradable polymers (along Nova-Poster):

The standard test-centered view vs. the mechanistic, environment-centered view and the implications for application, policy and innovation

Beyond the polymer: Processing effects and the 'Cellulose Enigma'

Classes of biodegradation rates/environmental lifetimes

Programmable biodegradation, enzymes and true biological recycling of mixed biodegradable plastic waste

What do policymakers need, what does the market need?

Challenges and future perspectives

Final discussion (15'), moderated by Dr. Miriam Weber or NOVA team member