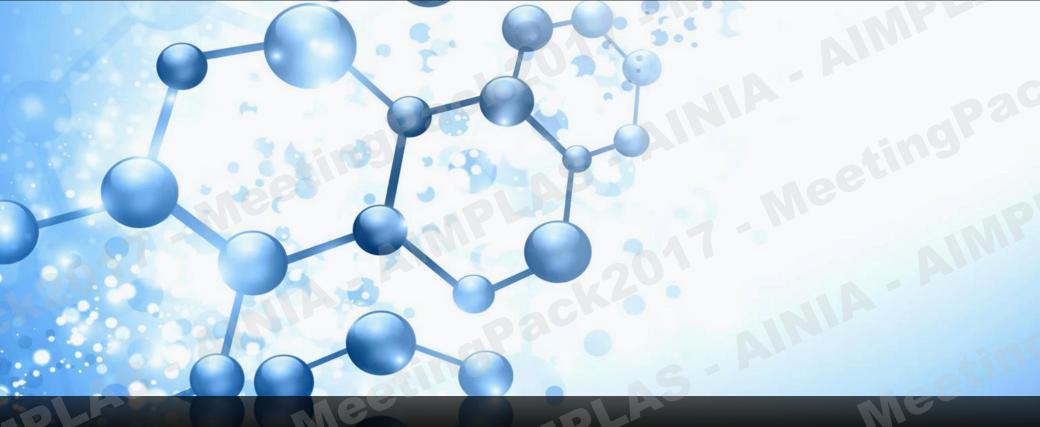


PEF — El polímero de nueva generación PEF — The next generation polymer

Thomas M.Kläusli (AVALON INDUSTRIES)



The Green Chemistry Company

PEF - EL POLIMERO DE NUEVA GENERACION

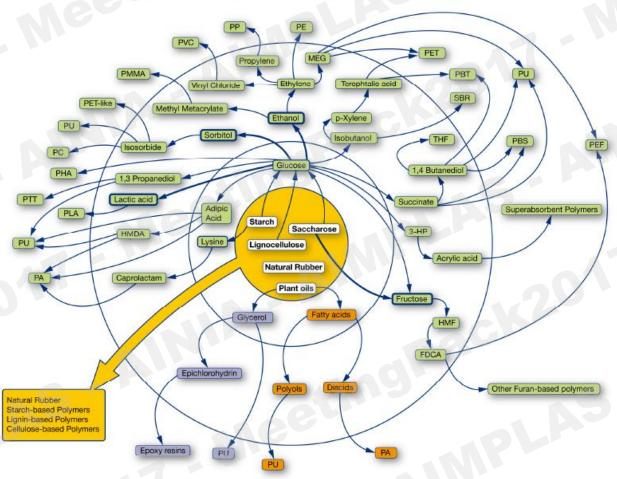
PEF - THE NEXT GENERATION POLYMER

meeting**PACK**



Sugar Based Chemistry

FROM BIOMASS TO POLYMERS

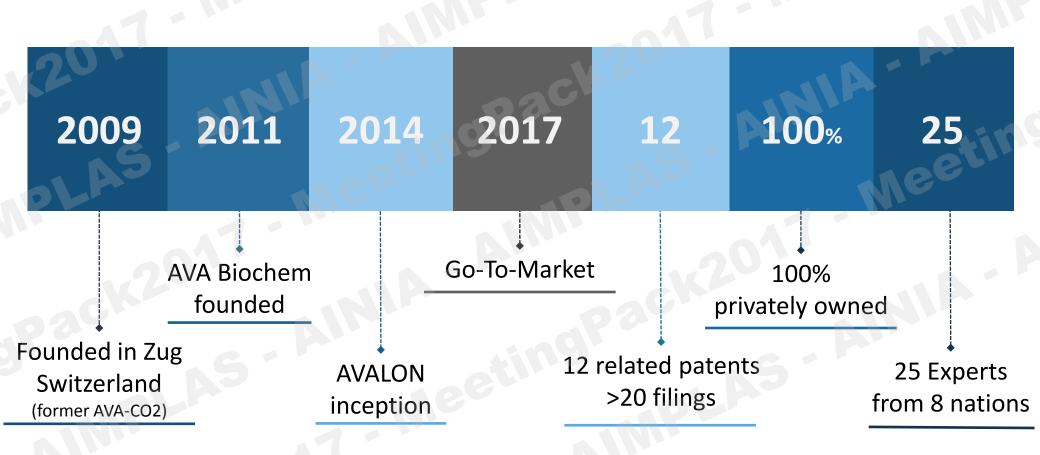




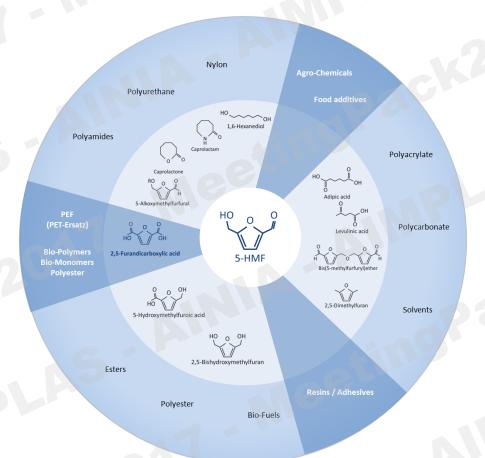


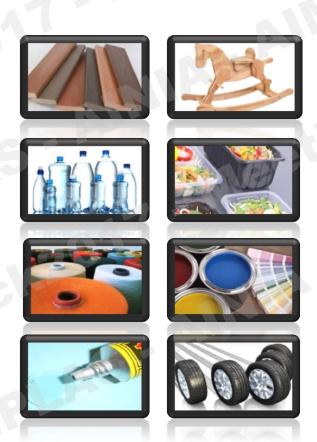


Company History



AVALON Industries is the global leader in the production of platform-chemical 5-HMF and develops innovative solutions in three distinct industries

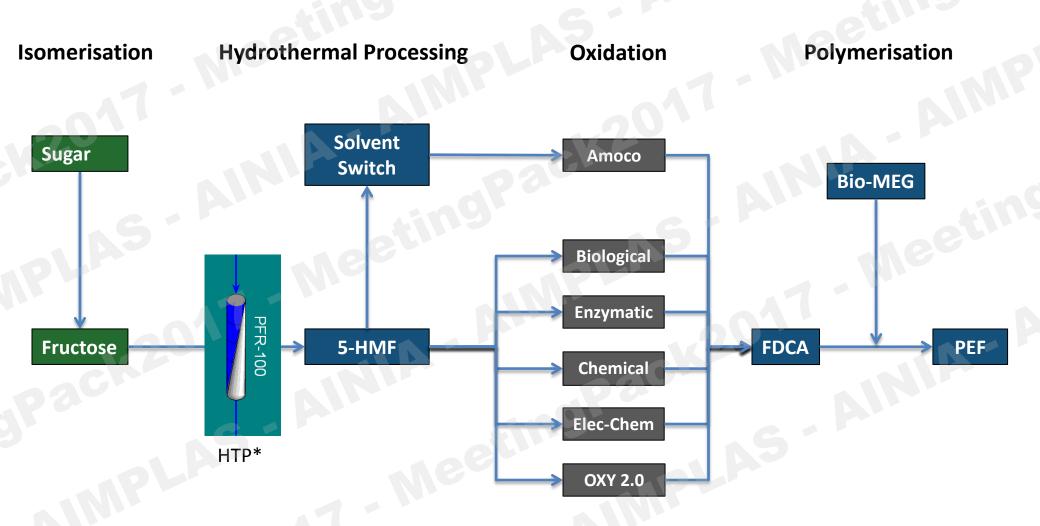


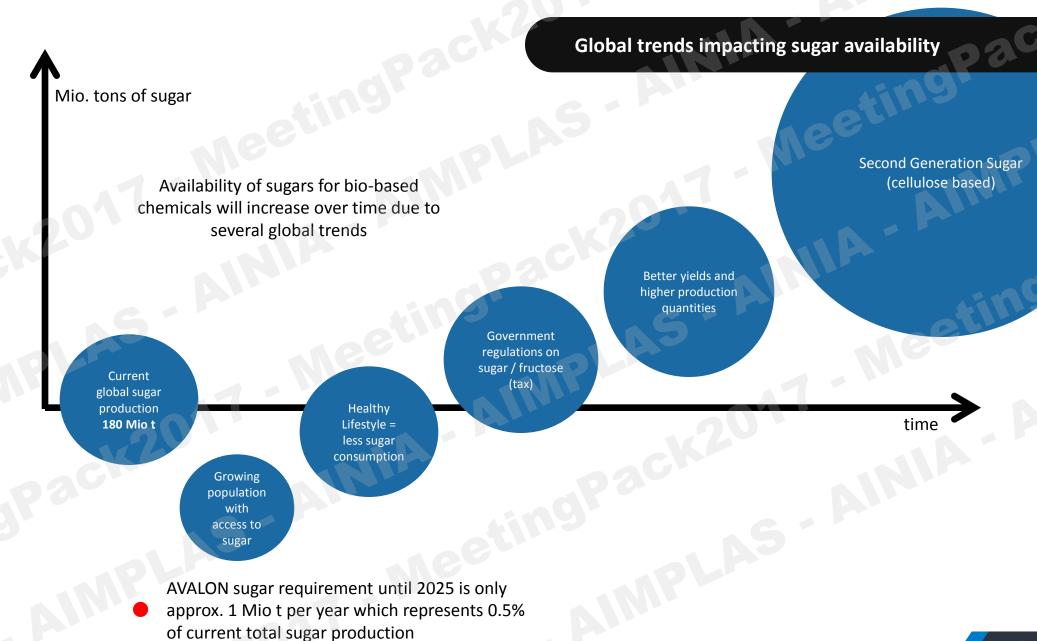




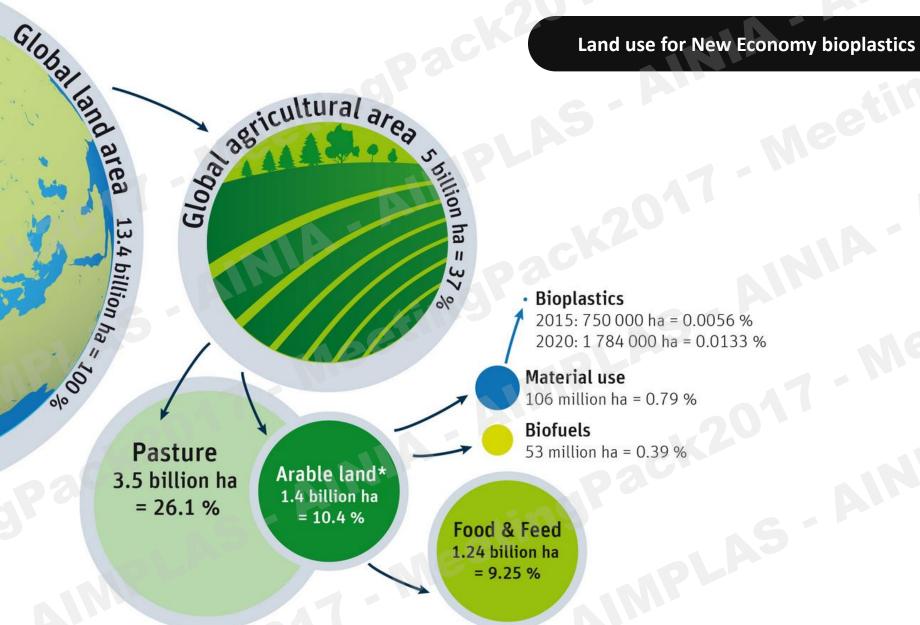


The long road to PEF

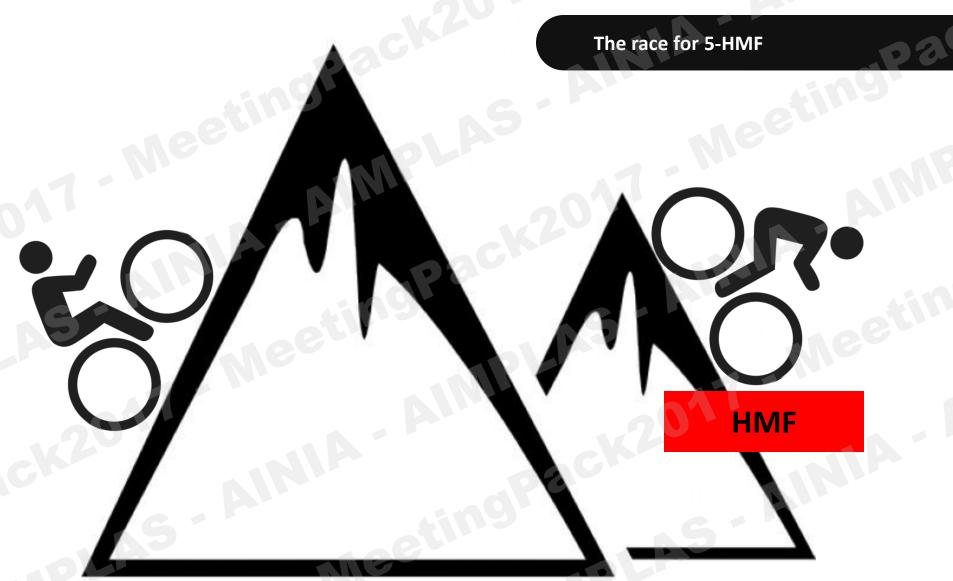












AVA Biochem BSL Ltd.

Largest 5-HMF production plant world-wide



AVA Biochem, Muttenz Industrial scale Single Plug Flow Reactor



Max. Production Capacity

5-HMF in water: 50 kg per hour (dry w.)

• 5-HMF crystalline: 12 t/a (dry w.)



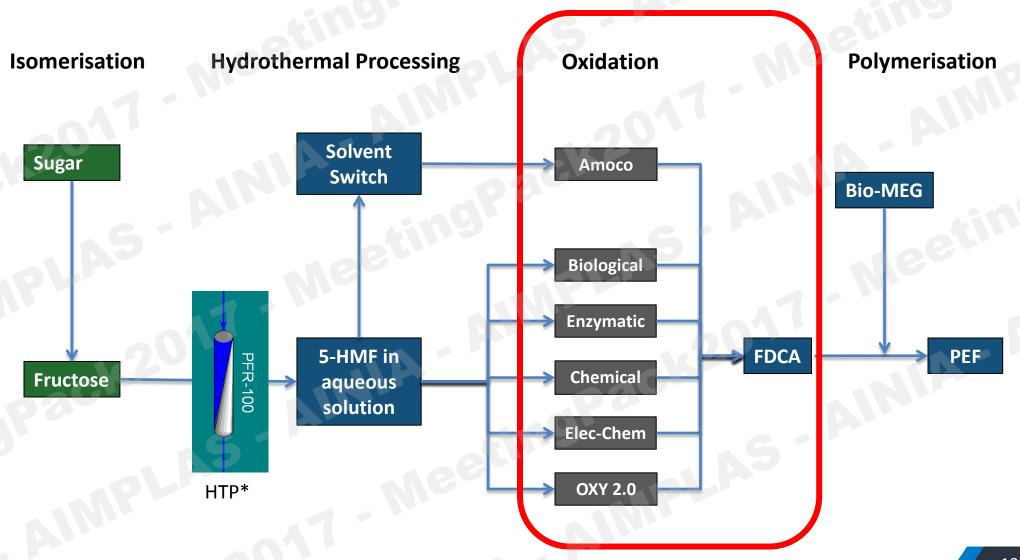
Start of Operation: 2014



Customer Base

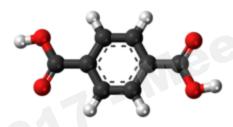
- Chemical companies
- Pharmaceutical companies
- Food additive producers
- Universities and R&D institutes

The long road to PEF





AMOCO process



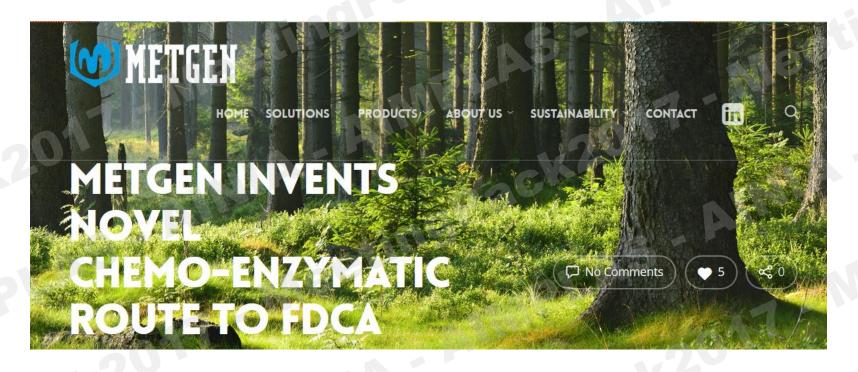
Terephthalic acid is the organic compound with the formula $C_6H_4(CO_2H)_2$. This white solid is a commodity chemical, used principally as a precursor to the polyester PET, used to make clothing and plastic bottles. Several million tonnes are produced annually.

In the Amoco process, terephthalic acid is produced by oxidation of p-xylene by oxygen in air. The process uses a cobalt-manganese-bromide catalyst (CMB).

Idle TPA production capacity can be used for the oxidation of 5-HMF to FDCA! Fast Go-To-Market and reduced CAPEX



Enzymatic Oxidation



MetGen has invented a revolutionary chemo-enzymatic pathway that enables streamlined processes towards platform chemicals, for example FDCA.



Elector-Chemical Oxidation



Electrification of the Chemical Industry

02-05-2017

VoltaChem demonstrates continuous electrochemical FDCA production

SUBSCRIBE TO OUR NEWSLETTER

Subscribe to our email newsletter to receive monthly news updates from VoltaChem.

Researchers from Shared Innovation Program VoltaChem have recently demonstrated a full continuous process for the conversion of biobased Hydroxymethylfurfural (HMF) to FDCA, a key intermediate for bioplastics. With the results in hand, the next step can be made towards optimization and pilot scale production.



OXY 2.01



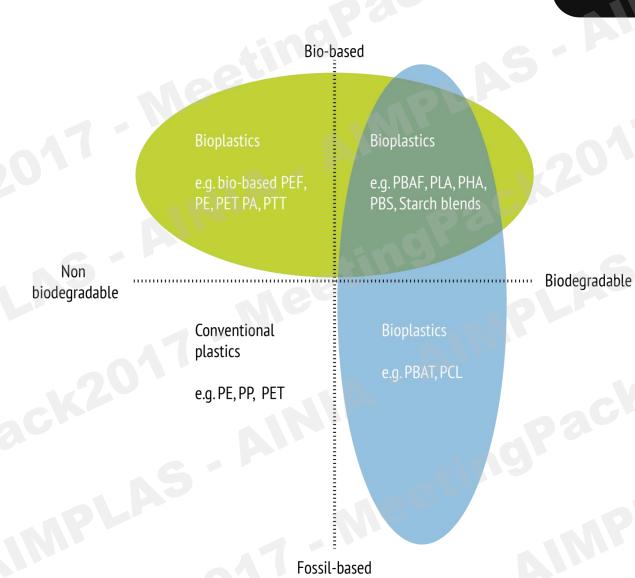
WELCOME TO THE FUTURE OF BIO-BASED CHEMISTRY

AVALON Industries' revolutionary Hydrothermal Processing (HTP) technology is the key to cost-efficient, industrial scale production of the bio-based platform chemical 5-Hydroxymethylfurfural. Our water-based chemical process provides a more sustainable, cleaner, faster and lower-cost method to convert first or second generation sugars into an important building block for the growing biochemical industry.

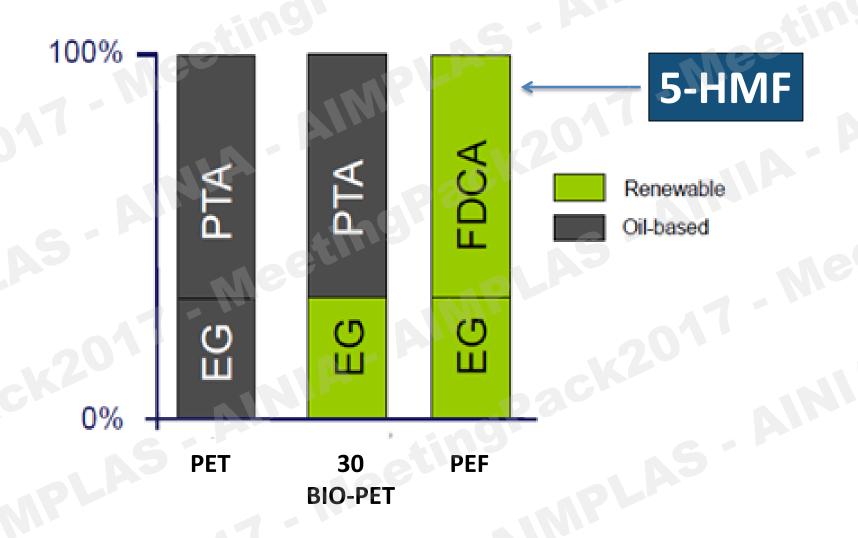
5-HMF has applications in the chemical, pharmaceutical and food industries. It will change the petro-based polymer industry and lead the way to a sustainable, 100% bio-based future. As a global technology leader for industrial scale 5-HMF production we cooperate with partners around the globe to make bio-based chemistry a reality.



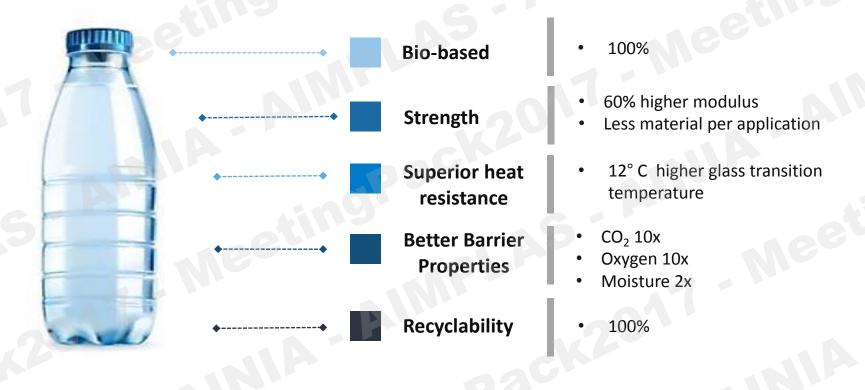
Biobased vs. Biodegradable



PEF: 100% Biobased



5-HMF based PEF: Superior Properties



Illustrative Example

Beer bottle 330ml

- Weight 30 grams
- Must be spiked with additives
- Additional layers to reach required barrier properties

PET

PEF

- Weight 20 grams
- Less need for additives
- 3 times better barrier properties than PET bottle



PEF stretching ratio

IV of PEF resin: 0.554 & 0.793

Thickness of cast film	Stretching ratio	Thickness of oriented film	Results
480 μm	2 x 2	180 μm	Ok
	2.5 x 2.5	80μm	Ok
	3 x 3	50μm	Ok



5-HMF based PEF: Main Success Factors

Carbon footprint

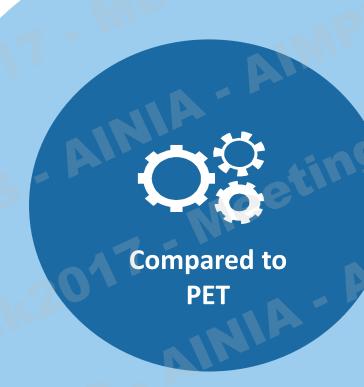
Bio-based products such as PEF can make the economy more sustainable, lower its dependence on fossil fuels and reduce the overall carbon footprint of plastic packaging and other materials

Better performance

PEF has better performance than PET and leads to longer shelf lives and allows replacement of PET as well as glass / aluminum / tin cans packaging

Recyclability

Improved bottle-to-bottle recycling Use of existing machinery & equipment



Operational Business Models



AVALON Industries

Feedstock
Supply
Agreement

(3)

- 1 Technology Licensing Agreement
- Joint Venture / Co-Investment

Off Take Agreements

(5)

Development Agreement: Process / Product / Application

Feedstock Supply

Large Scale Production

Development Partner / Customers







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