Lupranol BALANCE 50

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Agenda

1. BASF Sustainability
2. Lupranol BALANCE 50
3. Eco-Efficiency Analysis
4. Results
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1. BASF Sustainability
2. Lupranol BALANCE 50
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“For us, sustainable enterprise means combining economic success with environmental protection and social responsibility, thus contributing to a high quality of life for coming generations.”

CEO, Jürgen Hambrecht
BASF 2015
Four strategic guidelines for long-term success

Earn a premium on our cost of capital

Help our customers to be more successful

Form the best team in industry

Ensure sustainable development

The Chemical Company
Sustainable development
Long-term economic success

BASF 2015:
“Ensure sustainable development”

- Integrate sustainability in customer relationships
- Develop new target groups and markets
- Identify relevant sustainability issues
- Develop tailored solutions
- Reduce reputational risks
- Transparent communication
Agenda

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Castor Oil Basics

- fast growing plant
- 40 – 50 % oil content
- application in medicine, cosmetic and industry
- OH-functional non-edible vegetable oil
Castor Oil Cultivable Area

- Instead of plantation, little patches on middle sized acreages
- Farming with little or no irrigation
- No pesticides and nearly no fertilizer
- Truly GMO free crop
- Co-crop aside of millet, corn, etc.

(Statement Alberdingk Boley November 2007)

Castor seed 1,28 Mio t/a
Castor oil 0,53 Mio t/a

1) Alberdingk Boley: Rizinussaatarten Februar 2008
Lupranol BALANCE 50
DMC: Double-metal cyanide catalysis

- Neutral
- No saponification
- No ring-formation of ricinoleic acid
- Low in odors

ODOR!
Lupranol BALANCE 50
Polyol Properties

- OH-Number: 50 mg KOH/g
- Functionality: 2.7
- Viscosity: 725 mPa·s
- Excellent Odor: 1.2
- Biomass: 31 %
Lupranol BALANCE 50

- Good processing profile
- Good mechanical properties
- Low emission – Low odor
- 25 % of renewable raw material in the foam
1. BASF Sustainability
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Environmental Profile „From the Cradle to the Workgate“

Environmental impact over the entire life cycle*

<table>
<thead>
<tr>
<th>Consumption of Energy</th>
<th>Emissions</th>
<th>Toxicity Potential</th>
<th>Risk Potential</th>
<th>Consumption of Raw Materials</th>
<th>Land Use</th>
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<td>• Risk assessment approach</td>
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<td>• Index calculated by assessment criteria and impact factors</td>
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*Data acquisition and calculation is done according to ISO 14040 and 14044 (ecological part)
System boundaries
Compare Slab-Polyol vs. Lupranol BALANCE 50
System boundaries
Production Slab Polyol

Starter based on fossile raw materials

Slab Polyol

3 %

Fossile raw materials

3 %

production foam

phase of value

utilization disposal

identic
System boundaries
Production Lupranol BALANCE 50

- Castor Oil 31%
- Fossil raw materials 39%

BALANCE 50
production foam
identic phase of value
utilization disposal
Ecological Fingerprint

- **Tox potential**
- **Risk potential**
- **Resource consumption**
- **Land Use**

**Graph Details:**

- 1 = max. environmental impact
- 0 = min. environmental impact

**Legend:**

- Orange = Slab Polyol
- Green = BALANCE 50
TOX potential

TOX Points calculated Mio / t

minus 28 % tox-rating
Risk potential

Risk Points calculated / t

- fire risk
- explosion risk
- workplace accidents
- occupational disease

Slab Polyol

BALANCE 50
Resource consumption

kg/(a*Mio t)\(1/2\) / t

Slab Polyol

BALANCE 50
Weighted Land-Use $m^2 a / t$

- Arid to semi-arid climates are ideal
- Improved yield via hybrid castor seeds
- Productivity 1087 kg/ha

$100 m \times 65 m = 6500 m^2$

$= 1000 kg$

Lupranol BALANCE 50
Energy consumption

![Graph showing energy consumption comparison between Slab Polyol and BALANCE 50.]

**Delta:**
- 10100 MJ / t
- ≈ 2800 kWh
- Equivalent to 98,000 homes energy consumption/month

(US conventional polyols substituted by BALANCE 50)
Emissions
Waste accumulation

- Slab Polyol
- BALANCE 50

nt / t

minus 50 % waste disposal
Emissions
Global warming potential

27 % less global warming potential
Emissions
„Acid Rain“ – SO₂-Emissions

8 % less SO₂ emission

kg SO₂ Equivalent / t

Slab Polyol

BALANCE 50
Ecological Fingerprint Results

1 = max. environmental impact
0 = min. environmental impact

Tox potential
Risk potential
Resource consumption

Emissions
Energy consumption
Land Use

= Slab Polyol
= BALANCE 50

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Results

- higher land-use
- limited competition with food chain

+ up to 25% of bio-mass in resulting PU foam
+ less energy consumption
+ less resource consumption
+ less global warming potential
+ less SO₂ emission („Acid Rain“)
+ more ecologically friendly
Results

Validated Method
Eco-Efficiency Analysis
Thank you for your attention!