Zeology and biodegradability

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Biodegradability of Zeo White

In this paper the biodegradability for Zeo White is described.

- The paper focusses on Zeology tanned intermediate.
- Testing of biodegradability of Zeo White is done for both biodisintegration (break down) and bioassimilation (uptake and growth).

The biodisintegration of Zeo White is found to be rapid and results in almost complete compostability and aqueous biodegradation. Zeo White compost is well bioassimilated and shows a positive effect on plant growth.

The overall biodegradability of leather is influenced by the selection of chemistry applied throughout the leather making process. For end-of-life scenarios such as oceans, water effluent treatment plants, and compost, Zeo White is expected to be biodegradable.

Biodisintegration

Zeo White leather will rapidly biodisintegrate into fine pieces if purposely or accidentally placed into the environment . The biodisintegration of Zeo White under industrial composting conditions gave a proper compost within 15 days . The test demonstrates that the tannage stabilises the leather for in-use, but in the biosphere, the microbes can easily access and use enzymes to disassemble the collagen protein structure.

Figure 1. The biodisintegration of (a) Zeology tanned leather leading to usable compost and (b) conventional tanned leather as non usable material for compost.

Bioassimilation

Through the growth of plants or micro-organisms the biodisintegrated Zeo White leather is bioassimilated into the ecosphere. The plant growth tests of the Zeo White compost produced vibrant looking plants, that were almost equal to the viability of the control, figure 2a. The zeolite leather-containing compost performs close to equal with conventional growth compost . For the bioassimilation by micro-organisms in aqueous conditions, the Zeo White pieces showed rapid uptake of the leather substituents into biomass as measured by the gas monitored in this test . The zeolite material appears to be broken down by simple primary enzymes that allow easy assimilation of the amino acids into the bacterial cells, especially compared to conventional leathers (Figure 2).

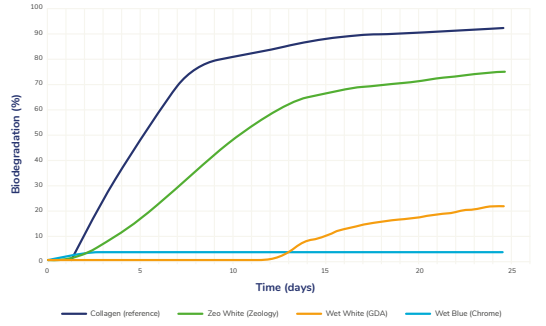

Figure 2. Bioassimilation based on a) Plant Response Test for Zeo White based compost, and b) the aquoues biodegradation by micro-organims[4] for different materials: untanned collagen, zeolite tanned, Wet White (GDA) and Wet Blue (Chrome).

Limitations

The biodegradability of a material can be hindered by the choice of the chemicals applied in its production. All of the above results obtained are for pure Zeo White tanned material treated made with properly selected harmless chemistries. In case of leather articles, such as waterproof leather or finished articles, the selected chemistry will have an impact on the leather's overall biodegradability. Zeo White leather offers a blanc canvas to create fully biodegradable leather with, and to achieve this the choice of additional chemistries has to be carefully made.

End-of-Life scenarios & Ecotoxicity

The overall biodegradability of Zeo White material is explored for different end-of-life scenarios, figure 3. Under aqueous, aerobic conditions, such as seas and oceans, ponds and effluent treatment plants, the micro-organisms will quickly biodegrade the tanned material. When the Zeo White is entered into a natural, home or industrial composting conditions than it will give compost that has a positive effect on plant growth. To date (2020-12), we have not yet obtained data for the anaerobic end-of-life scenarios, such as landfill.

A careful screening of persistent chemistry that could pose toxicological issues is standard practice for composting systems . A screening of the zeolite material showed that there are no components present that would cause concern if the zeolite containing compost were used to enhance soils.

For end-of-life scenarios such as oceans, water effluent treatment plants, and compost, Zeo White is expected to be biodegradable and will have a positive effects on the soil composition.

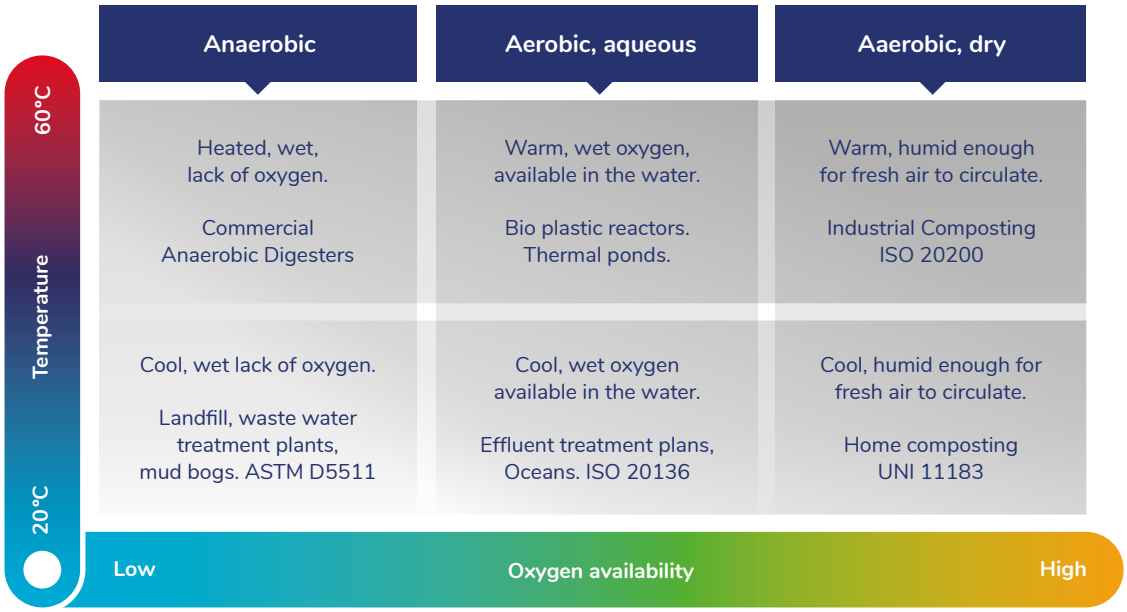

Figure 3. The range of end-of-life environments and the test used to simulate them.

Notes & References

1. Test result based on ISO 20200:2015. Plastics. Determination of the degree of disintegration of plastic materials under simulated composting conditions in a laboratory-scale test (ISO 20200: 2015). International Standards Organisation, Geneva, Switzerland

2. Compost evaluation based on BS EN ISO 14995:2006, Plastics. Evaluation of compostability. Test scheme and specifications (BS EN ISO 14995:2006). The standard expects that after 90 days in a biodisintegration environment that no more than 10% of the starting mass is held back by a 2 mm sieve at the end of the degradation. Similar Compost evaluations exist according to ISO 13432 for packaging materials, and ISO 17088 for plastic materials, or ASTM D6400 for the US.

3. The PRT test grows plants in a soil medium that contains the breakdown products of the material being tested. The growth of the plants is observed and compared to controls. The plants grew in the growth media that contained the ISO 20200 Zeo White leather compost.

4. Test results based on the ISO 20136:2017 biodegradation test (bioassimilation or ultimate biodegradability) processes material in an aerobic aqueous environment. The test measures how much CO2 has evolved. Leather -- Determination of degradability by micro-organisms (ISO 20136: 2017). International Standards Organisation, Geneva, Switzerland.

5. The ecotoxicity (ECO-TOX) test screens for restricted substances that would impact environmental health. The test outcomes are often compared to EU and North American standard soil/compost standards.

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More information

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