



## Avantium

**Avantium develops and commercialises innovative chemistry technologies across industry value chains in order to produce chemicals and materials based on renewable feedstock instead of fossil resources.**

Avantium also provides R&D solutions in the field of sustainable chemistry and is the leading provider of advanced catalyst testing technology and services to accelerate catalyst R&D.

Avantium produces chemicals from renewable sources for a wide range of consumer goods such as plastics and textiles. Our two lead products are FDCA and plantMEG™.

Together, they enable the production of the novel plastic PEF: 100 % plant-based and recyclable with superior performance.



### Interview

with **Ed de Jong**  
VP Development  
Avantium, Netherlands



Ed joined Avantium in 2007. He is currently VP Development – responsible for Public-Private partnerships of Avantium. In addition he is involved in feedstock selection and pretreatment (Avantium's Dawn Technology and Ray Technology) and Catalytic Biomass Conversion of carbohydrates into building blocks for polyesters such as PEF.

He is also involved in the valorization of side products of the YXY & Dawn Processes, c<sub>q</sub> lignins, humins and levulinates. He is co-chair of the IEA-Bioenergy Task 42 on Biorefineries.

**Your lead product is PEF (polyethylene 2,5-furandicarboxylate), a novel, plant-based, recyclable polymer. What special/better properties does PEF offer in relation to other polymers?**

Like PET, PEF is a versatile and reliable raw material for rigid packaging, with high level of design freedom. It can be converted and recycled on the widely available industry assets. When compared to PET, PEF provides superior barrier properties: an oxygen barrier that is 10 times better and a CO<sub>2</sub> barrier that is six to ten times better.

The water barrier that is twice as good, and humidity does barely affect the O<sub>2</sub> and CO<sub>2</sub> barrier performance. With its higher rigidity and strength, these improved barrier properties also provide light-weighting potential and a longer shelf life / reduced food waste in the value chain. With our partners, we learned that PEF adds no flavor and keeps the fizziness of the soft drink or beer.

**A recent Life Cycle Assessment showed the potential of your FDCA and PEF technology to curb global warming.**

**What are the results of the LCA, what do the results mean for the production and application of PEF?**

PEF is 100 % produced from biomass. Plants absorb CO<sub>2</sub> from the atmosphere for growth, creating the feedstock for PEF. PEF can also be recycled, on the same equipment as PET.

Depending on the application, PEF has a carbon footprint improvement of around 35 % in greenhouse emissions. More can be reached with further scaling of the technology. Would a PEF-based bottle (or carton) reach its end-of-life, then the biogenic carbon re-enters back into the natural carbon cycle.

Fossil-based bottles (such as PET) then release carbon that has been locked-up in the ground for millions of years and by that, contribute to global warming.

**You are working on further developments of PEF. So far you are using fructose as feedstock but plan to apply hemicellulose in the future. Which changes in the LCA outcome do you expect by switching to this feedstock?**

The impact originated by the plant-based feedstock could be further reduced by a switch to lignocellulosic feedstocks such as originating from second generation biomass.

This will be tested at Avantium Renewable Polymers in the framework of the BBI-JU PEFerence project, and should confirm that the YXY<sup>®</sup> process can use second generation biomass when it becomes available at commercial volumes and pricing.

**Which applications for PEF are planned, and which brands have shown interest to replace their fossil-based polymers with PEF?**

PEF has a wide range of applications such as packaging, film and textiles. With our partners like Ambev, Carlsberg, Refresco and Resilux, we commercialize packaging solutions where PEF replaces glass bottles and aluminium cans as well as non-polyester barrier layers in PET bottles, enhancing its circularity.

With our partner LVMH, we work on cosmetics packaging. Our partner Henkel will use FDCA to launch innovative, high performance polyurethane adhesives in electronics applications. Our partner Sukano develops masterbatches for PEF resins. Toyobo will develop PEF polymer for high barrier packaging film and for optical films used in electronics. And the US-based converter Terphane share develops PEF as a sustainable, high quality material for use in specialty polyester films.

Furthermore, our agreement with Monosuisse means Avantium is primed to enter a significant new sector: fibres. PEF, in its capacity as a plant-based polyester fibre, is an extremely promising solution for this high-volume market, which is confronting major sustainability challenges.

To support progress in this area, Avantium has formed the PEF Textile Community, with the five reputable global companies Antex, BekaertDeslee, Chamatex, Kvadrat and Salomon. Avantium and Antex have already worked together on producing yarns made from PEF.

***The Renewable Carbon Initiative is a joint venture of about 50 members striving to support and speed up the transition from fossil carbon to renewable carbon for all organic chemicals and materials.***

***What motivated you most to join the RCI and what is the added value you expect from your membership?***

Avantium shares the common goal with the Renewable Carbon Initiative to transition to move to a fossil-free industry. Avantium strongly believes that fossil carbon can be completely substituted by a combination of renewable carbon from plants, from CO<sub>2</sub> and from recycling.

Avantium develops and commercialises innovative chemistry technologies across industry value chains in order to produce chemicals and materials based on renewable feedstock instead of fossil resources. Our RCI membership gives us the opportunity to interact and collaborate with like-minded partners on this transition.

***How can the RCI profit from your membership?***

Avantium is a frontrunner in the emerging industry of renewable and sustainable chemistry. We are now at the point of commercialising our technology for the production of FDCA, the key building block for the plant-based and fully recyclable polymer PEF. We are constructing the world's first commercial facility for FDCA in Delfzijl, the Netherlands, and expect to start production in 2024.

We can show others what is needed to scale up successfully. The first experiment to make FDCA in Avantium's laboratories took place in 2005. We faced lots of ups and downs, ranging from technical, commercial and financing challenges. Overcoming such challenges is part of innovation, but it often felt like an uphill battle. Developing and commercialising new polymers is rare, because it is risky, time consuming and capital intensive.

The fact that PEF is commercialised by a start-up/scale-up company makes the journey even more unique. This is the result of the incredible commitment and tenacity of the team that has worked on this innovation: we have not been prepared to give up, because there has been such a strong drive in the team to make an impact on the plastics industry.

Of course, we could never do this on our own, and we always need to partner in order to be successful.