Viscose and lyocell fibres are wood-based cellulose fibres and fully biodegradable in a range of natural environments

1. Why are we releasing this statement?
2. Description of regenerated cellulose
3. Biodegradability of cellulose fibres

1) In the position statement of the International water industry on *non-flushable* and *flushable* labelled products, published on September 20th 2016, it is mentioned that a flushable wipe shouldn't contain plastic or regenerated cellulose and only contain materials which will readily degrade in a range of natural environments. The paper does not explain the meaning of the term 'regenerated cellulose' and does not provide any scientific basis to support this position.

   EDANA is of the opinion that there is no rationale to ban viscose and lyocell fibres (defined as regenerated cellulose in the literature) from flushable wipes and this statement aims to provide the rationale behind this position.

2) In the literature, the terms 'regenerated cellulose fibres' and 'man-made cellulose fibres' are used for wood-based cellulose fibres viscose and lyocell. Cellulose-based fibres are divided in to 2 categories: (a) Natural cellulose fibres e.g. cotton and bast fibres and (b) Man-made cellulose fibres viscose and lyocell (wood based cellulose fibres).

   Viscose and lyocell are made of wood pulp (thus from a renewable resource). The cellulose obtained from wood consists of the same natural polymer found in natural cellulose (cotton). Viscose and lyocell are not synthetic fibres (the raw material for synthetic fibres derives from crude oil).

   Both types of fibres, natural and man-made cellulose fibres viscose and lyocell (wood-based cellulose fibres), have a long history of use and continue to be used in the Textile and Nonwoven Industries.

   Though chemically identical, due to the manufacturing process there is a slight difference between natural and man-made fibres viscose and lyocell fibres (wood-based cellulose fibres) regarding their crystal structure.

   Native cellulose in natural cellulose fibres (like cotton) has a crystal structure referred to as *cellulose I*. Upon the viscose or lyocell process and the subsequent regeneration of viscose and lyocell fibres, the cellulose adopts to the crystal structure *cellulose II*, which has a different orientation of the cellulose chain and hydrogen-bonding system.

3. To understand the biodegradability of cellulose one should know that cellulose is a major component of plant/tree biomass and is therefore the most abundant natural polymer produced by nature. Cellulose is omnipresent and can be found in most organisms. Therefore, it's recycling in nature by biodegradation is indispensable for the carbon cycle.

When it comes to biodegradation, viscose and lyocell fibres benefit from their higher accessibility to water and microorganisms leading to full bio-degradation, at a rate comparable to cotton.

The biodegradability of viscose and lyocell fibres in relevant natural and man-made environments (waste water treatment plants, composting, landfill, soil, seawater etc.) is verified by international standards and certified by international certification organizations such as VINCOTTE and DIN CERTCO.

A final note on studies that report on fibres found in the marine environment: attempts to differentiate between man-made (wood based) 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 man-made (wood based) cellulose fibres. Therefore, the published results do not prove the presence of viscose fibres in the sampled marine environments. Attenuated total reflection (ATR) IR spectroscopy technique is a more suitable technique for discriminating types of natural versus man-made cellulose fibres, when used with a reference data set of spectra obtained with the same sampling technique [Lit. 1].

Compostability and Biodegradability Standardised Tests:

Compostability and biodegradability in soil per the European Standard EN 13432.
Key requirements are:

1) Biodegradation
2) Disintegration
3) Quality of the final compost and Eco toxicity
4) Chemical composition (limits for volatile matter, heavy metals and fluorine)

Biodegradability in the marine environment with reference to ASTM D7081 and EN 13432.
Key requirements are:

1) Marine Aerobic Biodegradation
2) Marine Aerobic Disintegration
3) Eco toxicity Aquatic Invertebrate acute toxicity test with Daphnia magna
4) Chemical Characterization (heavy metals including cobalt and fluorine)

Literature:

1) 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 fibres by Fourier Transform Infrared Spectroscopy – Applied Spectroscopy published in 2016 . Open access available at: http://journals.sagepub.com/doi/abs/10.1177/0003702816660725?ai=1gvoi&mi=3ricys&af=R

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