Lenzing's statements to references cited in section 7.1.3 Regenerated Cellulose (lines 208-209) of the second draft of IWSFG PAS1

LENZING
LEADING FIBER INNOVATION

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Content:

1. Reference 13 in the bibliography PAS1
2. Further references regarding regenerated cellulose

1. Reference 13:

"When microplastics is not plastic: The Ingestion of Artificial Cellulose Fibers by Macrofauna Living in Seagrass Macrophytodetritus"

Following issues were identified with the reference 13 in PAS1:

1) The study raises issues with dyed fibers and dye stuffs and their impact on aquatic organisms. It does not discuss the impact of fibers itself on the aquatic organisms.

Conclusion: Current flushable moist toilet tissues on the market are not colored and do not contain any dye stuffs.

2) Chapter 4 "Discussion" on p. D:
"As composition only 11 out of 91 fibers have been confirmed by Raman Spectroscopy and results or any interpretation must be taken with care".

Conclusion: to determine 11 out of 91 fibers is statistically not significant. Results are not statistically proofed.

3) Chapter 4 "Discussion" on p. D. & E:
"That was confirmed by Raman spectroscopy analyses that demonstrated their cellulose composition. The comparison of the analyzed AFs morphology with photographs of fibers from the literature revealed a close similarity with viscose fibers from the previous studies of Kramar et al (Figure 7)".

Conclusion: Raman spectroscopy is in general an alternative method to differentiate between pure cellulose I (cotton) and pure cellulose II (viscose/rayon) as long as the fibers are not contaminated with other solid or chemical compounds. If fibers are contaminated with other substances, identification between fiber types by use of Raman Spectroscopy will not lead to 100% accurate results.

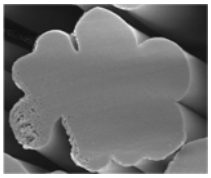
4) SEM image in figure 7 (p. F): shows fiber length and fiber surface and not the fiber cross-section. Therefore, it is not clear if this image is a viscose fiber or not. **To identify different fibers types by SEM method, a SEM image must be also made for the fiber cross-section.**

5) Chapter 4 "Discussion" p. E:

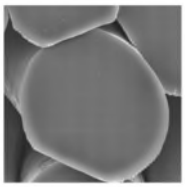
"*Nonsynthetic materials such as viscose can easily be mistaken for plastic due to its color, shape, or buoyancy".*

Conclusion: This statement is not correct. Viscose and synthetic fibers such as polyester show completely different fiber surfaces, fibers cross-sections, chemical and physical properties. Fiber cross-section of fibers:

Viscose



Polyester



6) Regarding retention of fibers:

Chapter 4 "Discussion", p. G:
"Even though 27% of sampled organisms contained 1 or more artificial fibers, the average amount of artificial fibers in each individual digestive tract was small (1.38 fiber) which is relatively low and could therefore indicate the small retention time of these fibers in the guts of the sampled invertebrates."

Conclusion: The fibers do not accumulate in the guts of the invertebrates.

7) Regarding "take-up" in the food chain:

Chapter 4 "Discussion" p. G:
"It has recently been demonstrated by in vitro studies that microplastics can be transferred in invertebrates from one trophic level to another. Plastics can be translocated to consumer tissues and then be transmitted to the predator or directly be transmitted from the consumer's digestive tract to the predator's digestive tract. The observed viscose/rayon fibers thus do not seem to be transmitted from lower to higher trophic levels via predation. One of the main possible explanations could be related to the lower retention time of the nonplastic observed fibers here in the gut."

Conclusion: The statement regarding potential take-up in the food chain, implying bio-accumulation, is proven false by this reference which states *"The observed viscose/rayon fibers thus do not seem to be transmitted from lower to higher trophic levels via predation."*

8) Regarding biodegradation of viscose:

Chapter 4 "Discussion" p. G:
"Indeed, cellulose, even of artificial origin like viscose, is more digestible and degradable than plastic. Some marine invertebrates are known to be able to digest cellulose, and this could explain both the faster digestive transit of the fibers and the absence of accumulation. The small average amount of

AFs found in the invertebrates' gut contents also seems to favor this nonaccumulation or transmission."

Conclusion: results of study support both the biodegradation and lack of bioaccumulation of viscose/rayon.

2. Further references regarding regenerated cellulose

References added to the bibliography PAS 1:

Reference 15 (attachment 1):
UNEP (2016). Marine plastic debris and microplastics – Global lessons and research to inspire action and guide policy change. United Nations Environment Programme, Nairobi.

Reference 16 (attachment 2):
Park, C. H.; Kang Y. K.; Im S. S.; „Biodegradability of cellulose fabrics", J. Appl. Polym. Sci. 2004, Vol. 94, 248-253.

Park et al. in 2004 shows the higher biodegradability of viscose/rayon compared to those of cotton.

Parts of the abstract:
Biodegradability of cellulose fabrics was evaluated by use of a soil burial test, an activated sewage sludge test, and an enzyme hydrolysis. Surface changes after biodegradation were observed by optical microscopy. From X-ray diffraction analysis (XRD), changes in the crystallinities and the internal structures as a result of degradation were also investigated. It was shown that biodegradability decreased in the following order: rayon>cotton>acetate.

Reference 17 (attachment 3)
I.R.Comnea-Stancu, K.Wieland, G. Ramer, A. Schwaighofer and B. Lendl On the identification of rayon/viscose as a major fraction of microplastics in the marine environment: discrimination between natural and man-made cellulosic fibers by Fourier Transform Infrared Spectroscopy – Applied Spectroscopy published in 2016.
"On the Identification of Rayon/Viscose as a Major Fraction of Microplastics in the Marine Environment: Discrimination between Natural and Manmade Cellulosic Fibers Using Fourier Transform Infrared Spectroscopy"
http://journals.sagepub.com/doi/abs/10.1177/0003702816660725?ai=1gvoi&mi=3ricys&af=R

A final note on studies that report on fibres found in the marine environment: attempts to differentiate between viscose/rayon (wood-based cellulose fibers) and natural cellulose fibres - using Fourier transform infrared (FT-IR) transmission spectroscopy and commercial libraries, as applied in the referenced deep sea debris research - lead to ambivalent results, with a high likelihood of false identification of natural fibres as viscose/rayon (wood based cellulose fibres). Therefore, the published results do not prove the presence of viscose/rayon fibres in the sampled marine environments. Attenuated total reflection (ATR) IR spectroscopy technique is a more suitable technique for discriminating types of natural versus viscose/rayon fibres, when used with a reference data set of spectra obtained with the same sampling technique.

Reference 18 (attachment 4):
VINCOTTE biodegradability certificates for Lenzing™ lyocell fibers

Biodegradability of Lenzing™ wood-based cellulose fibers:
"Lenzing™ viscose fibers and Lenzing™ lyocell fibers are being used for many years in wipes applications. These are made of pulp and pulp is made of renewable sources wood. The cellulose in Lenzing™ fibers, in natural cellulose fibers (e.g. cotton, bast fibers) and pulp are the same biopolymer and all fibers are fully biodegradable in a range of natural environments.
Lenzing provides all VINCOTTE certificates which show the biodegradability of their wood-based cellulose fibers in soil, in the sea water and in compost (home and industrial). Certificates VINCOTTE are based on current existing International Standards Tests and proofed by third party.