Biobased Chemistry in the Northern Part of The Netherlands (BERNN)

André Heeres, April 26th 2018, Syncom/Hanze University

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Avantium/Zambezi

Catalysis and Renewable Chemistries

- PEF

YXY Technology

Dehydration → MMF (5-methoxy methyl furan)

Oxidation → FDCA

Polymerization → PEF

Plant based Feedstock

Glucose → isomerization 1) bases 2) enzymes 3) Lewis acids → Fructose → dehydration $H^+$ → HMF

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Zambezi

Zambezi process (high purity glucose)

• Precursor FDCA and ethyleneglycol

• Pilot plant Delfzijl: summer 2018
BioBTX/BioPET100

- 2013: RUG-Syncom-KNN
- *Ex situ* catalytic pyrolysis (formation bio-aromatics)
BioBTX/BioPET100

- Different feedstocks screened

- Complex mixtures of aromatics obtained (including BTX)
BioPET100

• Downstream towards PET

Katalytische Pyrolyse: o.a. pX → Oxidation → PTA → MeOH, H₂SO₄ → Bioethanol → PET

Demo plant: summer 2018 (Zernike campus)
Linking Groningen to Delfzijl?

- Human resources, R&D, filling the pipeline
“Greening” clusters Eemsdelta/Emmen

• Can we utilize bulk chemicals available in “Eemsdelta” for modification of (fractionized biomass) to develop new/better products/processes?
"Greening" clusters Eemsdelta/Emmen

<table>
<thead>
<tr>
<th>Reagents Chemiepark Delfzijl</th>
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<tbody>
<tr>
<td>Oxidizing agents</td>
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<tr>
<td>Cl₂/NaOCl (Chlorine/Hypochlorite)</td>
</tr>
<tr>
<td>H₂O₂ (hydrogenperoxide)</td>
</tr>
<tr>
<td>O₂ (oxygen)</td>
</tr>
<tr>
<td>Acid/base</td>
</tr>
<tr>
<td>HCl (Hydrogen chloride)</td>
</tr>
<tr>
<td>H₂SO₄ (sulfuric acid)</td>
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<tr>
<td>NaOH (sodium hydroxide)</td>
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</tbody>
</table>

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An example

[Diagram showing chemical pathways and compounds such as NaOCl, H₂O₂, H₂O, H₂, NaOH, formaldehyde, zeolite catalysts, NH₃, 2,3-dicarboxy starch, α-polyglucuronate, tricarboxy starch, CM starch, high MWT, oxid. starch deriv., low MWT, glucose, glucuronic acid, gluconic acid, glucaric acid, HMF, FDCA, ethylene diamine, ethylene glycol, lactic acid, sorbitol, levulinic acid, 2-Methyl THF, γ-valerolactone, 1,4-sorbitan, 1,4-Pentanediol, succinic acid, glutaric acid, HMF, FDCA, 2,5-di(2-hydroxymethyl) furan, 2,5-di(2-hydroxyethyl) furan.]

Lactic acid = Novel compound
Ethylene glycol = Drop in chemical

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“Greening” clusters Eemsdelta/Emmen

- Yield of the conversion
- Costs processing
- Market potential

- Discussions with experts from industry
“Greening” clusters Eemsdelta/Emmen

Project description:
Epichlorohydrin is a large scale chemical and utilized as a building block for fine chemicals and as a crosslinker in polymer synthesis. Currently epichlorohydrin is being prepared from allyl chloride but it has been recognized that glycerol, in large scale available from biodiesel production, is an interesting and “green/sustainable” alternative.

Subject of design
The goal of this project is to perform a literature survey (open patent literature and desk research) in order to report the current state of the art, market analysis and the potential implementation of the production of glycerol in the chemistry site in Eemsmond/Delfzijl. The results obtained will be summarized in a final report.

Field of knowledge
Chemistry, Market analysis

Stakeholder company
Chempport Europe, SBE

1,3 Propanediol from glucose/glycerol

Project description:
1,3 Propanediol is a building block for the preparation of polyesters and has several applications in the chemical market. Currently, 1,3 propanediol is prepared from acrolein, ethylene oxide or via a fermentive route from glucose. A catalytic route starting from glycerol/glucose might be an attractive alternative for production.

Subject of design
The goal of this project is to perform a literature survey (open patent literature and desk research) in order to report the current state of the art, market analysis and the potential implementation of the production of 1,3 propanediol from glycerol in the chemistry site in Eemsmond/Delfzijl. The results obtained will be summarized in a final report.

Field of knowledge
Chemistry, Market analysis

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“Conclusions

• “Greenification” of chemiepark Delfzijl perfectly fits in the transition we are aiming for (renewables, less CO₂).

• First successes achieved, new propositions in progress.

• Linking the ecosystem of Groningen to Delfzijl is needed to reach full potential!

Er gaat niets boven Groningen

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Thanks for your attention

• Questions?