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EFFOST, SITGES

14 NOV 2017

Research Institutes of Sweden

Agrifood and Bioscience

Bioscience and Material

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Objective

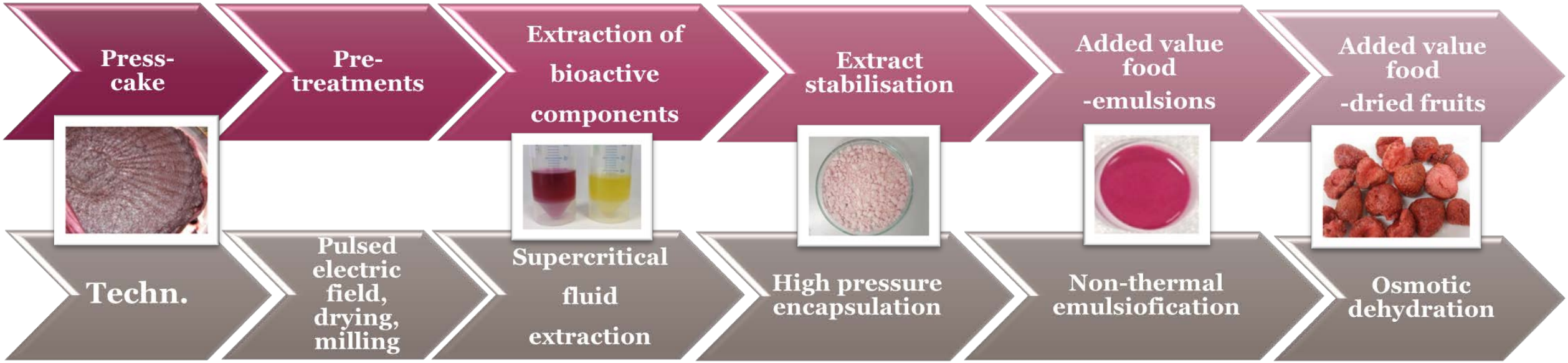
Develop sustainable innovative technologies for manufacturing of sustainable, attractive bioactive ingredients and healthy food from agricultural by-products.

Driver for the project

Berry processing industry generates a number of by-products (e.g. press cakes/skins/seeds)

- Rich in bioactive compounds.
- Majority discarded as waste.

Project outline



Project partners

RISE-Research Institutes of Sweden

Warsaw University of Life Sciences

Ruhr-Universität Bochum

Technische Universität Berlin

Main findings

- Extraction of bioactive compounds by pulsed electric fields (PEF) and supercritical fluid extraction (SFE)

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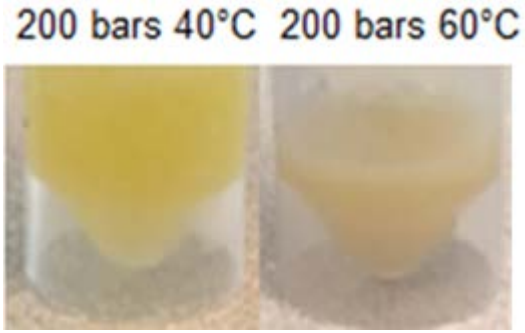
Drying and milling as pre-treatments

- Anthocyanin extraction yield could be improved by 40% by appropriate selection of drying technique and particle size. Freeze drying combined with particles < 710 µm was most successful

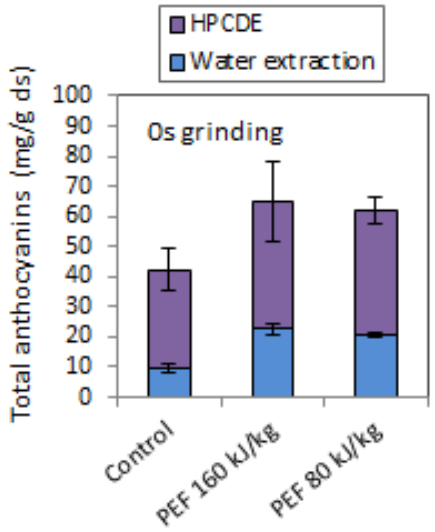


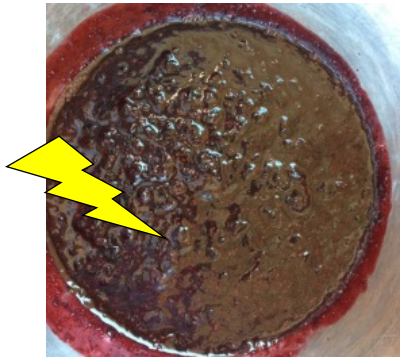
SFE of bilberry seed oil

- 200 bar and 60°C obtained higher recovery of vitamin E and higher antioxidant activity

PEF in a two-stage extraction process

- PEF as pre-treatment to high pressure CO2 extraction improved the anthocyanin yield when applied on unground fresh bilberry pomace, but not on heavily ground pomace





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Main findings

-Extract stabilisation

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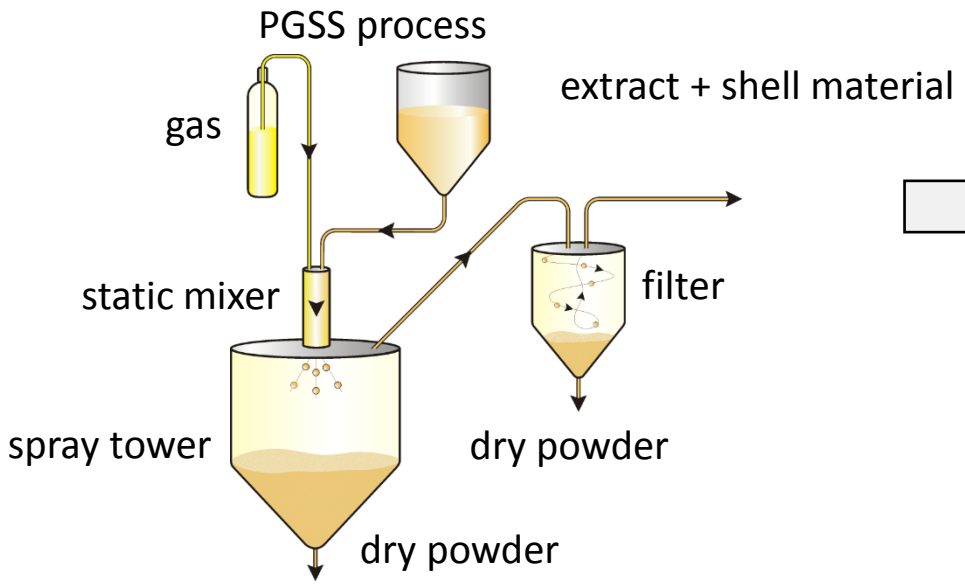
The high pressure process Particles from Gas Saturated Solutions (PGSS) and spray drying are used for the encapsulation of bilberry extract in particles of different shell materials.



Capsules of the bilberry extract and shell materials (Revel A, maltodextrin) have been successfully produced by PGSS.

The particles were analyzed concerning particle size, bulk density, morphology and moisture content.

maltodextrin + bilberry

Revel A + bilberry

Main findings

-Extract stabilisation

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Press-cake → Pre-treatments → Extraction of bioactive components → **Extract stabilisation** → Added value food -emulsions → Added value food -dried fruits

The high pressure process Particles from Gas Saturated Solutions (PGSS) and spray drying are used for the encapsulation of bilberry extract in particles of different shell materials.

- Capsules of the bilberry extract and the shell material Eudragit have been successfully produced by spray drying.
- The particles were analyzed concerning particle size, bulk density, morphology and moisture content.

Eudragit + bilberry

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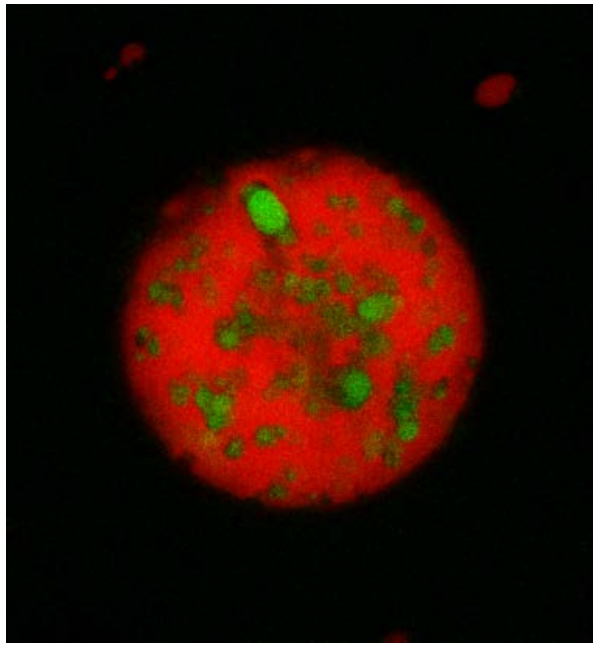
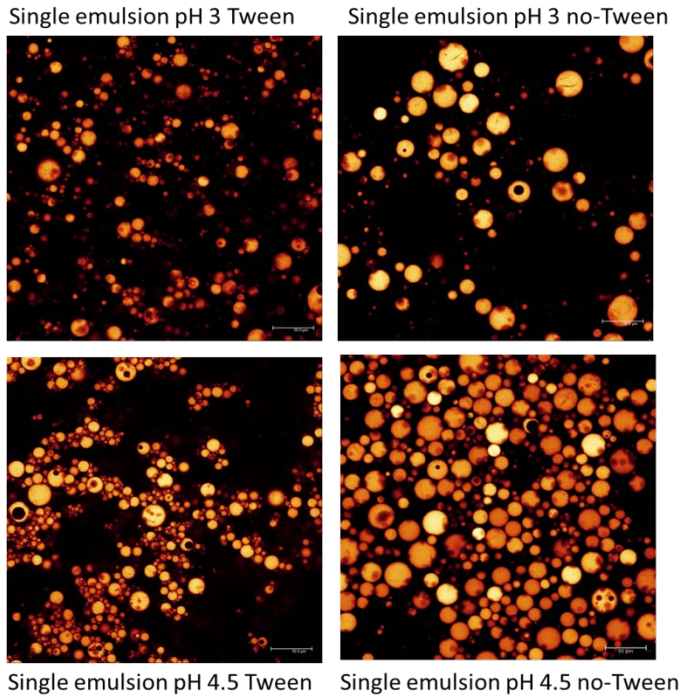
Main findings

- Added value emulsions

Developed non-thermal emulsification method (o/w/o) where bilberry seed oil were located in the inner oil phase surrounded by an aqueous phase of anthocyanins stabilized by whey protein isolate.





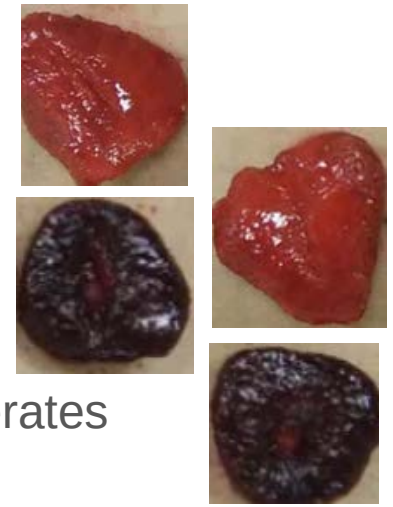
- At pH 4.5 slow structure formation, rigid final product. Cause drops to agglomerate/align.
- At pH3 fast structure formation, soft final product.
- Anthocyanins has no notable effect on formation or resulting microstructure.
- Emulsifier generates smaller droplets

Main findings

- Added value dried fruits

Bilberry by-products extract was used as a natural substance enriching in osmotic dehydration as a pretreatment. Osmo-dehydrated fruit were dried by freeze-drying and by convective-microwave-vacuum drying („puffing")

Osmodehydrated fruit



Osmodehydrated in sucrose with 0, 5, 10, 15% extract and dried by „puffing"

Osmodehydrated in sucrose with 5, 10, 15% chokeberry concentrate and dried by „puffing"

- Osmotic dehydration for 24 h at 50°C generates high quality products, without shrinkage.
- Bilberry by-products extract or fruit concentrates are good as osmotic and natural enriching substances.
- Attractive osmodehydrated dried fruit (snack) production both as „puffing" and freeze-drying method.
- Higher antioxidant activity of osmo-dehydrated products combined „puffing" drying in comparison to the freeze-drying.

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Conclusions

- Selection of appropriate pre-treatments and extraction conditions were crucial to obtain an oil enriched in Vitamin E as well as to improve the anthocyanin extraction yield.
- Pressure and temperature influenced the recovery of Vitamin E and antioxidant activity of bilberry seed oil.
- PEF improved the anthocyanin extraction yield when applied on unground bilberry pomace.
- Bilberry extract was encapsulated in particles of different shell materials with the PGSS process and spray drying. It was possible to obtain different particle morphologies and sizes (5 to 60 µm) by controlling the processing parameters.
  The correlation between those processing parameters and resulting particle properties are valuable for different branches of the food industry for designing custom-made particles.

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Conclusions

- Using non-thermal emulsification method it was possible to create stable micro capsules with anthocyanins stabilized by WPI in the continuous phase while encapsulating the bilberry seed oil.
- Final pH and emulsifier had significant impact on the structure of the micro capsules.
- Bilberry by-products extract may be used as enriching substance in osmotic dehydration pretreatment and also in sustanaible technology of dried fruit (pro-helthy snack with added value fruit) production.
- „Puffing" method generates high quality product, very similar to the freeze-dried fruit; the technique is also more economic (lower energy consumption); quick method (1-2 h) compared to freeze-drying (24 h).

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THANK YOU

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