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Plant-Based Proteins – A Building Block for the World of Coatings

Future of BioChemicals
November 12th, 2026; Dr. Daniela Leistl



The Challenge

From sustainability to resilience

Developments in the Field of Coatings

Yesterday

„SUSTAINABILITY“

- **CO_2 reduction**
- **Renewable feedstocks**
- **Circularity**
- **Environmental impact**

Today

„SUSTAINABILITY“
+
„RESILIENCE“

- **Supply security**
- **Regional sourcing**
- **Diversified feedstocks**
- **Availability and stability**

Raw materials account for > 50% of coating production costs.[1]

+ 60% - Epoxy resin price increase during major supply disruptions.[1]

+ 400% - Increase in container freight rates between China and Europe. [1]

[1)] **CEPE:** ***The coatings industry under pressure due to developments in the market of raw materials*** **(2021).**

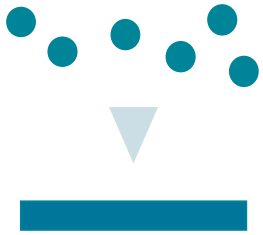
→ The future of biochemicals will be shaped largely by sustainability AND resilience.

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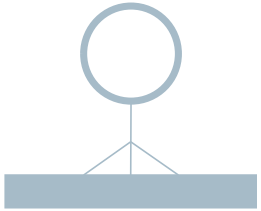

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Why proteins?
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Proteins as a functional material class

- Cohesive network formation
- Continious films after drying
- Potential binder functionality



- Amino-, carboxyl and hydroxyl groups
- Surface interactions
- Adhesion to polar substrates



Adhesion

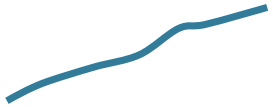
Film formation

PROTEINS
Natural polymer architectures

Emulsifi-cation

Rheology

- Viscosity adjustment
- Sag resistance
- Flow and application control



- Amphiphilic structure
- Stabilization of interfaces
- Emulsion and dispersion systems



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Regional availability and side streams

Source of protein	Availability in Europe	Main-/Sidestream	Relevance for coatings
Rapeseed	~ 20 Mio t seed/year[1]	Rapeseed meal, press cake	✓ Existing infrastructure ✓ Large volumes ✓ Side stream valorization ✓ Regional availability
Field Pea	~ 2.4 Mio t/year[2]	Has become mainstream through targeted protein cultivation[3]	✓ Dedicated protein crop ✓ Excellent functionality ✓ Availability in EU - Established food protein market
Field Bean	~ 2 Mio t/year[4]	EU's protein roadmaps list field beans as a promising crop for strengthening Europe's protein supply[4]	✓ Adapted to Central Europe ✓ Recognised in EU protein strategies – Food and feed applications ✓ Expanding value chains

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1) EU Rape and Turnip Rape Seeds Production Statistics (2021–2025)
2) 26_10_E_W_dry_peas.pdf
3) European Commission | Agri-food data portal | Agricultural markets | Oilseeds and protein crops
4) Towards-A-Legume-Renaissance-in-Europe-A-practical-roadmap-for-fava-beans-for-food-and-feed.pdf



From agricultural feedstock to coating binder

Protein sources and value chains

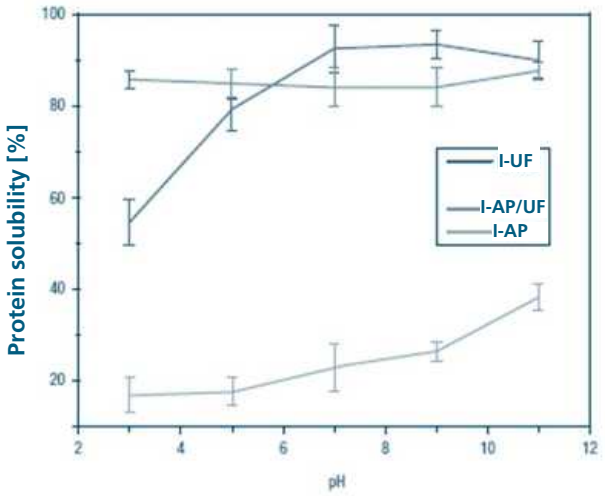
Feedstock	• Pretreatment • Protein structure • Native functionality
Processing	• Fractionation • Protein isolation • Drying
Functionali-zation	• Hydrolysis • Acylation • Phosphorylation • Crosslinking
Formulation	• Application-specific suitability • Interactions with ingredients • Quality assessment



Coating performance is determined not only by the protein source, but by the entire value chain from feedstock to functionalised ingredient.

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Impact on functionality



Solubility

Improved solubility enables efficient incorporation into aqueous coating systems.



Dispersion stability

Tailored amphiphilicity improves compatibility and dispersion stability.



Film forming

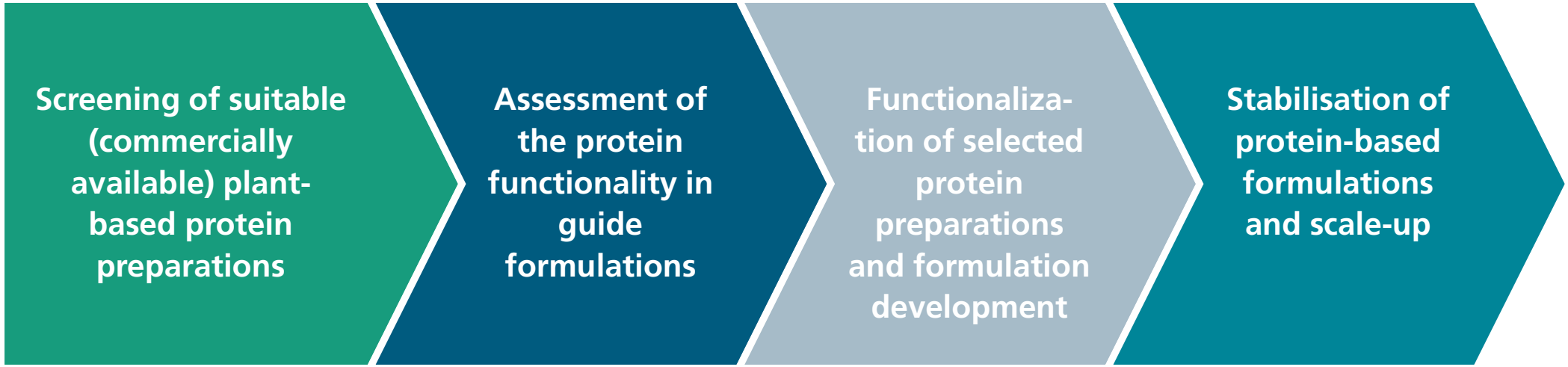
Controlled network formation translates into coating performance.

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Performance
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Case study: replacement of acrylic binders

DisPro - Protein-based binder system for dispersion paints



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Case study: replacement of acrylic binders

Functionalization by Phosphoesterification

Functionalization of selected protein preparations and formulation development

Hydroxyl-containing (Ser, Thr, Tyr)

Protein-OH → **Protein-OH-PO_3^{2-}**

STMP/STPP



Protein-NH_2 → **Protein-NH-PO_3^{2-}**

STMP/STPP

Amino-containing residues (Lys, His)

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Case study: replacement of acrylic binders

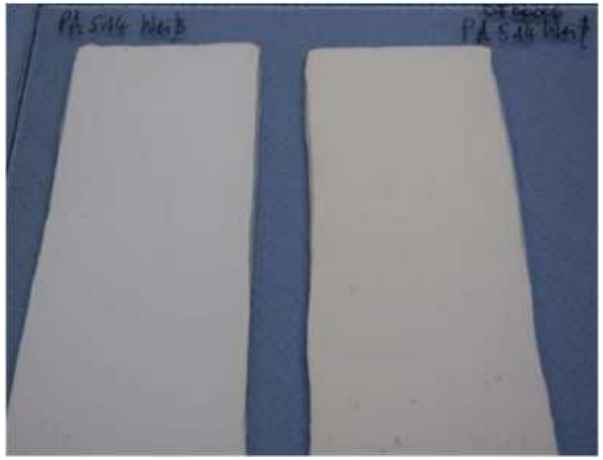
Functionalization by Phosphoesterification

Functionalization of selected protein preparations and formulation development

Solubility ↑

Dispersion stability ↑

Film formation ↑



Conventional emulsion paint with a standard binder(left) and protein-based emulsion paint in which 50% of thestandard binder has been replaced with phosphorylated pea protein (right).

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Conclusion and outlook

From Replacement Thinking to Formulation Thinking

Sucessful Application of Protein based binders

What proteins are NOT

- ❖ **Universal drop-in replacements**
- ❖ **One-size-fits-all solutions**
- ❖ **Direct acrylic binder substitutes**
  - Colour
  - Odour
  - Water sensitivity
  - Microbial stability
  - Regulatory aspects

What proteins CAN BE

- ✓ **Functional formulation ingredients**
- ✓ **Tailored through modifications**
- ✓ **Selected by application**
- ✓ **Integrated into formulation design**
  - Which protein source fits?
  - Which functionality is targeted?
  - Which modification is required?
  - How does it interact in the system?

➢ **Proteins deserve the same consideration as conventional binders, additives, and resins, which are also evaluated not in isolation but within the context of the overall formulation.**

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Future Tasks and Necessary Collaborations

Moving from promising concepts to validated solutions

Ongoing projects

1. BioCoMa

Towards outdoor applications

- Weathering resistance
- Long-term durability
- Protein-based systems under realistic exposure conditions

2. Scale-up Initiative

From laboratory to pilot scale

- Industrial feasibility
- Upscaling of protein modification
- Process robustness
- Consistent product quality

Key Challenges

- **Structure-property relationships**
- **Reliable application datasets**
- **Industrial implementation**
- **Regulatory framework**

Collaboration needed

Industry:
Application of protein-based binders in real formulations

Raw material suppliers:
Provide regional feedstock systems

Research partners:
Gernerate application knowledge

End users:
Define performance requirements

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We look forward to working together with you!

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