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WITH CHARACTER.

HIGH PERFORMANCE SUSTAINABLE WAX BASED SURFACE MODIFIERS

Coatings Trends & Technologies

September 2025

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MEANING OF SUSTAINABILITY

"Meeting the needs of present generations without compromising the possibilities of those of the future to meet their own needs"

UN Sustainability Definition of Dr. Gro Harlem Brundtland

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KEY PILLARS OF OUR CLIMATE REDUCTION STRATEGY

- We reduce our specific energy consumption by 10% until 2025
- Increasing energy and process efficiency of our internal operations
- Electrifying the heat generation

- We are increasingly covering our electricity needs without fossil fuels
- Investment in own photovoltaic power generation facilities
- Electrifying of fleet

- We are increasingly replacing fossil raw materials with bio-based raw materials

- We replacing fossil raw materials with recycled raw materials if possible
- Increasing circularity of packaging materials
- Increasing the proportion of recycled packaging materials

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PRODUCT CARBON FOOTPRINT (PCF) CALCULATION OF WAX BASED SURFACE MODIFIER

Activity data	Source of data	Data quality	CHT data Annual production	Emission factor	Emission CO_2 (e) per kg
Energy	CHT primary data in kwh	Calculated for production areas with production hours	67,485 kwh	DBEIS	0.04
Raw material	CHT ERP system – primary data	Best case approach	222,480 kg	Supplier + ecoinvent	0.70
Packaging	CHT ERP system – primary data	Calculated based on packaging numbers – best case approach	15,610 kg	ecoinvent	0.144
Waste	CHT ERP system	Calculated based on packaging numbers / recipe – best case approach	5,600 kg	ecoinvent	0.01
Raw material Transportation	Secondary data	Calculation based on tonskm from supplier to CHT factory		DBEIS*	0.001

*DBEIS: emission factors published by UK Department for Business, Energy and Industrial Strategy

CO_2 of 1kg Pilot Product: 0.89 kg CO_2(e)

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BIOBASED RAW MATERIALS

BALANCING CHALLENGES AND BENEFITS WITHIN SUPPLY CHAIN USING BIOBASED RAW MATERIAL

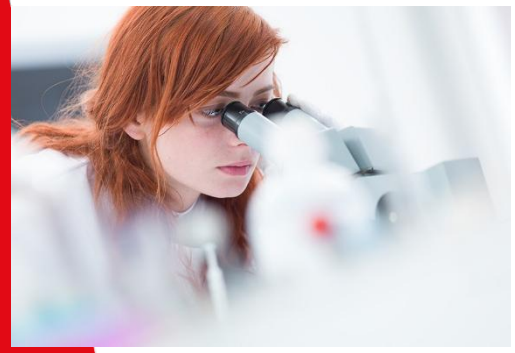
Pro

- Improvement of livelihoods
- Yield performing crop

Cons

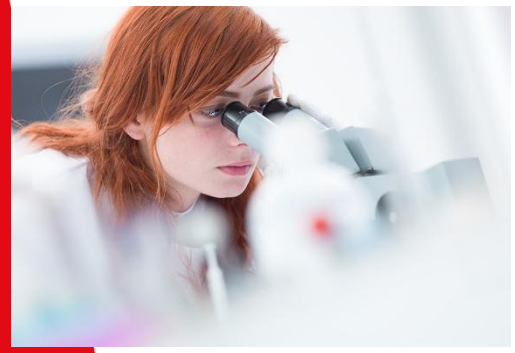
- Forest clearance, loss of biodiversity
- Labor and human rights issues

Biobased raw material use needs clear rules and certifications



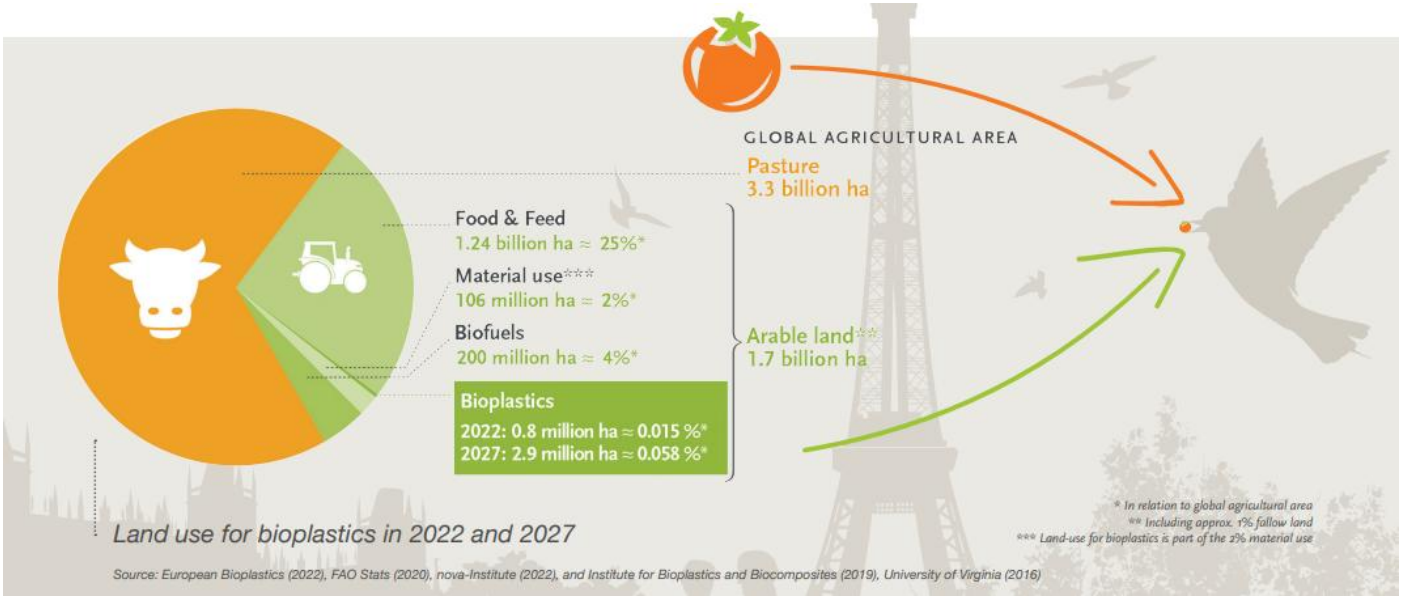
INTRODUCTION TO BIO-BASED RAW MATERIALS

- **Historical Use of Biomass**: Humanity has used bio-based materials like wood and textiles for millennia.Science and research in the field of chemistry
- **Ethics of Raw Material Use**: The use of primary crops like sugarcane for chemicals and plastics is often questioned, but land scarcity is not a barrier as long as sustainable practices are followed.
- **Key Question**: Can bio-based raw materials be a viable solution to replace fossil resources?



LAND USE AND RESOURCES

- **Land Requirements:** Even with growing demand, land use for bio-based plastics globally occupies only a tiny fraction (0.015% of global agricultural land).
- **Potential:** With modern agriculture, intensified use of pasture land in countries like Brazil could free up millions of hectares for bio-based materials.
- **Biofuels and Bioplastics:** Resources used for bioethanol can also be applied to produce bio-based plastics like polyethylene.



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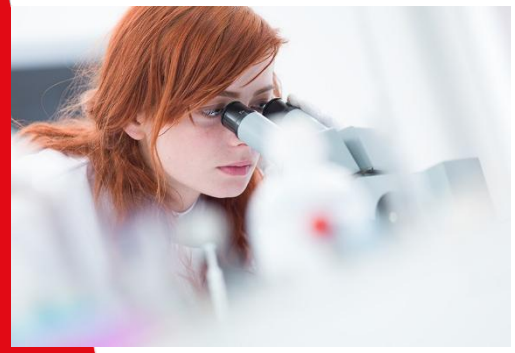
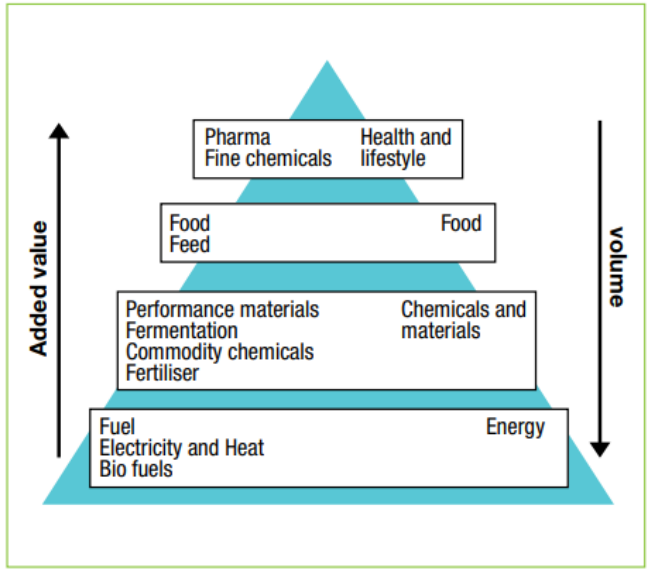


CASCADING USE OF BIOMASS

- **Cascading Principle:** Biomass should first be used for food and high-value chemicals, followed by materials, and finally energy.
- **Environmental Advantage:** Materials like bio-based plastics are harder to decarbonize than energy, so their production should be prioritized.
- **Fact:** 4% of global biomass would be sufficient to meet the entire plastics demand.



Source: www.bio-basedeconomy.nl[4]

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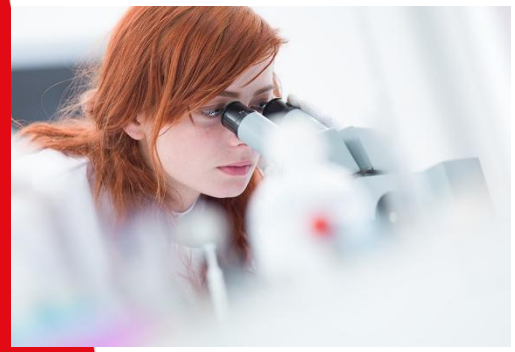

SUCCESS STORY: SUGARCANE IN BRAZIL

- **Sugarcane Use:** Brazil supplies 16% of its energy through sugarcane and is a global leader in sugar and ethanol production.
- **Efficient Utilization:** Sugarcane occupies just 1% of Brazil’s land, with by-products like vinasse used as fertilizer – a prime example of cascading use.
- **Significance:** Sugarcane cultivation helps restore degraded soils while also reducing greenhouse gases.

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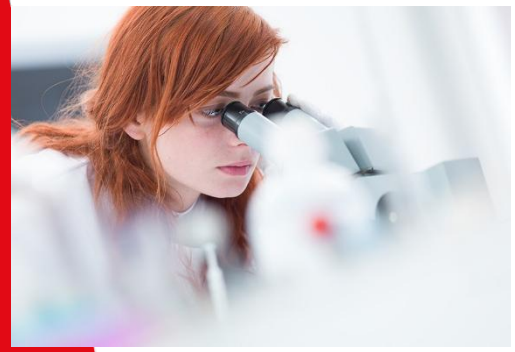
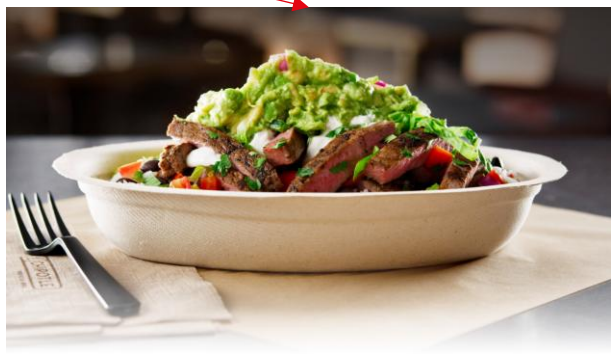


FUTURE PROSPECTS FOR BIO-BASED PLASTICS

- **Projections:** By 2050, approximately 20% of global plastics production could be bio-based.
- **Land Use Potential:** Brazil could produce 182 billion liters of sugarcane ethanol without affecting sensitive biomes like the Amazon.
- **Technological Innovation:** Advances in biopolymer production could result in 50% higher yields per hectare.

HOW TO REDUCE THE IMPACT - LOSING ISN‘T EASY

- Losing weight is similar to reducing PCF – You have different options!



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OPTION 1: SUPPLIER SELECTION

	Data source	Emission CO_2 (e) per kg
Supplier 1 (Raw Material)	Ecoinvent	1,04*
Supplier 2 (Raw Material)	Supplier	0,84*
Supplier 3 (Raw Material)	Supplier	0,68*

- Ecoinvent is always an option but only as backup
- Focus on suppliers with accurate data quality; ideally third party verified

Make the same burger with different suppliers

OPTION 2: TECHNOLOGY SHIFT

Product	Wax Type	Barrier effect		
		Water	Oil/Grease	Water vapour
Product 1	Paraffin	✓		✓
Product 2	Natural blend	✓	✓	
Product 3	Natural blend	✓	✓	✓
Product 4	Carnauba	✓		

- Replace fossil based raw materials with bio based materials
- Many options not yet fully evaluated e.g. rice wax, bee wax, soy wax, jojoba wax, candelilla Wax
- In line with ISO 14067 bio based sources often have negative PCF

It’s no longer a burger, but it does contain “meat”

It might be better, but it requires more evaluation

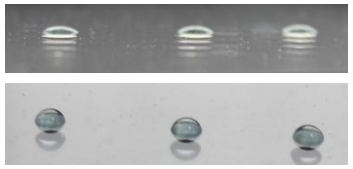
OPTION 2 - PRODUCT 2
NATURAL WAX EMULSION

APPLICATION AREA

- Wood coatings
- Industrial coatings
- Seed coatings

Contact angle

W014



Θ 71°

Θ 85°

+ 1.5% (solid) Product 2

PURPOSE AND DESCRIPTION

- Generates water barrier
- Generates oil/grease barrier
- Recommended for all kind of coatings
- Based on 100 % renewable ingredients

TECHNICAL DATA

Characterization:	Fine particle sized wax dispersion
Chemical Structure:	Natural wax blend
Appearance:	Tan liquid
pH Value:	9.5 ± 0.5
Concentration:	35 % ± 1
Ionic Character:	Non ionic / anionic
Melting Range:	~ 80 °C

MEASURING METHOD

Contact angle: KRUSS DSA 100
W014: Wood varnish (internal testing formulation), PU/Acrylate based

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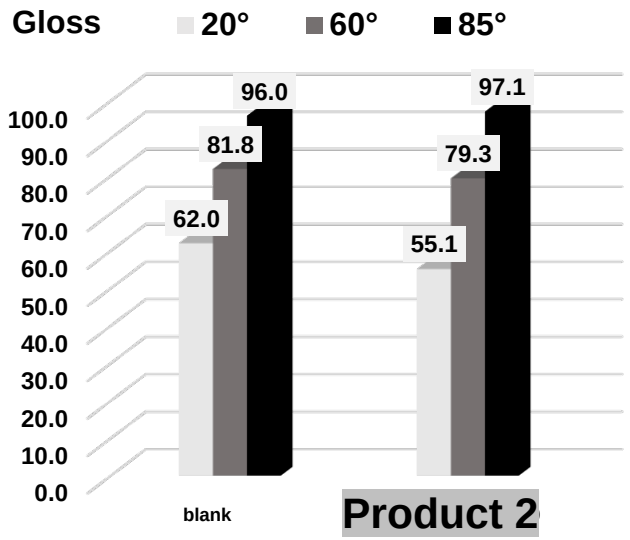
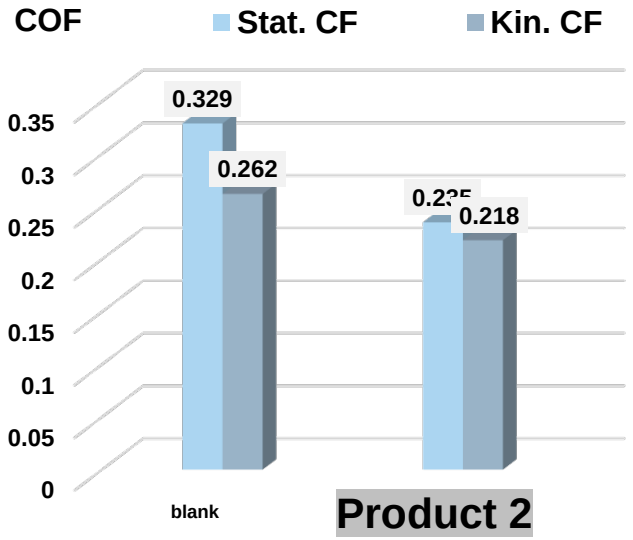
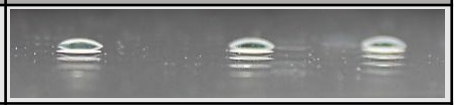
OPTION 2 - PRODUCT 2

NATURAL WAX EMULSION





Product 2	
solids	35%
Ionic chararacter	nonionic/anionic
pH value	9.5
melting point	80°C

	contact angle	
Blank	70,7°	
PRODUCT 2	85,3°	

method	gloss / COF / contact angle
system	waterbased PU/acrylate dispersion
dosage	4% delivery form
conditions	60µm wet film thickness, drying

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OPTION 2 - PRODUCT 3
NATURAL WAX EMULSION

APPLICATION AREA

- Wood coatings
- Industrial coatings
- Seed coatings

PURPOSE AND DESCRIPTION

- Generates water and water vapor barrier
- Generates oil/grease barrier
- Recommended for all kind of coatings
- Based on 99% renewable ingredients

TECHNICAL DATA

Characterization:	Fine particle sized wax dispersion
Chemical Structure:	Natural wax blend
Appearance:	Tan liquid
pH Value:	9.5 ± 0.5
Concentration:	35% ± 1
Ionic Character:	Non ionic / anionic
Melting Range:	~ 80 °C

OPTION 2 - PRODUCT 4
NATURAL WAX EMULSION (CARNAUBA)

APPLICATION AREA

- Seed coatings

PURPOSE AND DESCRIPTION

- Improves antiblocking
- Improves scratch resistance
- Improves water repellency
- Biobased
- Recommended for all kind of seed coatings

TECHNICAL DATA

Characterization:	Fine particle sized wax dispersion
Chemical Structure:	Aqueous dispersion of a carnauba wax
Appearance:	Tan liquid
pH Value:	4.5 ± 0.5
Concentration:	30 % ± 1
Ionic Character:	Non ionic
Melting Range:	~ 85 °C

OPTION 3: SAME TECHNOLOGY – DIFFERENT ORIGIN

Activity data	Product 1 CO_2 (e) per kg	Product 2 CO_2 (e) per kg
Energy	0,04	0,004
Raw material	0,70	-0,51
Packaging	0,15	0,15
Waste	0,01	0,01
Transportation raws	0.001	0.09
Totals	**0,901**	**-0,256**

- Product 1 & 2 are PE-Wax emuslsions
  - Product 1 is based on traditional PE-Wax
  - Product 2 is based on a PE-Wax based on biological sources
- **Both products provide same properties and physical behaviour**

Make a “burger” from bio-based sources

OPTION 3 - PRODUCT 1

NATURAL WAX EMULSION (HDPE)

APPLICATION AREA

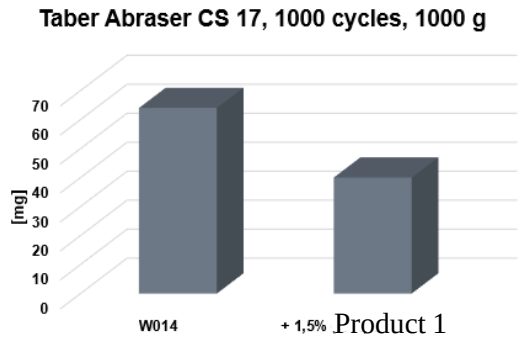
- Wood Coatings
- Industrial Coatings

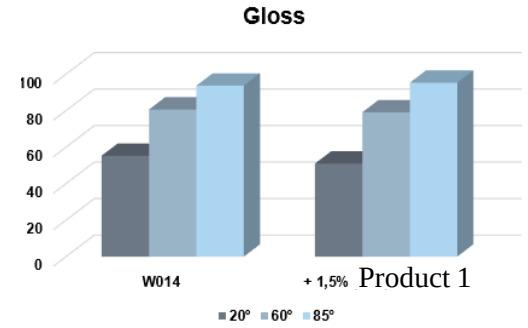
PURPOSE AND DESCRIPTION

- Improves scratch resistance
- Improves abrasion resistance for high gloss systems
- Improves slip
- Improves anti-blocking

MARKET POSITIONING

- Recommended for high gloss parquet and furniture coatings



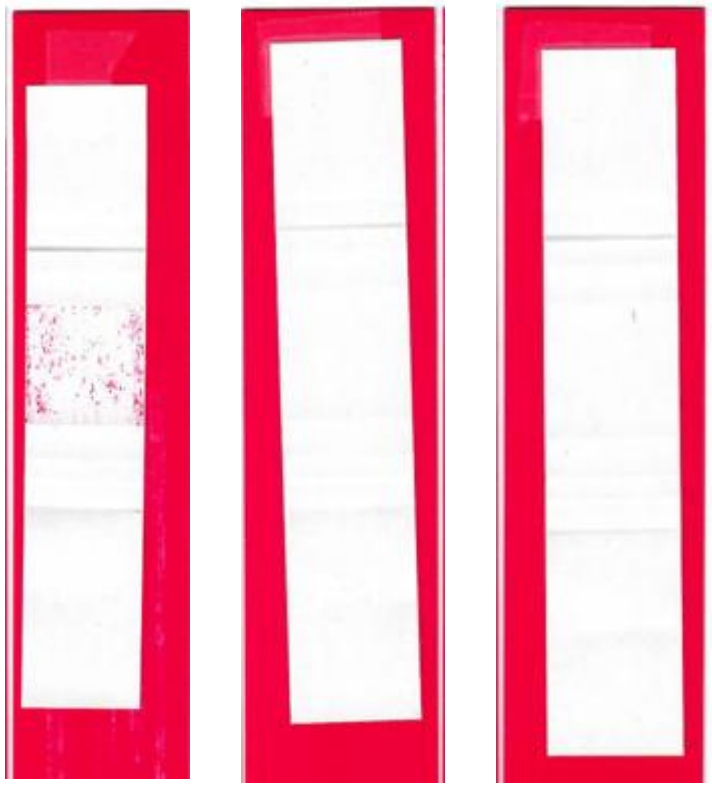


TECHNICAL DATA

- **Characterization:** Fine particle sized wax microdispersion
- **Chemical Structure:** Emulsion of a **Biobased** HDPE wax
- **Appearance:** Yellowish transparent liquid
- **pH Value:** 8.0 ± 0.5
- **Concentration:** 35% ± 1
- **Ionic Character:** Non ionic
- **Melting Range:** ~ 120 °C

MEASURING METHOD

OPTION 3: PERFORMANCE CHECK I



- Abrasion resistance test
  - Conducted with Gakushin Color Fastness/Rubbing Tester
  - Dosage 1,5% in high gloss OPV
  - Thickness: 6µm wet

- **PE-Wax and bio-based PE-Wax have the same performance**

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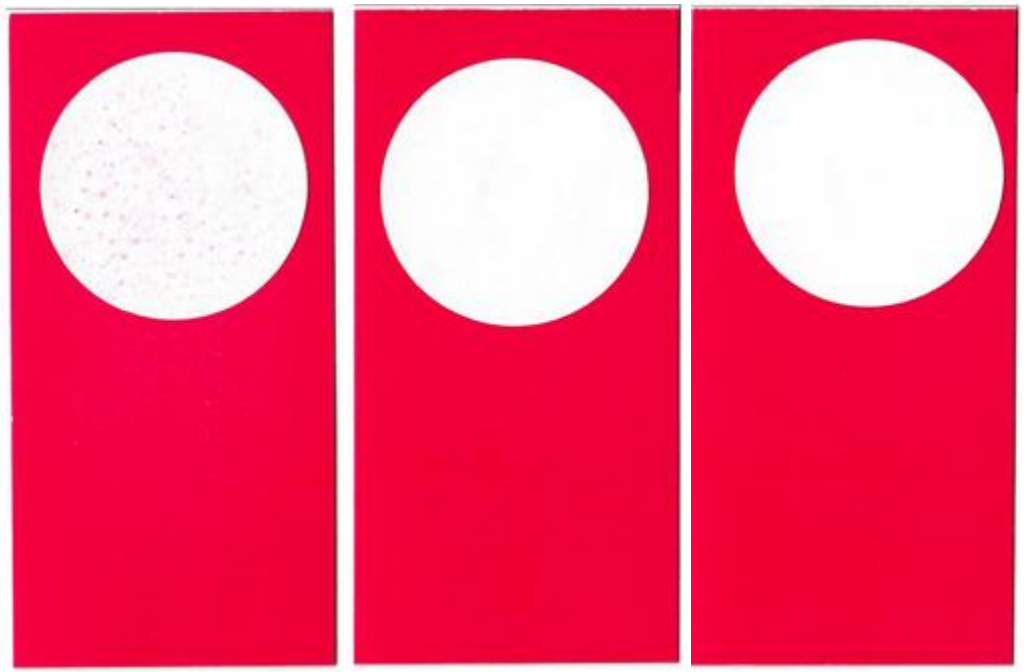
OPTION 3: PERFORMANCE CHECK II



- Abrasion resistance test
  - Conducted with Quartant Abrasion Tester
  - Dosage 1,5% in high gloss OPV
  - Thickness: 6µm wet

- **PE-Wax and bio-based PE-Wax have the same performance**

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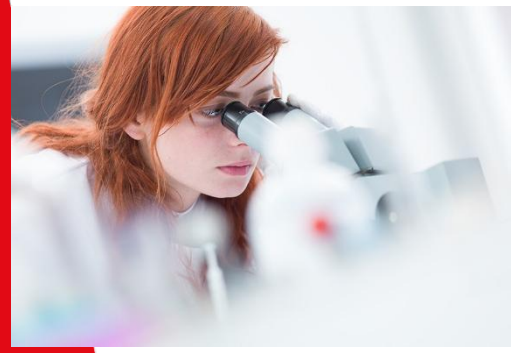

CONCLUSIONS AND OUTLOOK

- **No Competition with Food Production:** Using biomass for plastics is ethical and does not threaten food security as long as the cascading principle is applied.
- **Urgency of Transition:** Moving from fossil to bio-based feedstocks is essential to combat climate change, with waste-based technologies being developed simultaneously.
- **Global Support:** Organizations like the UN and WWF endorse the responsible production of bio-based plastics.

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Thank you!

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