Sustainable Polyurethanes from biobased chemicals

Dr. Natalie Bittner

Innovation Management
Covestro Deutschland AG
Covestro at a Glance
One of the World's Leading Polymer Producers

WE MAKE the world a brighter place.

BASIC CHEMICALS

curious courageous colorful

€11.9 bn SALES

>10,000 PRODUCTS

more than 15,600
EMPLOYEES

8 world-scale production facilities in 3 main regions

POLYCARBONATE
COATINGS

POLYURETHANES
ADHESIVES AND SEALANTS
SPECIALTIES

Research Development

~2% R&D INVESTMENTS OF SALES
Sustainability
Global trends

WE NEED TO MASTER THESE CHALLENGES WITH INNOVATIVE AND SUSTAINABLE SOLUTIONS.

Climate change
Population growth
Demographic change
Urbanization
Sustainability

Drivers for renewable raw materials

RESOURCE/ TECHNOLOGY
- technical breakthroughs in biotechnology
- scarcity of fossil resources

PERFORMANCE
- new raw materials
- improved performance of new materials

ENVIRONMENT
- reduction of carbon footprint
- corporate image
Covestro

Business units and key industries

- Granules, Sheets, Films
- Raw materials for:
  - Surface coatings
  - Adhesives and sealants
  - Specialities
- Raw materials for:
  - Flexible foam
  - Rigid foam
  - Thermoplastics

Thermoplastics
- Rigid foam
- Flexible foam
- Thermoplastics

July 24th, 2017 │ BIO World Congress on Industrial Biotechnology │ Dr. Natalie Bittner, Covestro Deutschland AG
Covestro
Sustainable raw materials for our products

PC blends with biobased material
PC blends with recycled material

Polyether (Polycarbonate)
Polyester
Polyurethane
Isocyanate
Diamine
Polyol

Carboxylic acids
Alcohols
Glycerol
Sugar
Natural oil
CO₂
Bio-based thermoplastic polyurethane (TPU)

Desmopan®
Bio-based thermoplastic polyurethane (TPU)

Desmopan®

2 OCN – R – NCO + HO – polyester or polyether – OH → HO – X – OH

Hard segment

Soft segment

Bio-based Polyester Polyols

Hard segment

Soft segment
Bio-based thermoplastic polyurethane (TPU)

A joint development of Reverdia & Covestro

Sugar → Succinic Acid

Succinic Acid + Diol → Polyol + Isocyanate → TPU

Manufacturers and brand owners

TPU → Applications

- About 4 kg less CO₂ per kg TPU
- Three Desmopan® types with 42-65% bio-content

Figure 1. Indicative Examples of Carbon Footprint Reduction (kg CO₂ per kg acid, polyol and TPU, respectively) Enabled by Using Biosuccinium™ instead of Adipic Acid

Simulated data from Biosuccinium supplier Reverdia

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Waterborne bio-based polyurethane dispersion

Impranil® eco

We developed waterbased PU to eliminate solvents like DMF in textiles, decrease the water consumption by 95% & the energy consumption by 50%.

Through incorporating renewable materials we further increase the sustainability.
Impranil® eco
Significantly improved carbon footprint

- **Example substitution adipic acid by bio-succinic acid**
  (similar advantage for other selected bio-based raw materials)

- **Bio-based** and significantly **improved carbon footprint** cradle-to-gate in comparison to standard products (internal assessment done, external certification in process)

5 step petro-based synthesis vs. 3 step bio-based synthesis

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</tr>
<tr>
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Bio-refinery
Biomass

Refinery
Crude oil extraction
Impranil® eco
Renewable materials for synthetic leather

• Initially **three products** will be offered, that will enable **bio-based PUD** to be used in every layer of the synthetic leather or other coated fabric.

• **Performance matches** existing products and **the bio-based versions** can be dropped in directly **without reformulation.**
Partnership Along the Value Chain

Covestro links chemicals to key consumer markets
Partnership Along the Value Chain
Covestro links chemicals to key consumer markets

- DIOLS
- DICARBOXYLIC ACIDS
- EPOXIDES
- DIAMINES
- AROMATICS

Chemicals → Polymers & Intermediates → Applications

CO2
To make the world a brighter place
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The company assumes no liability whatsoever to update these forward-looking statements or to adjust them to future events or developments.
THANK YOU FOR YOUR ATTENTION

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