sustainabable chemistry for the coatings world
Andre van Linden – Director Scientific Academic Partnerships
A startup in Groningen 1792
Sassenheim: Production and R&D

AkzoNobel
Pushing boundaries in the paints and coatings industry

With our company purpose – People. Planet. Paint. – front and center, innovation is the spark that ignites our ability to advance our products, services and technologies while benefitting our customers and the world around us.
Our approach to sustainable business

Focus areas

- Climate change
- Circularity
- Health and well-being

Our key sustainability ambitions by 2030

- **50%** less carbon emissions in our own operations and across value chain*
- **100%** circular use of materials in own operations driven by reduce, reuse, recycle
- **>50%** of revenue from sustainable solutions
- **>100,000** members of local communities empowered with new skills

*baseline 2018
Paints and coatings industry has a direct impact on carbon emissions

- Global total
- Paints and coatings full value chain
- AkzoNobel full value chain
  - Own operations
Four action areas for carbon reduction

Circular solutions
- Reduce solvent emissions
- Energy transition
- Process efficiency

Suppliers
- Scope 3: 46%

AkzoNobel
- Scope 1+2: 2%

Customers
- Scope 3: 30%

End-of-life
- Scope 3: 11%

VOC
- 11%

Proprietary information of AkzoNobel
Together, our impact goes beyond paints and coatings

We play a significant role in reducing the carbon footprint of other industries.
Raw Materials

Mining & Manufacturing

Biobased

Renew

Reduce

Paints & Coatings

Reuse

Painted Surface

Reduce

Recycle from other sources
Sustainability: “triple R”
Re-duce, Re-use and Re-new

- SB to WB, Low Bake
- Lower VOC
- Less SVHC

- Long service life
- Doing more with less

- No carbon emission from paint

- Paint waste recycling
- Recycled packaging

- Recycled raw materials

- Recycle paint and substrate
- Triggered release
- Biodegradable coating

- Alkyds
- Low% bio binders
- Mass balance

- >50% bio binders
- \(^{14}\)C bio-based

- Full bio binders
- Bio-based colors

Today | Soon | Later
Crosslinking in waterborne coatings with new building blocks

Bio-sourced building blocks

- CHITIN
- LIGNIN
- HUMINS

Functionality added

- HYDROPHOBICITY
- CROSS-LINKING HANDLES
- PARTICLE-STABILIZED EMULSIONS
- COALESCENCE CONTROL

Sustainable coating polymers

- GREEN DRYING CATALYST
- DURABLE FILM PROPERTIES
- GREEN FOOTPRINT PRODUCTS

Coating products of the future
ARC-CBBC: Biobased raw material

Johannes G. H. Hermens, Thomas Freese, Keimpe J. van den Berg, Rogier van Gemert, Ben L. Feringa

New way to produce reactive biobased materials from furfural towards butanolide

• By using light and a bit of heat.
• Upscaling in flow process.

http://advances.sciencemag.org/content/6/51/eabe0026
Efficient biobased synthesis of Acrylic acid

Johannes G. H. Hermens, Andries Jensma and Ben L. Feringa

- Using the butenolide from earlier article
- Upscaling of butenolide process is running
- Building blocks for waterborne coatings
- Novel synthetic route
  - Atom economy
  - Design for energy efficiency
  - Safer solvents and auxiliaries
  - Use of renewable feedstocks

![Chemical structure](image)

- 81% Yield over 4 steps
- Mild reaction conditions
- Aerobic oxidations
- High atom efficiency
Collaborative consortia
Return on investment

- New and patented inventions (biobased building blocks, catalysts)
- Guidelines and insights for developments, engagements for own employees
- Independent proof for our own inventions
- Access to latest and leading-edge characterization techniques (AFM, 3D Microscopes, TEM, SEM, Synchrotron, etc.)
- Relative high leverage from sponsoring (often in-kind for companies)
- PR articles on Multi-Media and conferences
- High-level exposure (Dutch government, Coatings community)
- Access to Talent Pool, presence at conferences
- Direct link to customers
- Find out what is interesting our suppliers, so know what they are developing
Collaborative consortia

Center for Bioplastics and Biocomposites
- High-value bio-based raw materials and renewable polymers
- Recyclable, compostable and biodegradable coatings

WBC
- Research cooperative with industry and academia on fundamental science for the innovation of wood composites.

ULTRA-DREAM
- UV-Light Triggered Rapid and Adjustable Degradable REnewAble Materials

AkzoNobel
- New and sustainable chemical building blocks with specific focus on catalysis
- New functional materials and coatings
- Aromatic Renewables as an Opportunity for MATerials with Improved Circularity and Sustainability

Collaborative consortia

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ARC CBBC

Key Features
- Collaboration with top researchers from Dutch universities
- Involvement of multiple companies, universities, and government
- Special program dedicated to coatings and materials
- Access to talent pool

Customer Benefits
- Improvement of products
- Better, quicker, more thorough

Bila and Mula programs
- Cobalt free curing
- Novel and efficient catalysts
- Bio-based coatings
- Epoxy catalysts
- Styrene free vinylester-ene curing.

Crosslinking in waterborne coatings with new building blocks
- Bio-based Building Blocks
- New Cross-Linking mechanisms
- Film-Formation from WB paints
- Advanced Spectroscopy on paints and coatings
- Air-cleaning technology
- Smart coatings
- Responsive coatings
- Structural coatings

https://arc-cbbc.nl/
The Center for Bioplastics and Biocomposites (CB²)

Key Features

- Focus is on renewable resources and focuses on developing high-value biobased products from agricultural feedstocks.
- Collaboration with ca 40 partners (e.g. Ford, 3M, Amazon, BASF, Hyundai)
- Several proposals from AkzoNobel accepted and running.

Customer Benefits

- Improves customer carbon footprint

AkzoNobel is involved in several CB2 projects

<table>
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<tr>
<th>Lignin-Derived Compounds</th>
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<tr>
<td>Biodegradable Xylan-based Polymer Materials</td>
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<td>Bio-based Building Blocks for Durable Coatings</td>
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<td>Plant Oil-based Latex Adhesives</td>
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<td>Polymers - Next Generation Packaging Materials</td>
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<tr>
<td>LCA Tool for Sustainable Bio-based Coating Material Design</td>
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https://www.ndsu.edu/centers/cb2/index.html
MOOI / Aromatics

Key Features

- Aromatic Renewables as an Opportunity for MATerials with Improved Circularity and Sustainability
- April ‘23 – March ‘26
- Circular or bio-feedstock for bulk and platform chemicals
- Coordinator: WFBR
- 14 different partners

Research Themes

- Demonstrate full carbon circularity
- From TRL 2/3 to TRL 5
Ultradream

Key Features

- UV-Light Triggered Rapid and Adjustable Degradable REnewAble Materials (ULTRA-DREAM)
- Initiative from Wageningen Food and Biobased Research with Archer Daniels Midland
- PPS starting in 2023
- Spin off from project where FDCA esters are susceptible to UV-irradiation so biobased is possible.

Research Themes

- Use carbohydrate derived monomers
- Create novel biobased polymers
- Testing of Biodegradation and chemical recyclability

WUR site on Ultra-Dream
Conclusions

Steps are made, but many more need to follow
Biobased is major in transition, but it is a lot of work with potential other effects
Like eating an elephant: bite by bite
New investments in processing needed to reach enough scale

Whole value chain needs to work together (from building block providers to new ways of application)
Clever regulation and support will help!