PolyGreen

natural polyols

PIPOC 2017
PolyGreen's Natural Polyols for Polyurethane Applications and More

by Dr. Wolfgang Rupilius
Jens Eulitz

PolyGreen
natural polyols

AGENDA

1. Company Introduction of PolyGreen Chemicals (Malaysia) Sdn Bhd
2. The Green benefits of PolyGreen's Polyols:
3. The Commercial Benefits of PolyGreen's Polyol
4. What PolyGreen Can Offer ?
5. PolyGreen's Developments

1.

Who is PolyGreen?

PolyGreen
natural polyols

PGM is a pioneer in the Natural Oil Polyols industry!

We are the first (and only) commercial producer of Palm-Oil based NOP.

PolyGreen
natural polyols

PolyGreen Chemicals (Malaysia) Sdn Bhd (PGM)

- Common development of the basic technology with MPOB in the 90's
- Founded in 2006, PolyGreen Chemicals (Malaysia) Sdn Bhd (PGM)'s industrial sized plant in Malaysia has now a capacity to produce up to 30,000 MT annually.
- Only company in Malaysia handling 60% bulk Hydrogen Peroxide
- PolyGreen offers a "green" Polyol with high Bio content and biodegradability which is cheaper than synthetic polyols and other Natural Oil Polyols.

ECOlogy + ECOnomy

- Palm Oil is a renewable resource as a green alternative to other finite resources such as petroleum.
- The use of renewable raw materials can significantly contribute to a sustainable development.
- In ages of depleting fossil oil reserves it is obvious that the utilization of renewable raw materials wherever and whenever possible is one necessary step towards a sustainable development.

PolyGreen
natural polyols

Resources conserving production process:
Less is More

Less Fixed Cost

Production facility less capital intensive compared with petrochemical plants due to inhouse technology resulting in fewer manufacturing steps

Less Energy Consumption

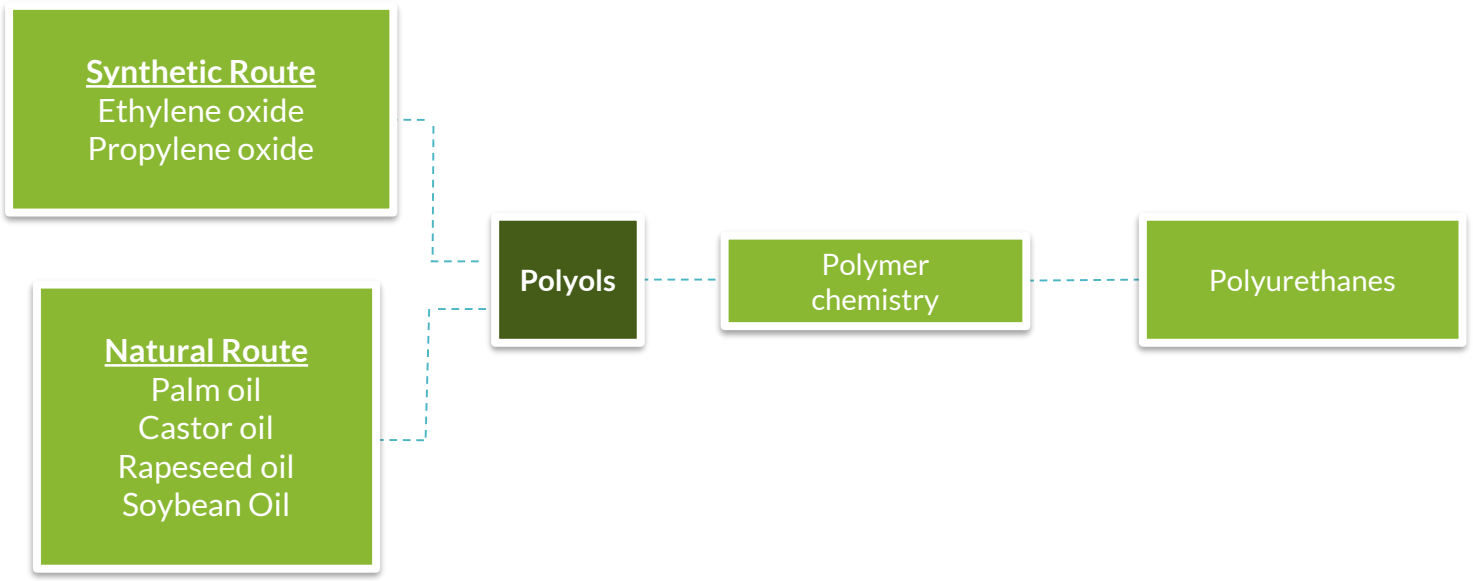
Reactions under mild conditions result in less energy consumption than for synthetic Polyols and other Natural Oil Polyols.

PolyGreen
natural polyols

A green alternative to producing polyurethanes

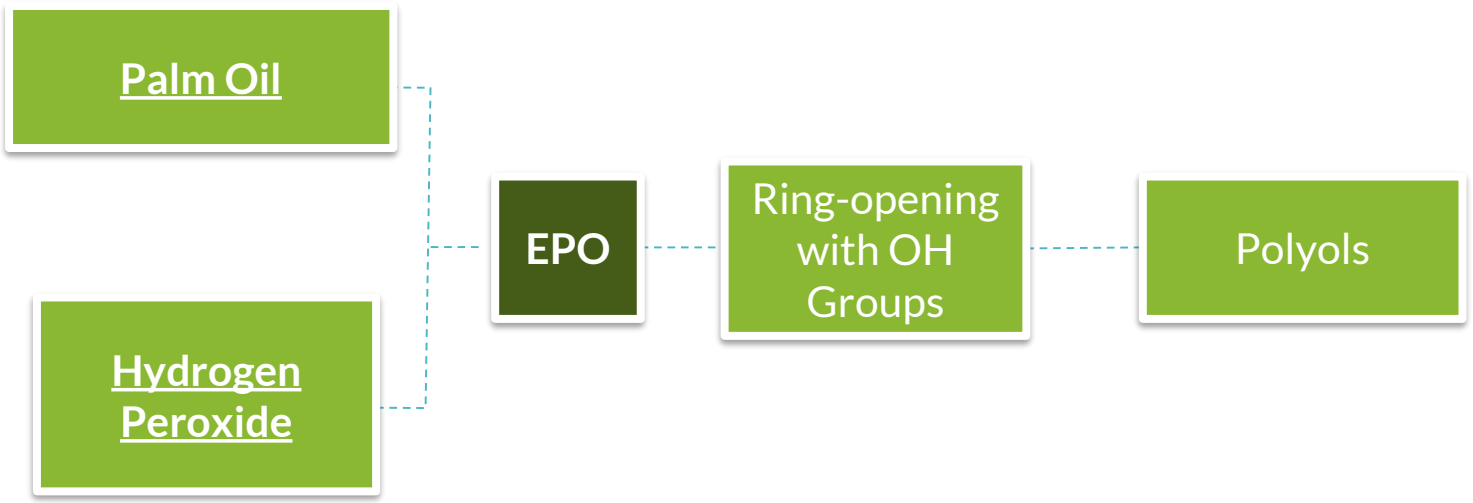
What are polyols?

An alcohol containing multiple hydroxyl groups that is processed and made into products we use everyday.



PolyGreen
natural polyols

PolyGreen's Production Process



PolyGreen
natural polyols

PolyGreen & the PU industry:

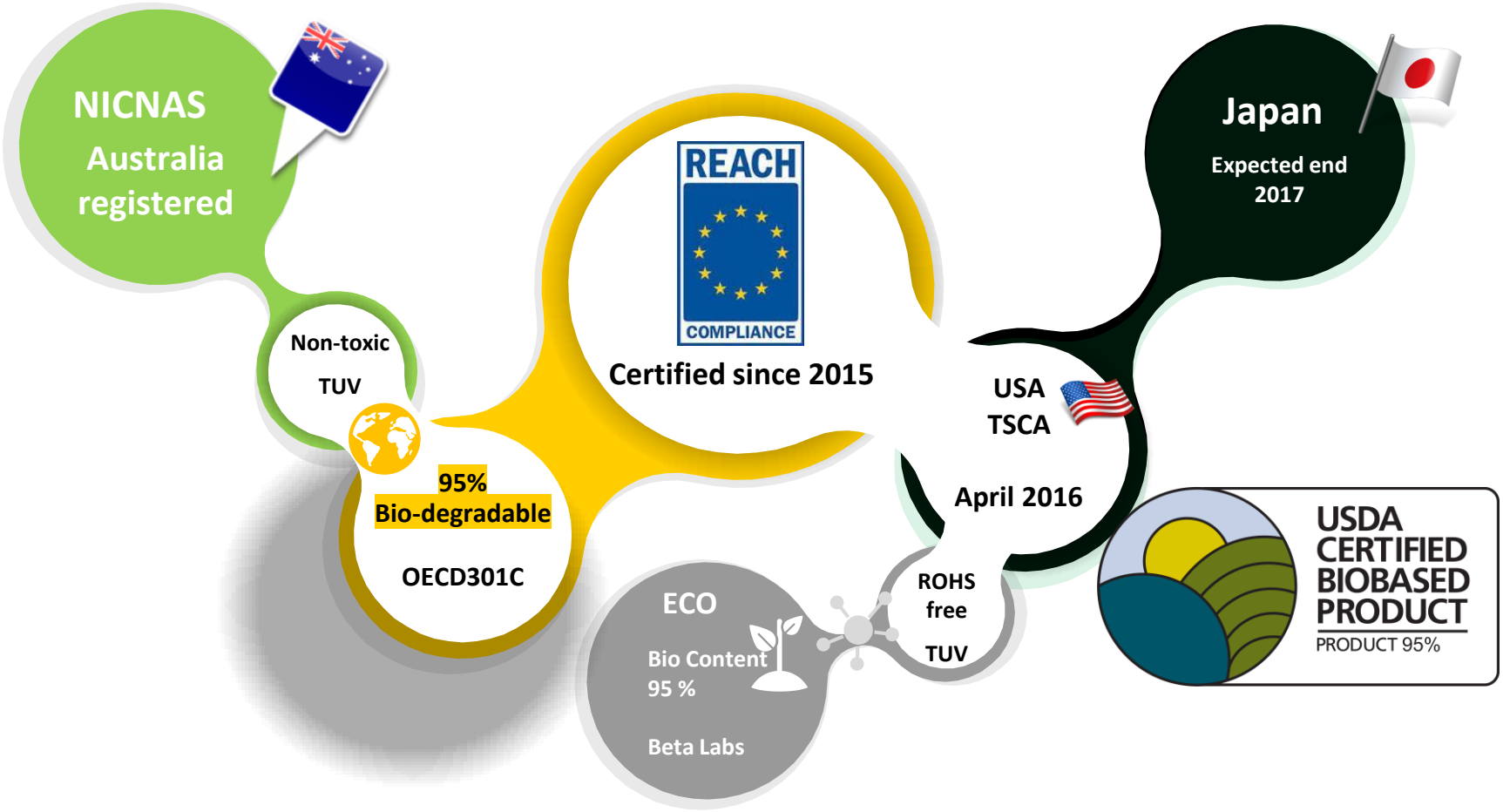
- Natural Oil Polyols are sold and used to substitute synthetic feed stock Polyols offering producers a green and renewable alternative.
- There is an estimated annual demand of about 7.5 million metric tons of Polyether Polyols per year with an annual growth of 6% for all types of Polyurethane applications.
- The majority of demand is for the use of flexible foams (about 48%) and rigid foams (about 21%).
- Natural Oil Polyols have been used for a long time in non-foaming PU applications. But only during the last 15 years Natural Oil Polyols were developed for foaming formulations.
- Today there is a growing awareness and demand for green Polyols to be used in flexible and rigid foams.

PolyGreen
natural polyols

PolyGreen around the world:
where we are and where we sell to

PolyGreen
natural polyols

PolyGreen around the world:
Certifications & Tests



PolyGreen
natural polyols

PolyGreen at home:

Our plant & warehousing in Malaysia

PolyGreen
natural polyols

PolyGreen at home:
Product Development Centre








2.

The Green Benefits of PolyGreen's Polyols

Why us..?

PolyGreen
natural polyols

PolyGreen
natural polyols

Sustainability:
Green Benefits of Palm Oil based NOP's

HIGHER YIELD

- Oil palm is entirely GMO-free and produces up to 10 times more oil per unit area than soybean, rapeseed or sunflower.

LESSER LAND

- Oil palm produces more than 34% (palm and palm kernel oil) of the world's eight major vegetable oils on less than 5% of the total area under oil crops.

PROVIDE JOBS

- The Palm Oil industry provides employment to rural based population and ensures better prospects for the country and its citizens. One worker is needed for about 5-7 hectares of Oil Palm Plantations. This offers employment to almost 1 million people in Malaysia.

PolyGreen
natural polyols

Sustainability:
Palm Oil advantages vs. other natural oils

Soybean Oil
10 times more land required compared to Palm Oil
Most soybean is genetically modified
Seasonal crop

Castor Oil
Low Yield
Limited availability (~1.5m MT)
Price sensitive
Seasonal crop

Sunflower/Rapeseed Oil
Large land area required - low yield

Seasonal crop

All Oils besides Palm Oil
annual ploughing/planting required
respectively insufficient availability

PolyGreen
natural polyols

Sustainability:
Oils and Fats Summary

Do you know: that other Oils use up to 10 times as much land as Palm Oil?

	Production in m MT	Total Harvest Area in m Ha	Percentage of total Agricultural Area of 5 b Ha	Yield per Hectare/year
Total Oils & Fats	204.9	275.98	5.52 %	
Palm Oil	61.4	15.5	0.31%	3.53
Soybean Oil	48.8	120.0	2.40%	0.41
Rapeseed Oil	26.2	22.5	0.45%	1.16
Sunflower Oil	15.0	24.6	0.49%	0.61
Others	53.5	93.4	1.87%	

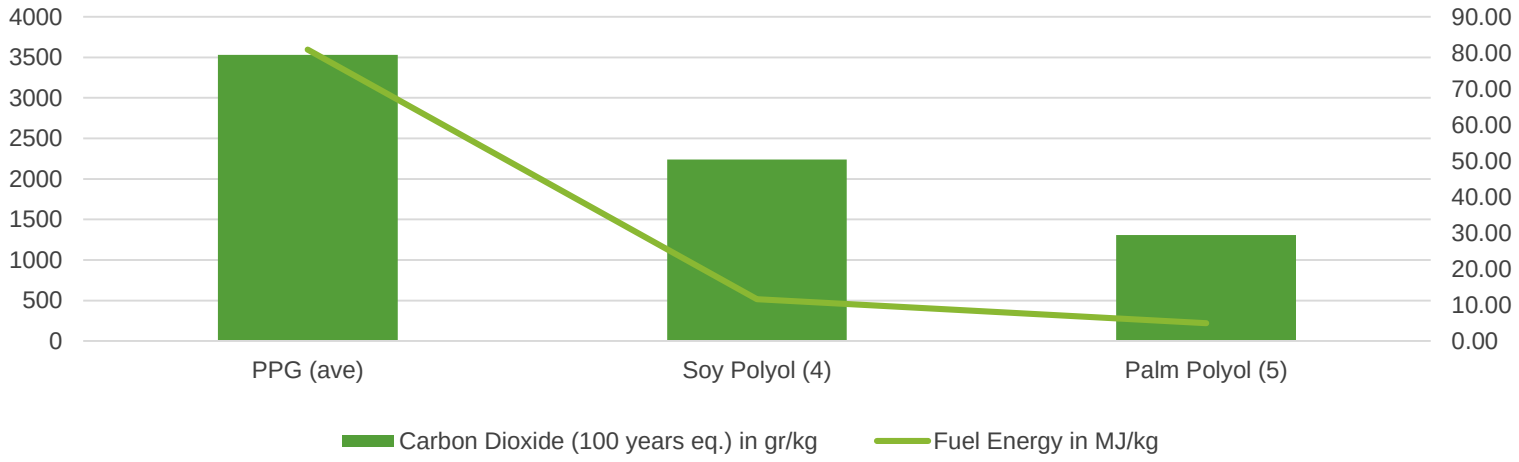
Source: Global Oils & Fats 2015

PolyGreen
natural polyols

Sustainability:
Life Cycle Assessment of Polyols

The Palm Polyol study is based on pilot plant data. Actual data from PolyGreen's industrial plant expected to be even better than the results shown here.

LCA Comparison of Carbon Dioxide Equivalent and Fuel Energy used during different Polyol productions

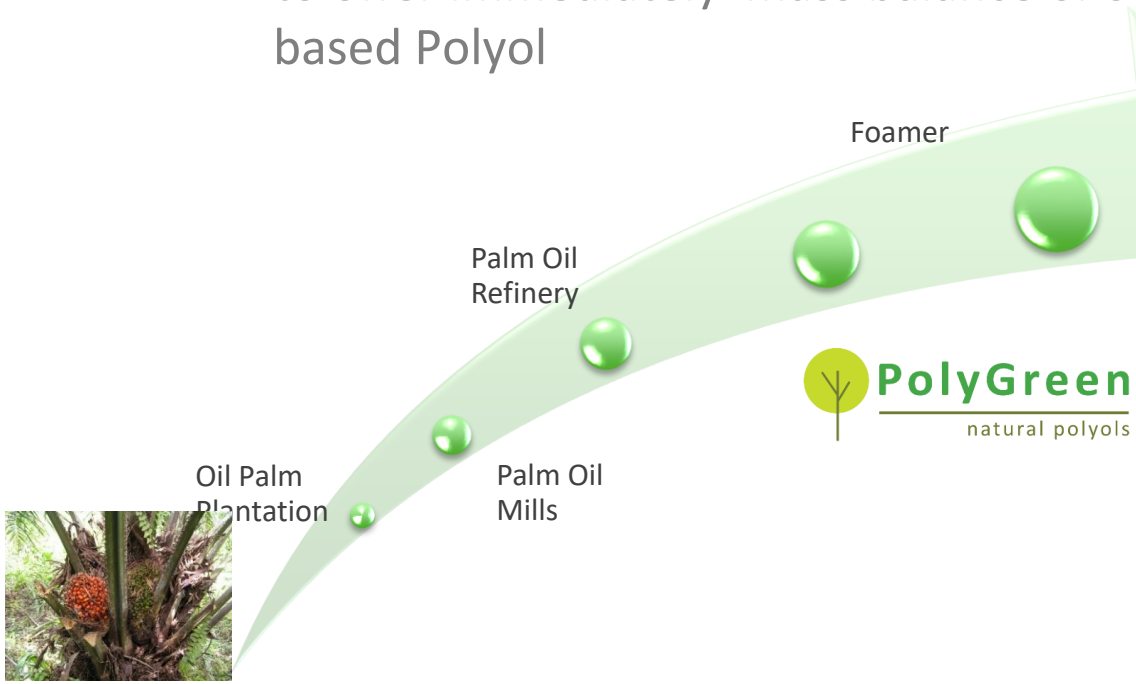


Evaluation of Environmental Impacts and GHG of Palm Polyol Production using Life Cycle Assessment Approach (Journal of Oil Palm Research Vol.27 (2) June 2015 p. 144-155)

PolyGreen
natural polyols

Sustainability:
Sustainable from Palm Oil to Final product

- Shortest available supply chain from Oil Palm Plantation to Final product
- POLYGREEN produces its polyols by batch process and is able to offer immediately mass balance or segregated certified based Polyol



3.

The Commercial Benefits of PolyGreen's Polyols

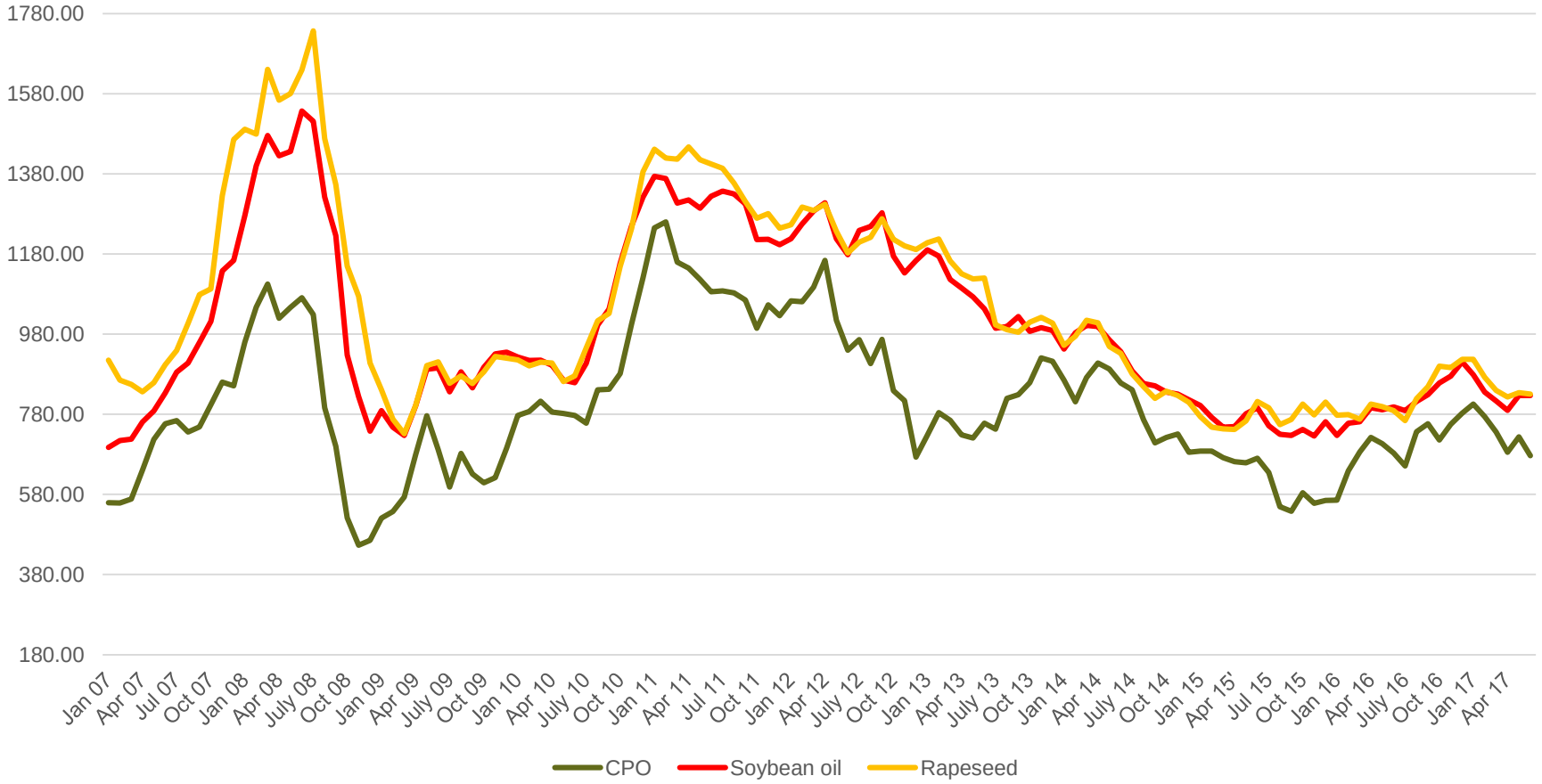
How to save the planet and LOWER COST!

PolyGreen
natural polyols

PolyGreen
natural polyols

The Commercial Benefits of PolyGreen's Polyols:

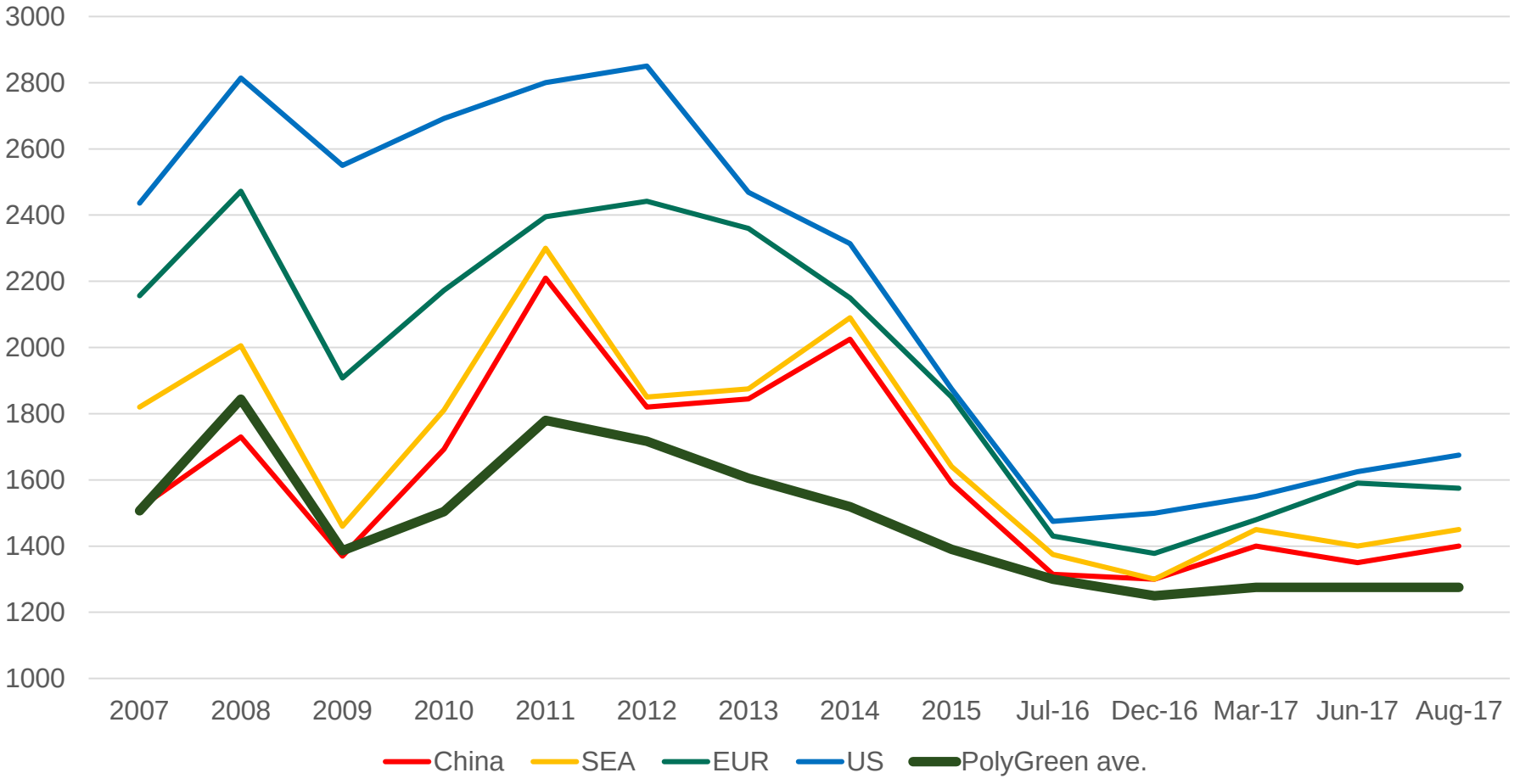
Comparison of prices for CPO, SBO & RSO from Jan 2007 – April 2017



Source: MPOB website, WorldBank

PolyGreen
natural polyols

The Commercial Benefits of PolyGreen's Polyols:
Comparison Mineral Oil Polyol prices vs. PolyGreen



Source : Industry, own calculation

MOST COMPETITIVE NOP IN THE MARKET

PolyGreen Polyol is not only cheaper than other NOP's, it is offering savings against synthetic Polyether Polyols as well

4.

PolyGreen's Development

PolyGreen
natural polyols

PolyGreen
natural polyols

2017 – current status

New Polyol based on Palm Oil and Glycerine successfully introduced, creating a new market for Glycerine

Excellent price/quality performance

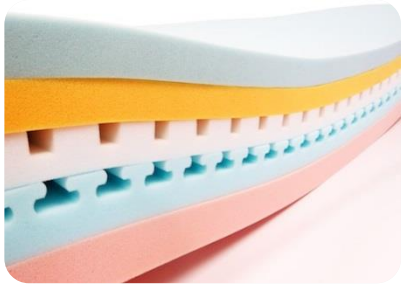
Excellent properties for Flexible Foam production for demanding Markets

Technology developed to eliminate odours and volatile compounds in Polyurethanes

PolyGreen
natural polyols

Our current Products

Trade name	PolyGreen F 6037	PolyGreen F 7020	PolyGreen F9024/5
Application	Conventional and Viscoelastic Foams, Adhesive,	Currently Flexible Foams and evaluated for Adhesives	HR Slabstock and conventional Flexible Foams
Functionality	2	3	3
Bio Content	89 % according ASTM 6866-12	95 % according ASTM 6866-12	> 97%
Biodegradability by OECD 301 C/D	85%	97%	97% (expected)

PolyGreen
natural polyols

Technical benefits:

because being green and cost efficient is not enough..

We can help you make better products!

SUPPORTS FLAME RETARDANTCY OF FOAMS> resulting in savings

- PolyGreen Polyols support flame retardant effects and result in savings of up to 40% of liquid flame retardants using conventional foaming technology

REDUCTION OF CYCLE TIME FOR HOT STAMPING> resulting in savings

- Cycle time of hot stamping for bra- cup and shoe foams can be reduced by 10-15% resulting in lower manufacturing cost

UNIQUE GLASS TRANSITION PROPERTIES > for viscoelastic foams

- PolyGreen's Polyols offer a wider Glass Transition temperature range which reduces the temperature related foam property variations

27

PolyGreen
natural polyols

Foam Made with PolyGreen
On Foaming Pilot Plant

Material	Standard PPG Foam			PGC Pilot Plant Trial	
	Qty	EUR		Qty	EUR
PPG 48	100	140.00		80	112.00
PG F7020	0	0.00		20	24.00
A33	0.16	0.90		0.16	0.90
A1	0.05	0.85		0.05	0.85
Silicone	0.96	4.80		0.96	4.80
CC	9.86	2.66		9.86	2.66
Tin	0.17	1.02		0.12	0.72
water	3.17	0.00		3.17	0.00
TDI	42.5	148.75		42	147.00
	cost	298.98		cost	292.93
Density	35			35	

Test conducted	Results
Density (kg/m3)	35.5
Tensile Strength DIN EN ISI 1798 - Dry (kPa)	158
Elongation - Dry (%)	138
Compression Set (75%) DIN 1856	6.92
Cell Count/ cm	22
Compression Strength DIN EN ISO 3381/1	
at 25% (kPa)	**4.72**
at 40% (kPa)	**5.60**
at 65% (kPa)	12.98
Airflow (lt/m2/s) DIN EN ISO 9237	255
Ball Rebound (%) ASTM 1564-72	40

28

PolyGreen
natural polyols

2017 – present market of our Polyols

- Bedding industry (mattresses and pillows)
- Furniture Industry (sofa's and chairs)
- Carpet Industry (carpet underlay)
- Textile Industry (Shoes, Bras , Shoulder Pads)

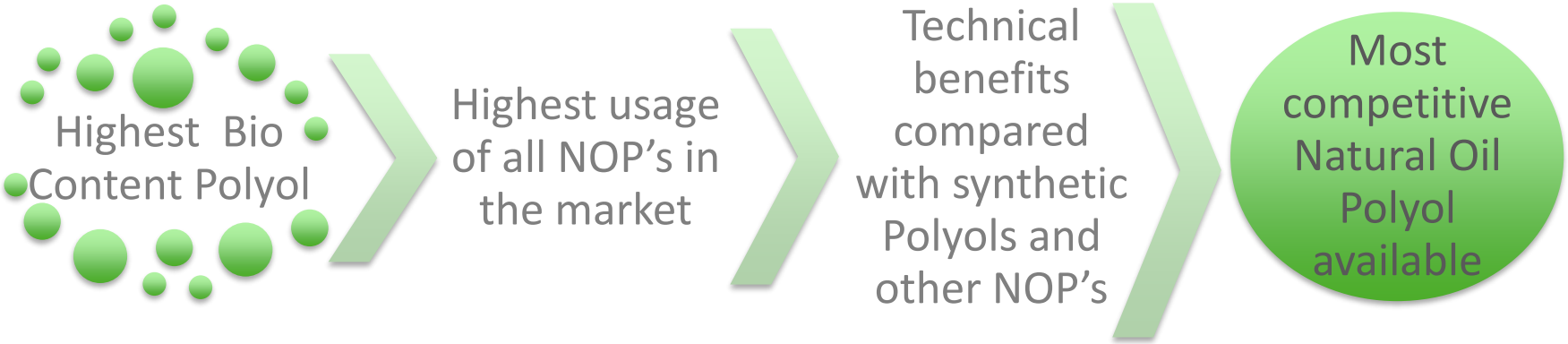
PolyGreen
natural polyols

2017 – development work

- Food Industry (lamination of food packaging)
  Trial order received
- Adhesives (for Polyurethane and rubber applications, e.g. running tracks) **Trial order received**
- Polyols for Rigid foam (Insulation for housing to address energy saving requirements in many countries)
- Coating (for wood floor coatings and Polyurethane Flooring)
- Car applications (seating, sun visors, car ceiling)

PolyGreen
natural polyols

Summary
PolyGreen's Polyols



Global presence with added value Palm Oil products in growing markets

Thanks!

Any questions?

You can contact me at:
jeulitz@polygreen.com.my &
wolfgang.rupilius@gmail.com

PolyGreen Chemicals (Malaysia) Sdn Bhd
24, Jalan Wan Kadir I, TTDI, 60000 Kuala Lumpur