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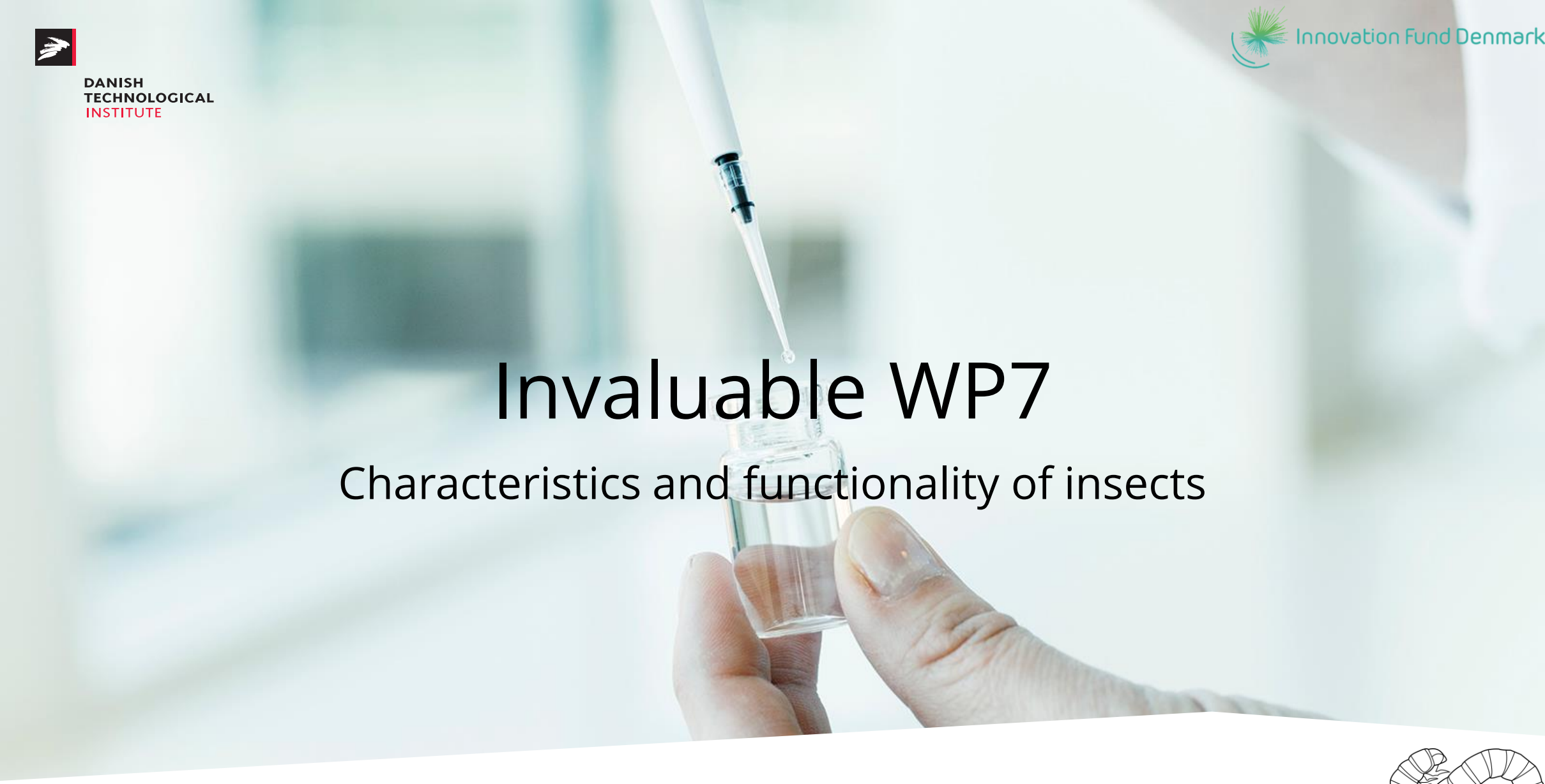

Invaluable WP7

Characteristics and functionality of insects

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Agenda

- About me
- About DTI – Food Technology
- Physical functionality of mealworm meal
- Fatty acid composition after different fat extraction methods
- Fractionation of fatty acids and possible applications
- Conclusions

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About me

- Anne Louise Dannesboe Nielsen
- Director of Food Technology, DTI
- Chemical engineer, PhD in organic chemistry
- Working in food science for 7 years
- Involved in insect product development for 5+ years

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About DTI Food Technology

Product development
New food concepts, applications, novel technologies

Physical and chemical characterisation
Characterisation & analysis

Process development
Microencapsulation, drying and stabilisation of ingredients

Food safety
Legislation and labelling
HACCP, prevention of food fraud

Sensory & consumer tests
Consumer and market tests
Sensory of food and non-food

Pilot production
Extrusion of food and feed, milling,

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How DTI Food Technology can help your business

- Product development of insect food products
- Functionality of insect ingredients
  - Emulsion capacity, water-absorption, foam-stabilising ability
- Insect meal processing
  - Lipid extraction (pilot scale)
  - Protein extraction (pilot scale)
  - Extrusion (pilot scale)

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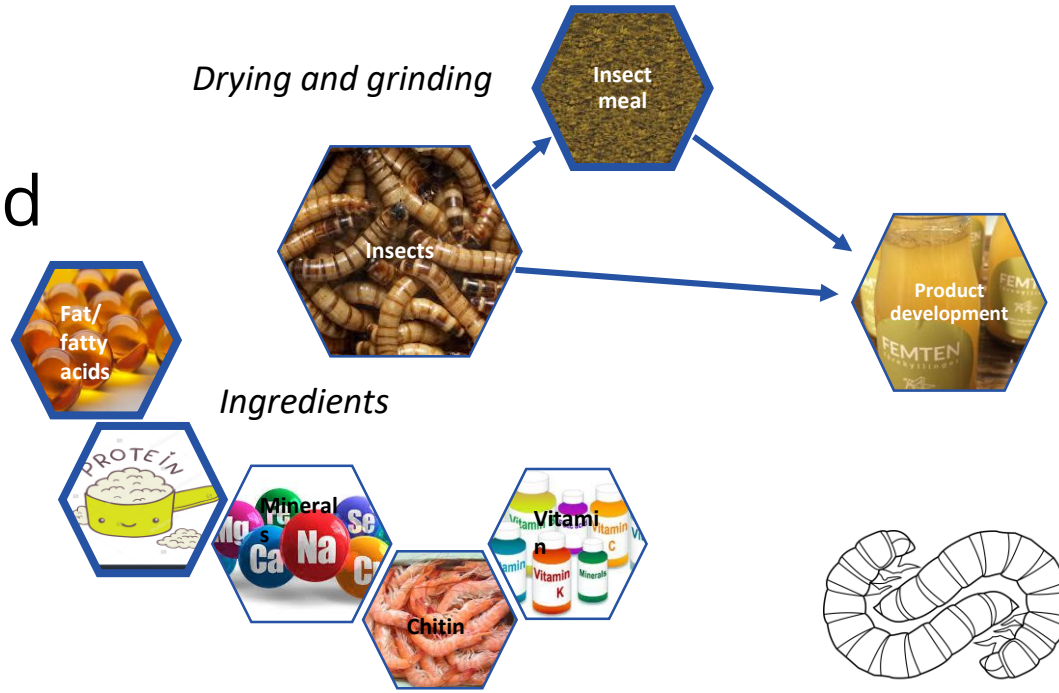
Insects as a functional ingredient

- High value products
- Specialised functionality on final food
- Wider applications
- Higher consumer acceptance



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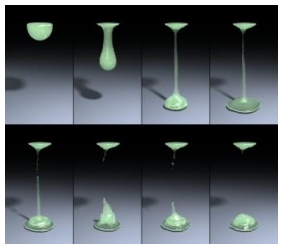
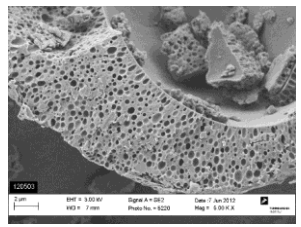
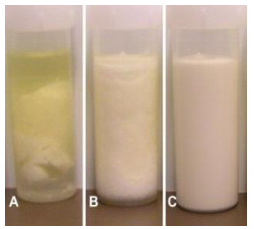
Physical functionality of insect meal

- Water activity
- Water binding
- Lipid binding
- Emulsion capacity (oil in water and water in oil)
- Foaming capacity
- Solubility
- Color measurement (L a* b*)
- Particle size





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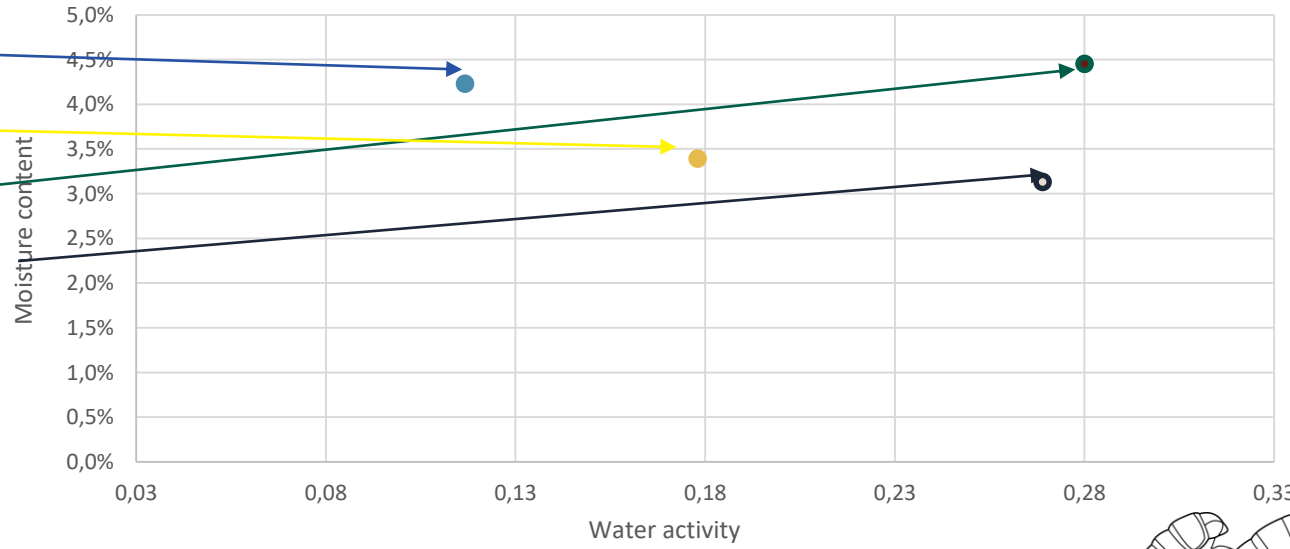
Drying

- Samples: Tenebrio molitor, grown at DTI, ground to 2mm after drying
  - Freeze dried: 96 hr
  - Heat dried 55°C: 16 hr
  - Heat dried 120°C: 70 min
  - Microwave dried 900W: 12 min
  - Defatted freeze dried
    - Using diethyl ether
    - Fat content reduced by 50%
    - Not included in all analysis



Preliminary work by Christine Reimers

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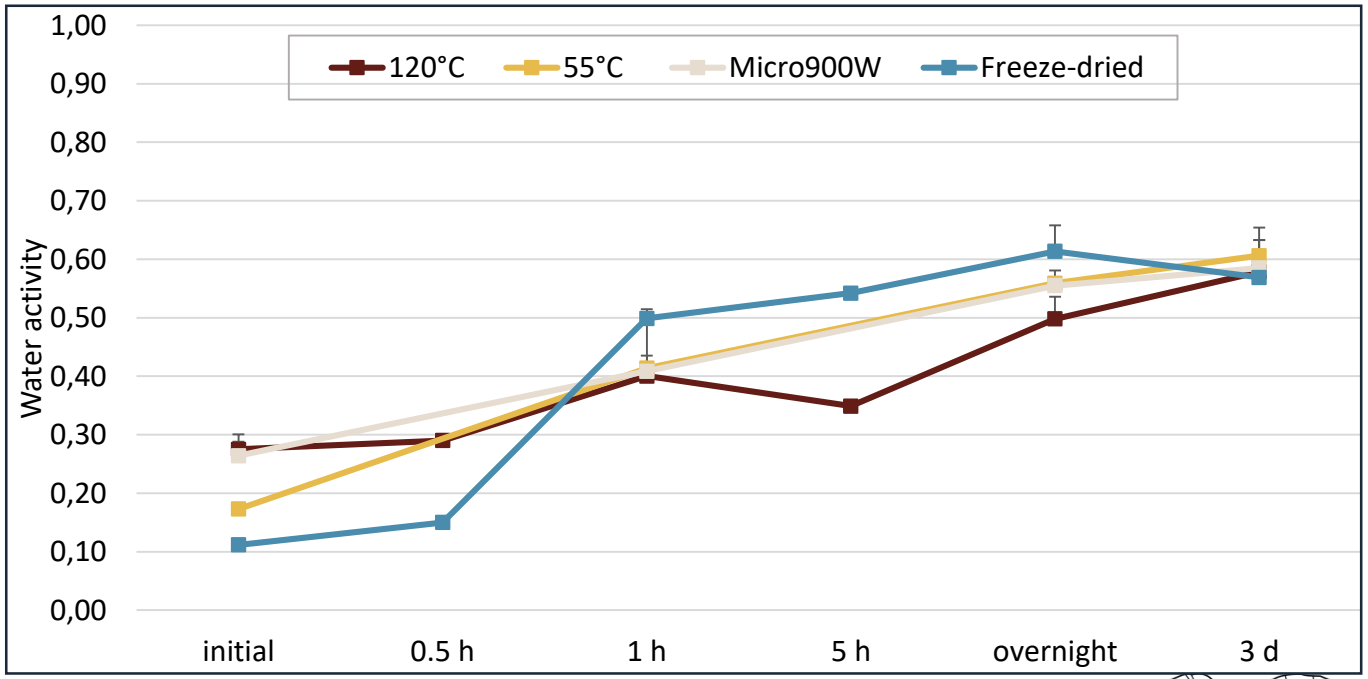
Water activity over time

- Same tendency independent of drying method
- Increasing over time -> hygroscopic powder
- Importance of packaging and storage



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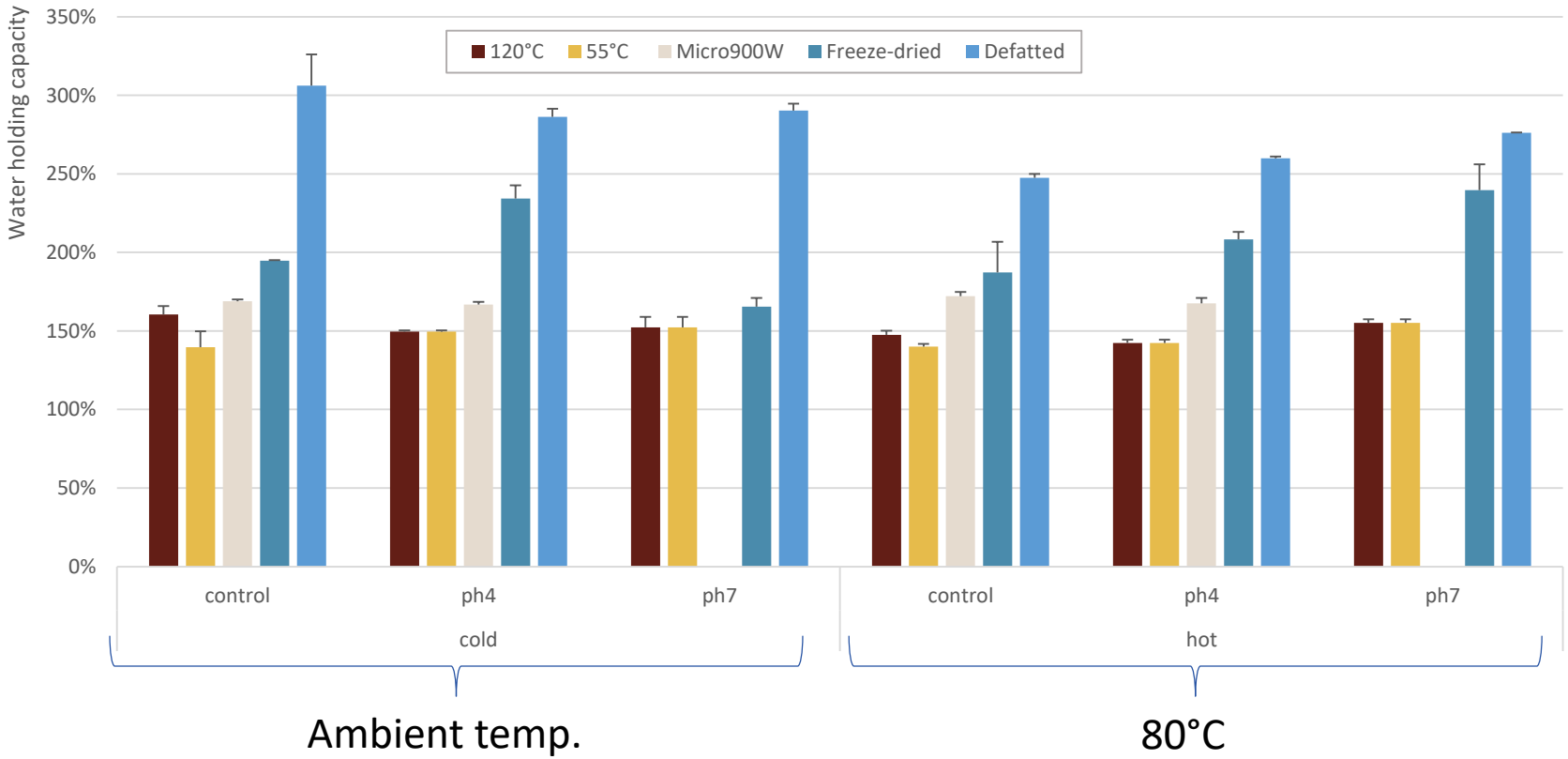
Water holding capacity (WHC)

- Two temperatures
- Significant differences
- Two pH-values
- High in freeze-dried
- High in defatted insect meal



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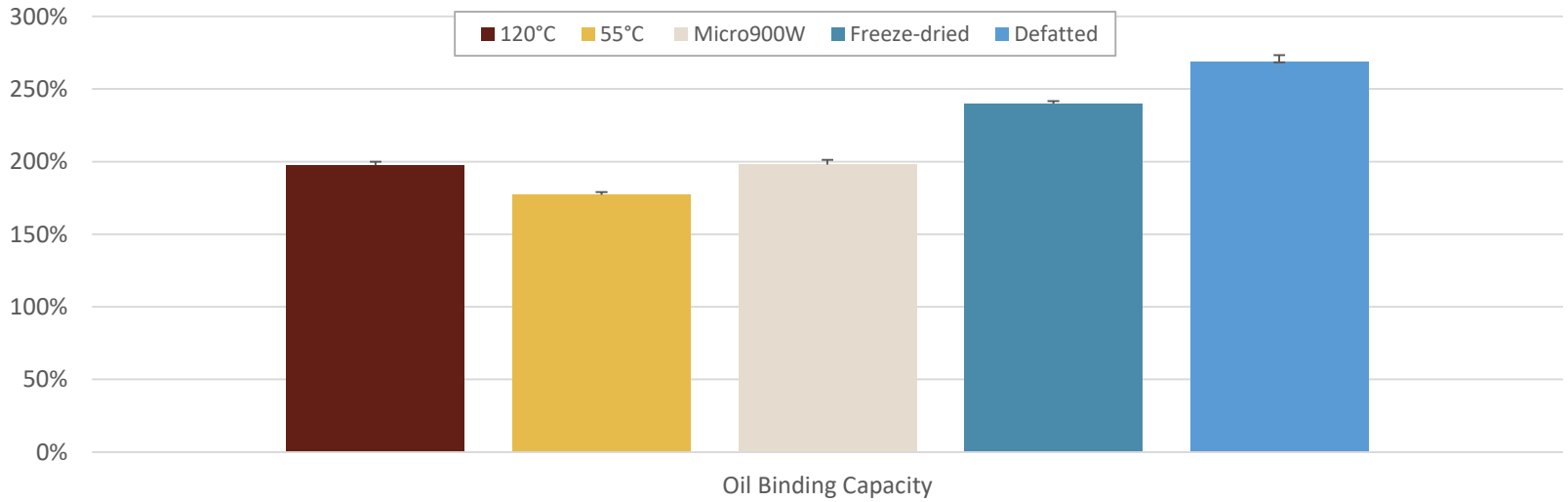
Oil binding capacity

- Highest in defatted flour
- Lowest in 55 °C
- Lower effect than seen on water-binding



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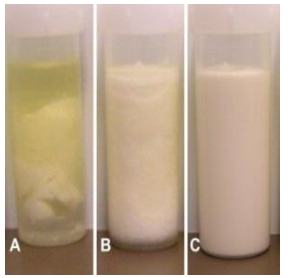
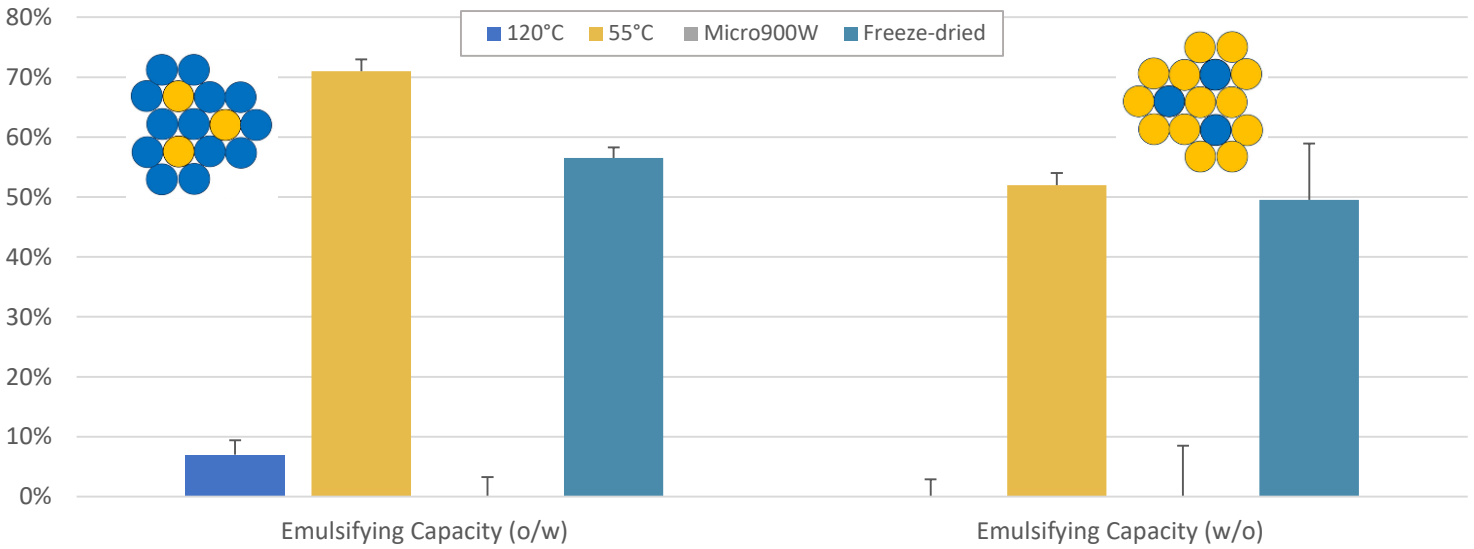
Emulsion capacity



- Oil in water
- Water in oil
- Very weak emulsions
- w/o only present due to phase inversion



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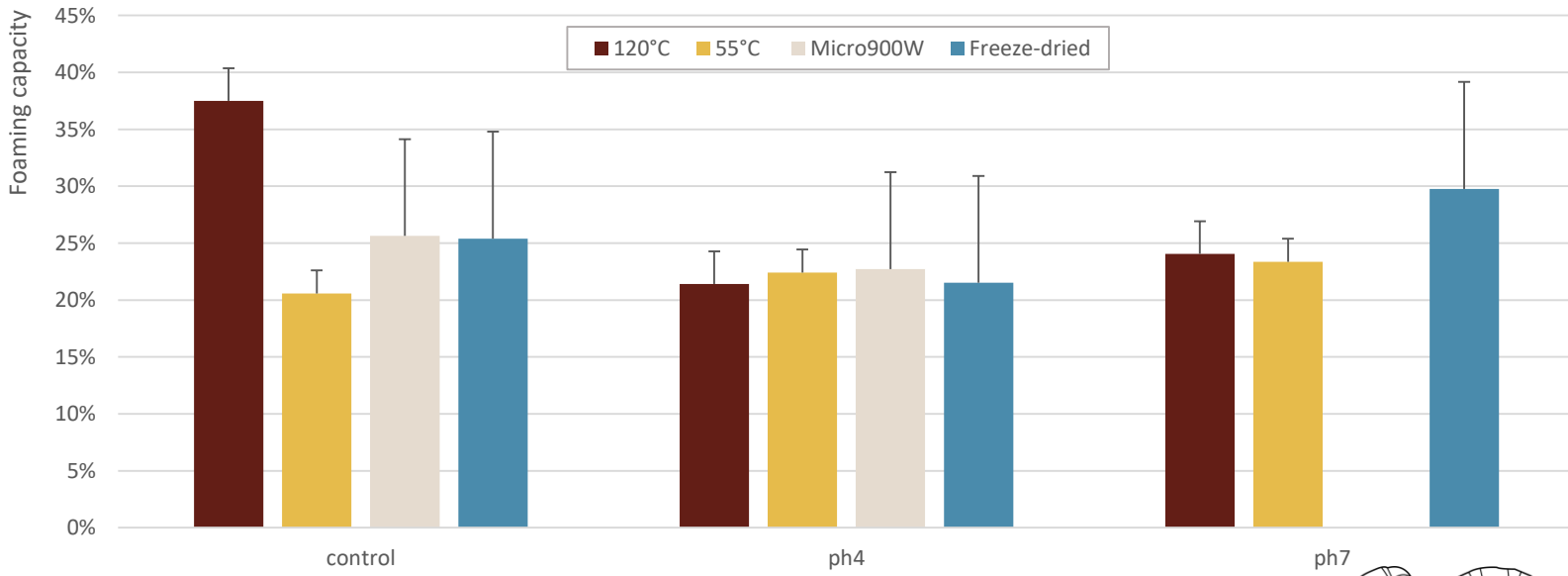
Foaming capacity and stability

- Highest foaming capacity achieved without pH regulation
- Huge variances
- More measurements needed



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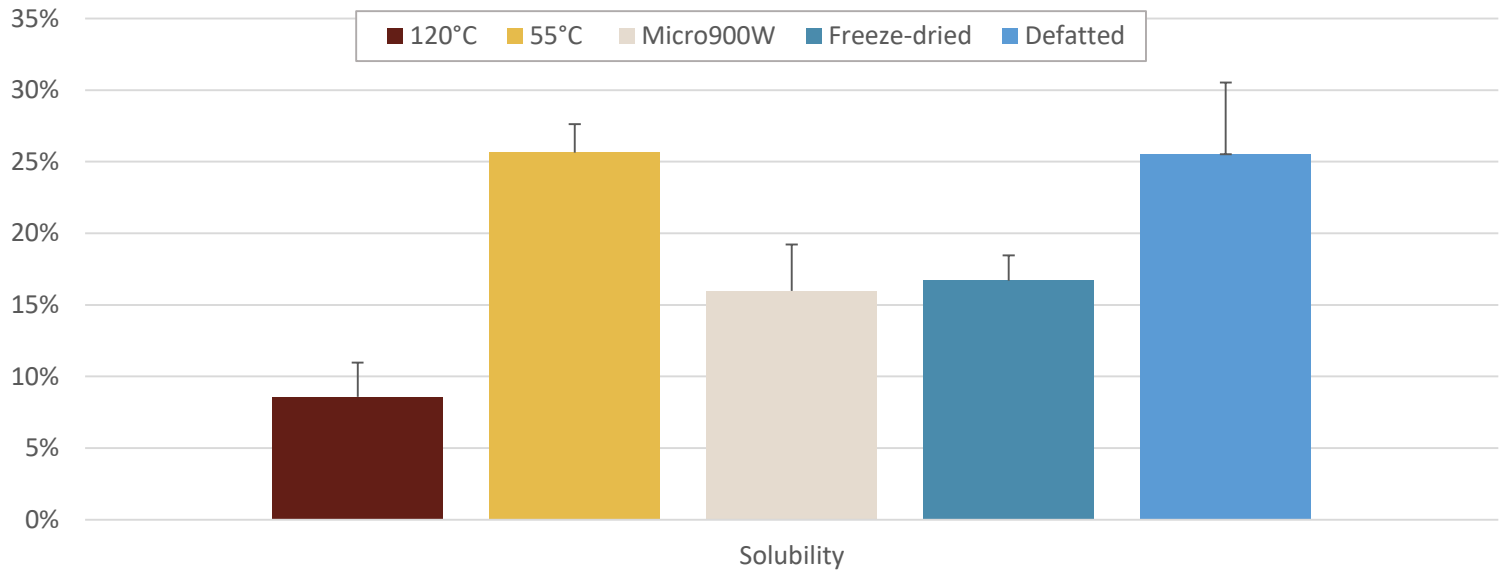
Solubility

- Low solubility of all samples
- 55°C and defatted flour highest



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L a* b* Colour

- Freeze dried is reference
- L score is causing the high ΔE
- Big colour difference between methods
  - Enzymatic browning?
  - Maillard reaction?

	Freeze-dried	55°C	120 °C	Micro-900W
L*	65.86	31.02	44.23	43.47
a*	4.89	3.88	11.05	9.91
b*	17.53	4.31	19.25	17.97
ΔE	Reference	37.27	22.55	22.95

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Lipid extraction and purification

- Meal from *Tenebrio molitor* (common mealworm)
- Lipid extraction
- Enzymatic hydrolysis of extracted lipids
- Purification of fatty acids by short path distillation

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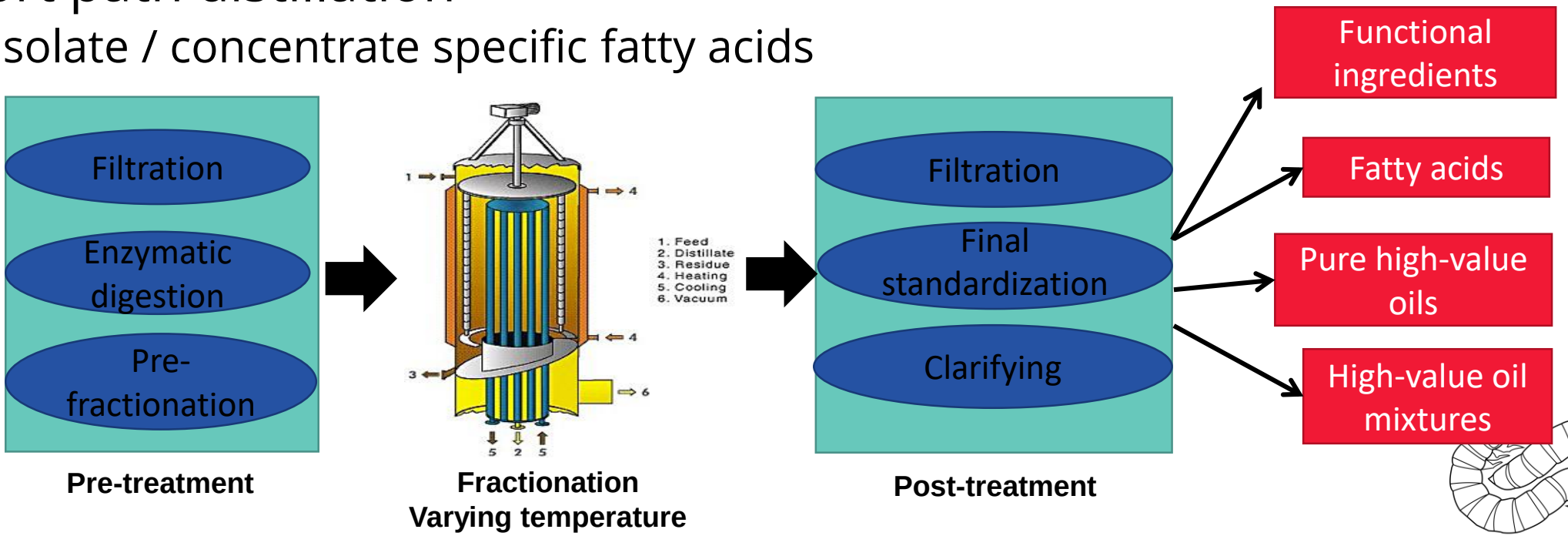
Lipid hydrolysis

- Enzymatic hydrolysis with food grade enzymes
  - Temperature evaluation
  - Enzyme concentration
  - Type of stirring
  - Type of enzyme
  - Filtration of lipids afterwards

Lipid purification

- Short path distillation
  - Isolate / concentrate specific fatty acids



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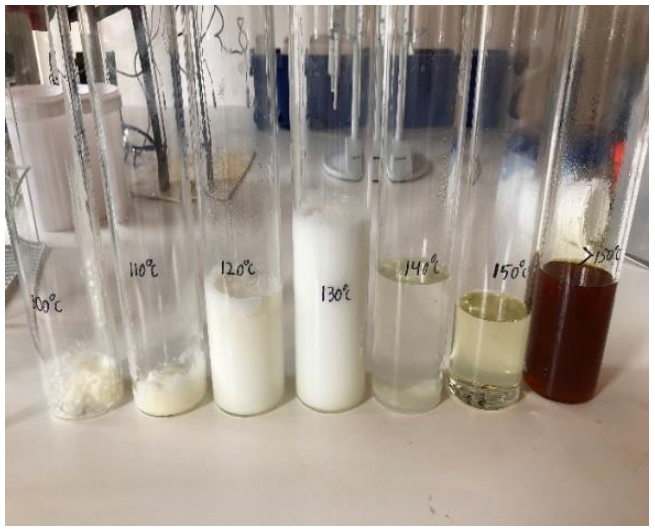
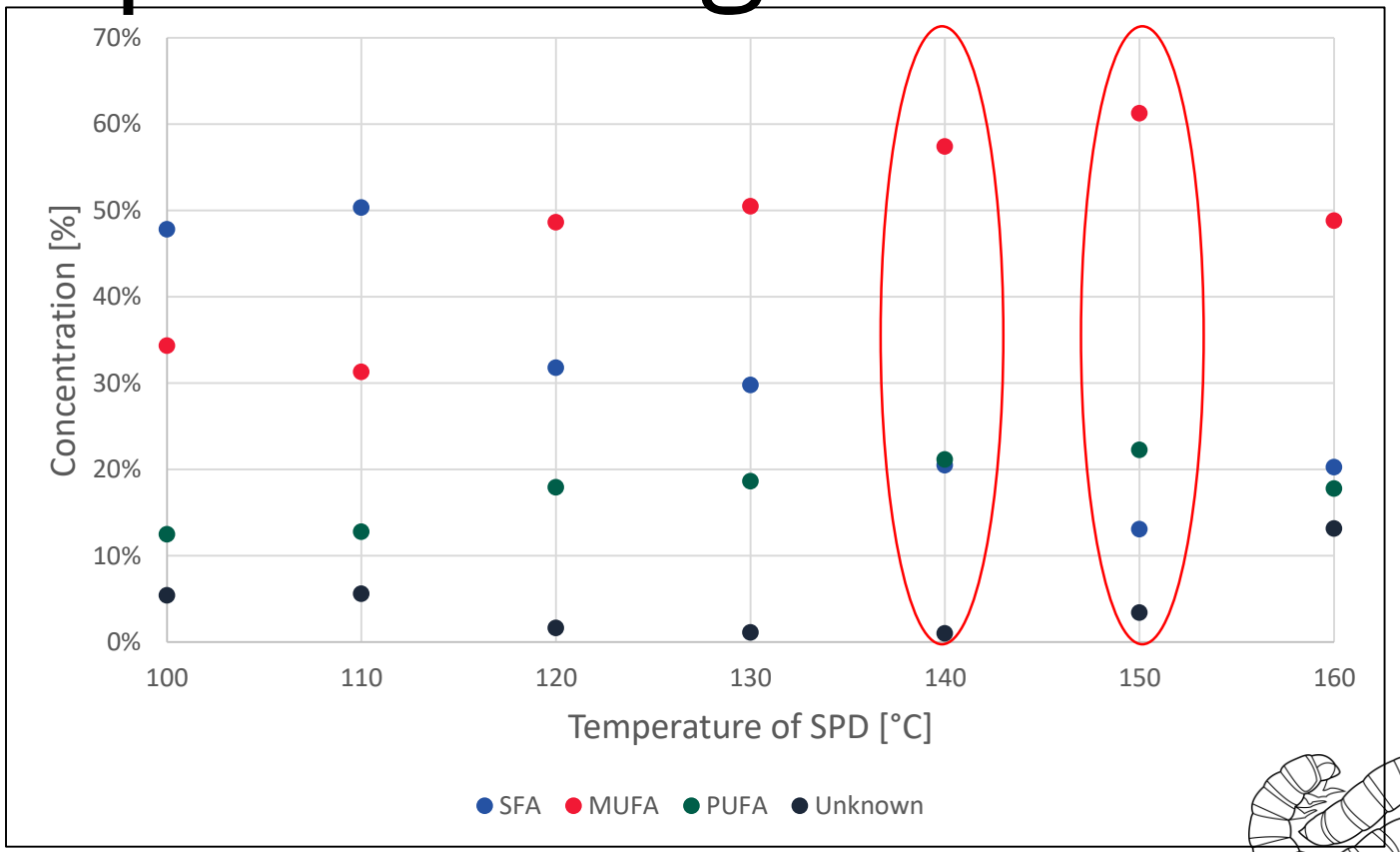
Purification of lipids through SPD



The different distillate fractions collected by SPD at increasing temperature



Fatty acid distribution from SPD with increasing temperature.

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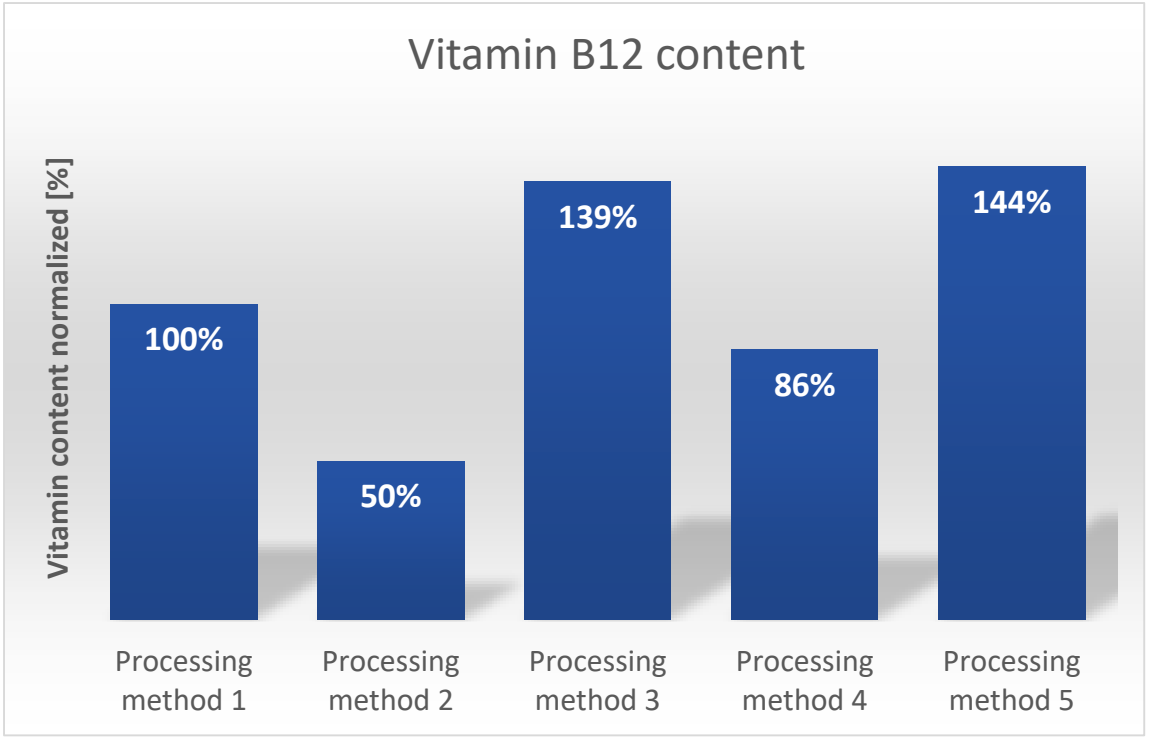
Other ingredients

- Minerals
  - Essential in food
  - From natural (insect) source
- Chitin
  - Processing to high-value products (chitosan)
  - Glucosamine (dietary supplement), medical devices etc.
  - Any special properties?
- Vitamins
  - B1, B2, A, E, B12
  - Based on insect diet and type



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Conclusions

- Processing affects water binding, oil binding, colour
- Emulsion capacity and foam stability are low
- Lipid extraction is possible, different fractions obtained

- => insect meals holds potential as functional ingredients
- => processing affects properties and nutrient content

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Questions?

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