Effect of organic hydrocolloids on quality of Seabuckthorn beverages and cosmetic emulsions

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Agenda

- Aim of the work
- Scientific background
  - Stabilisation of dispersed systems by biopolymer interactions
  - Effect of zeta potential
- Effect of biopolymer interactions in seabuckthorn products
  - Beverages
  - Cosmetics
- Summary

Aim of the work

- Enrichment of seabuckthorn pulp or juice with seabuckhorn oil (0.7 to 2.2 % fruit pulp or seed oil) for additional value (healthy and nutritional)
- Finding a suitable organic emulsion composition for such oil enrichment.
- Depression of oil creaming rate of enriched juices

Strategy

- Selecting manipulable parameters for creaming rate
- Combination of organic proteins and polysaccharides to influence the particle charges
- Preparation of oil emulsions with biopolymers as emulsifier/stabilizer
- Preparation of enriched beverages (juices and drinks)
- Suitability of emulsions with biopoymers used for cosmetics

Parameters for phase separation
(dispersed systems)

Main parameters for droplet (cloud) stability
(e.g. seabuckthorn juices):

- Particle size
- Differenz in density
  (disperse and continuous phase)
- Content of anorganic salts
- Viscosity
- pH-value
- Content of ionic biopolymers
- Net attractive or repulsive interaction
- Electrical charge of particles
  (zeta potential)

Stoke´s law

manipulable by adding biopolymers

Conclusions for stable systems:

- Realising fine dispersed particles
- Preventing particle aggregation (Stoke´s law)

Possible way to solve the problem:

- Increasing electrostatic repulsion by adding charged biopolymers (increasing zeta potential by combination of proteins with polysaccharides)

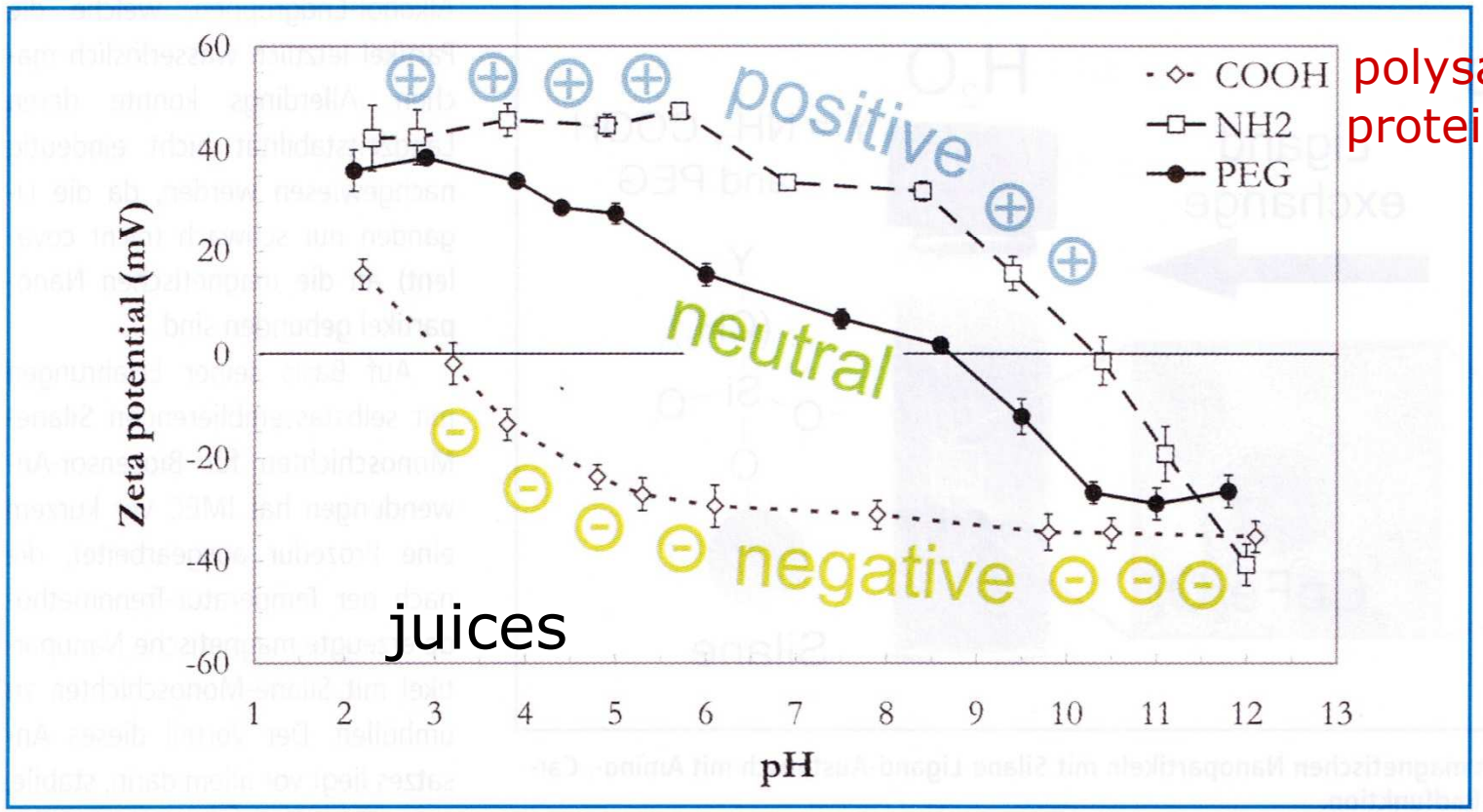
Strategy

- Preparation of emulsions with seabuckhorn pulp oil using
  - proteins (whey) as emulsifier and
  - ionic polysaccharides (pectin or Na-CMC) as stabiliser
- Testing the phase stability of emulsions in juices
- Testing the effect of biopolymer content on emulsion consistency (for cosmetics)

Effect of biopolymer mixtures on electrostatic forces (zeta potential)

Zeta potential

Effect of amino and carboxyl groups



polysaccharides
proteins

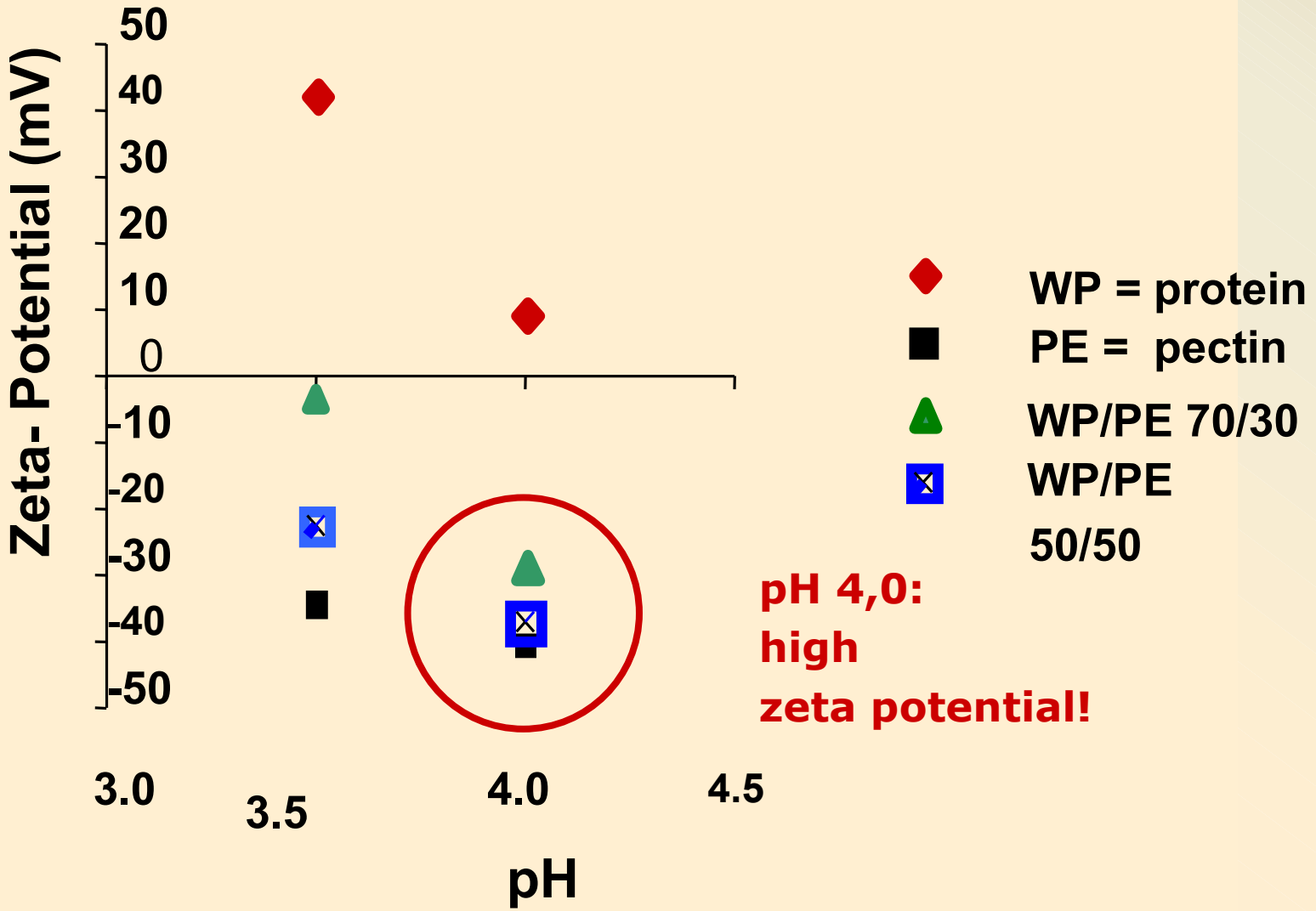
Abb. 4: Abhängigkeit des Zeta-Potentials (als Maß für die Ladung der Nanopartikel-Oberfläche) vom pH-Wert.

Karent, K., GIT (2007) 8, 632

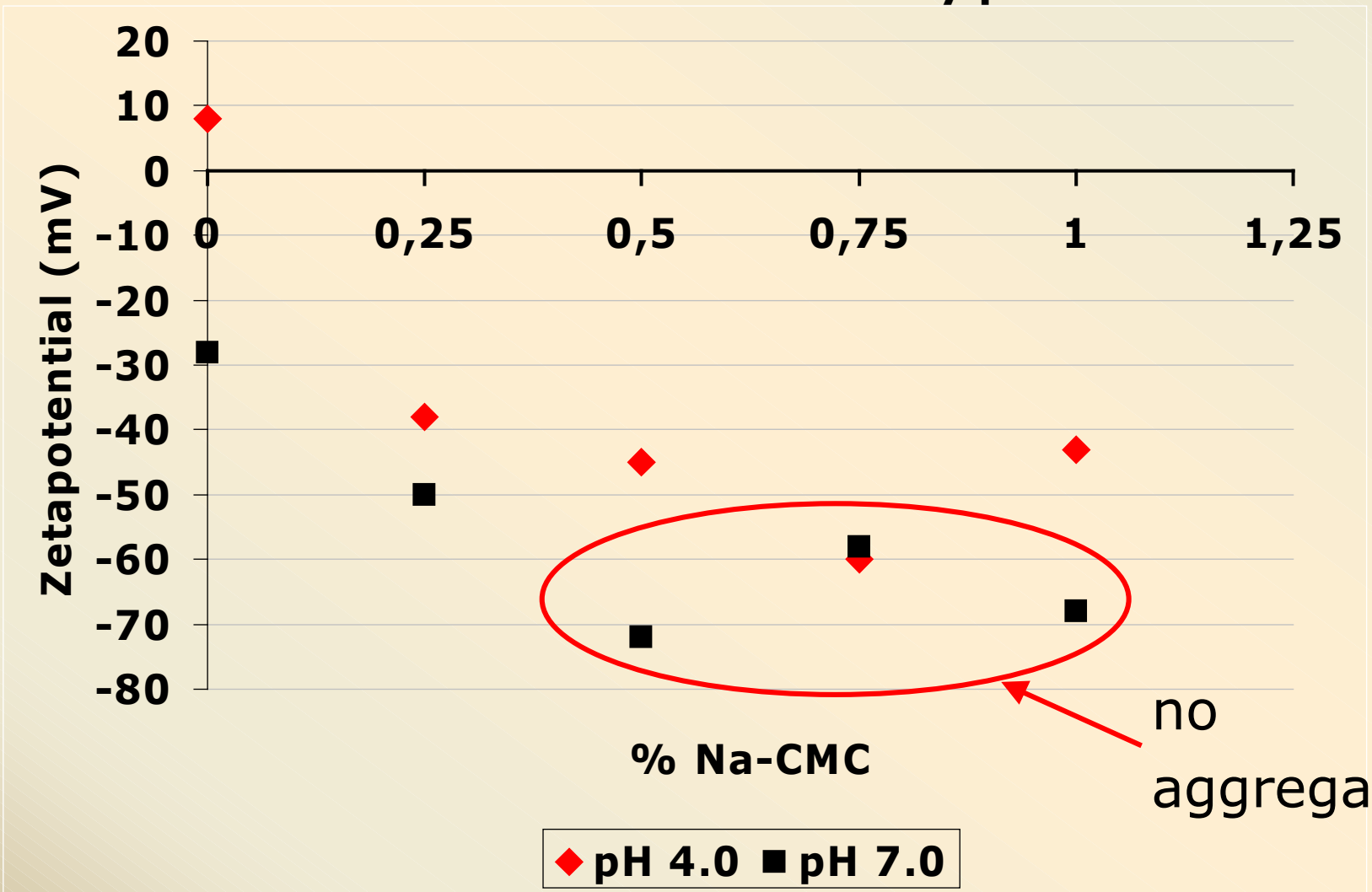
Biopolymer solutions

Zeta potential
at different pH-value

Zeta potential of protein-pectin-solutions



Zeta potential of protein-NaCMC-solutions



Seabuckthorn products supplemented with pulp oil

Supplementation with oil

Seabuckthorn oil

dispersed

Protein-polysaccharide-solution

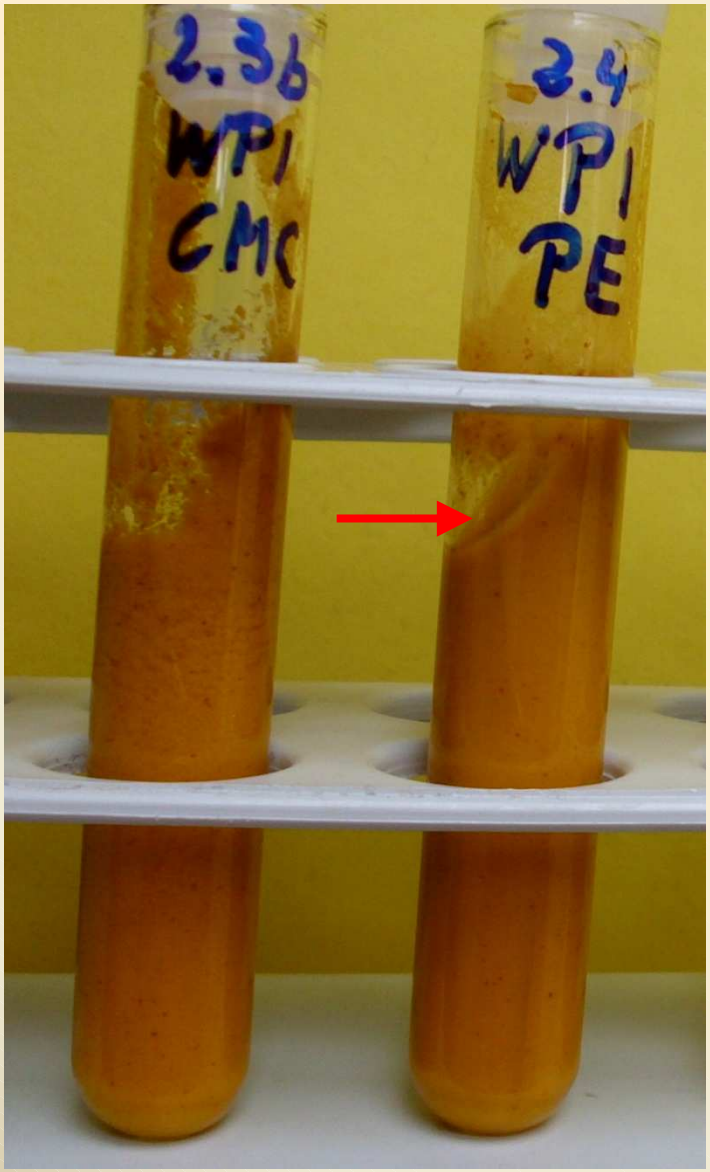
Homogenization

Emulsion

15 % oil

Enriched pulp, juice, beverage…

Supplementation of pulp with 2.25 % oil



2.3b:
Pulp with 15 % CMC-emulsion

2.4:
Pulp with 15 % pectin-emulsion

A good flow behaviour is induced by pectin!

Seabuckthorn pulp

(~ 4 % oil, non phase stable)

↓

Separation oil phase

↓

Preparation emulsion

↓

Enrichment

of pulp, juice, light beverages

with 1 to 3 % oil

Supplementation of juice (25 % pulp)

control enriched

ζ = -12.8 mV -19.3 mV

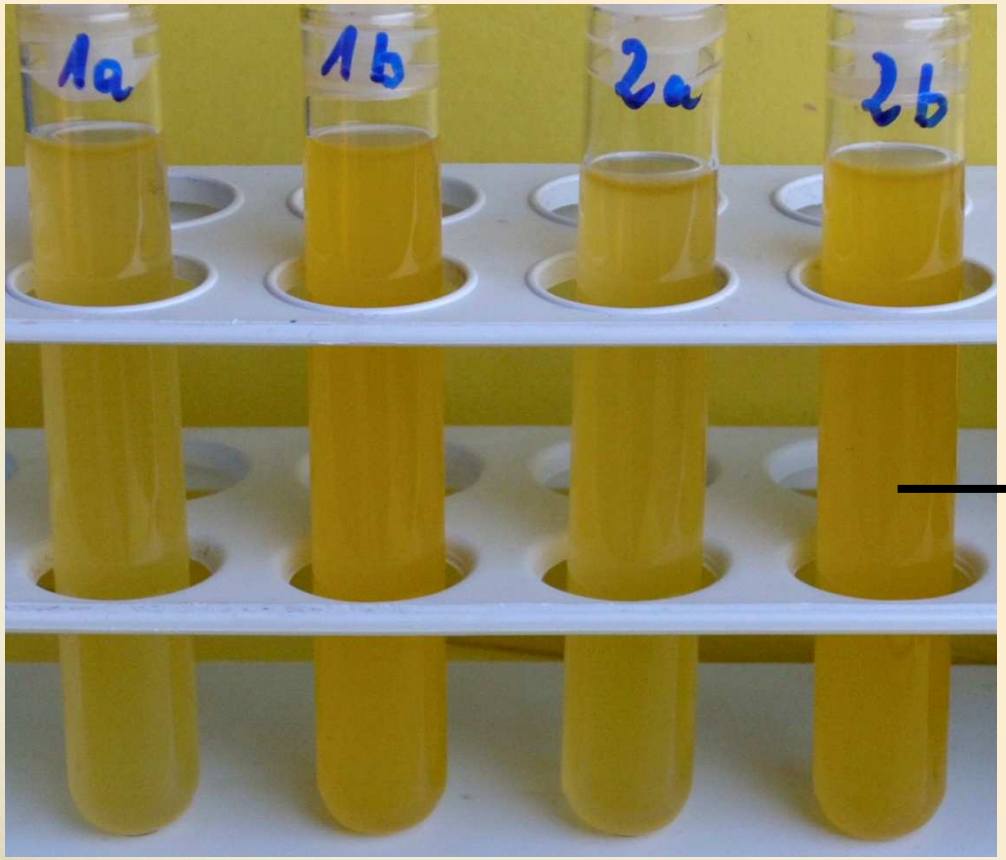
zeta potential

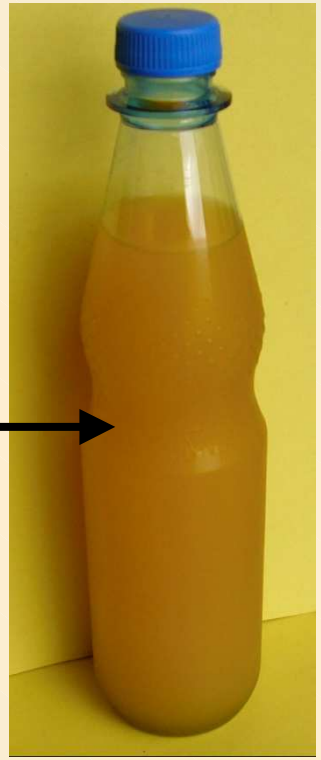
3c:
Juice with 10 % pectin-emulsion (1.5 % oil)

The supplementation with pectin-emulsion decreases phase separation!

New cloudy beverages with pulp-oil

(0.2 or 0.4 % emulsion)





a, 0,03 % oil

b, 0.06 % oil

Light beverages can be prepared **without** wheighting agents!

1, with sweetener **2, with 5 % sucrose**

Liqueur with 3 or 15 % emulsion

(5 % or 15 % sucrose)

No droplet aggregation!

High phase stability
with 17 % ethanol!

Oil: 0.45 % **2,25 %**

Sucrose: 5 % **< 15 %**

Droplet distribution
size ~ 0.9-1,0 µm

Organic cosmetics with seabuckthorn oil

Advantages:

- Organic cosmetics (cremes, lotions) can be prepared with a few ingredients (minimum 4 components)
  - Water, oil, protein, polysaccharide, *preservative if necessary*)
- Emulsions containing ionic biopolymers can be tailored in consistency by
  - changing the biopolymer content or
  - the oil content
- The emulsion basis is applicable for cosmetics and foods

Advantage of emulsions with protein-polysaccharide combination

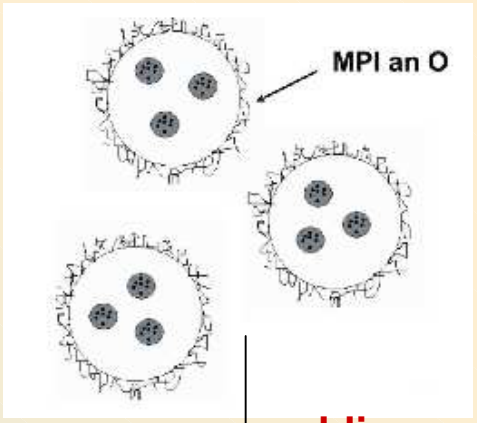
Emulsion has multi-functionality:

- prevents droplet aggregation
- reduces phase separation and creaming
- improves sensory (taste, mouthfeeling)
- reduces acidity (taste),
- suitable for tailoring texture

References:
*Muschiolik G., Lebensmitteltechnik **42** (2010) 3, 37-38*
Muschiolik G., COSSMA (2010) 5, 16-17

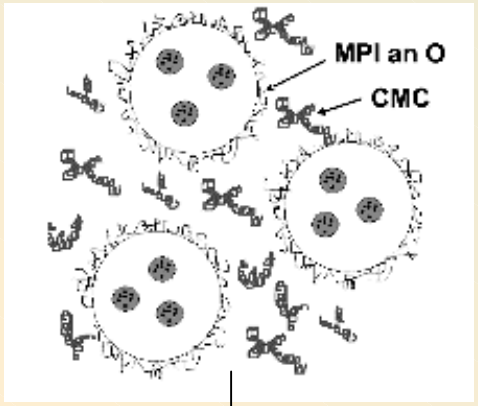
Effect of protein-polysaccharide-combination on particle aggregation

Protein as emulsifier



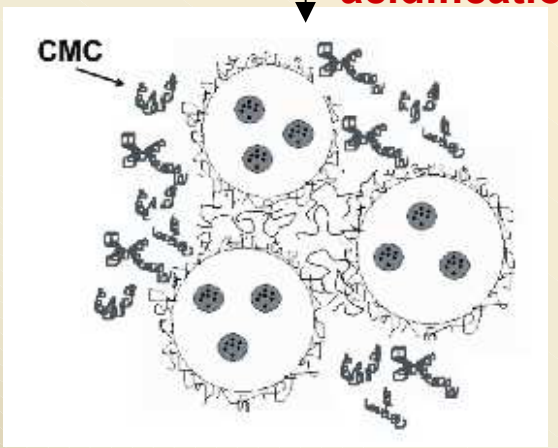
Emulsification

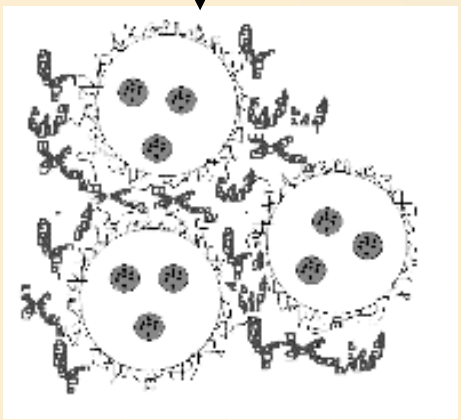
Protein + ionic polysaccharide



adding polysaccharide, acidification

acidification





no stable, flocculation

stable, high zeta potential

Emulsions with seabuckhorn oil, stabilised by protein-polysaccharid-combination

Additional effects of supplementation

Pulp

e.g.

- reduction of phase separation
- improved consistency
- reduced acidity

Juices, beverages

e.g.

- reduction phase separation
- improved color
- improved texture and sensory

Cosmetics (creams, lotions)

e.g.

- pleasant creaminess
- no stickiness
- organic ingredients are available

Summary

- Seabuckthorn-oil-emulsions stabilized by combinations of protein/polysaccharide are suitable to
  - supplement juices with oil and to
  - prepare organic cosmetics.
- The combination of proteins with polysaccharides effects
  - an improvement in stability and consistency of dispersed systems and
  - extend the product development.

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Thank you!