

Towards understanding of the formation of layered and fibrous structures in dense biopolymer blends

Fibrous structures for meat replacers



Birgit Dekkers

Costas Nikiforidis

Remko Boom

Atze Jan van der Goot

Food Process Engineering department



Take home message



- Shear-induced structuring of a water-in-water emulsion, consisting of pectin/soy blend, leads to the formation of fibrous structures
 - Pectin = dispersed phase, SPI = continuous phase
- Under shear flow pectin forms elongated droplets, the degree of deformation and hence fibrousness can be tailored with
 - Heating temperature
 - Shearing time
 - Rotational speed

Fibrous structures

- Interest in making fibrous structures for the application of meat replacers
- Shear-induced structuring with simple shear flow under heating
- Soy protein concentrate (SPC)
 - Soy Protein Isolate (SPI) + Polysaccharides → Pectin

SPC



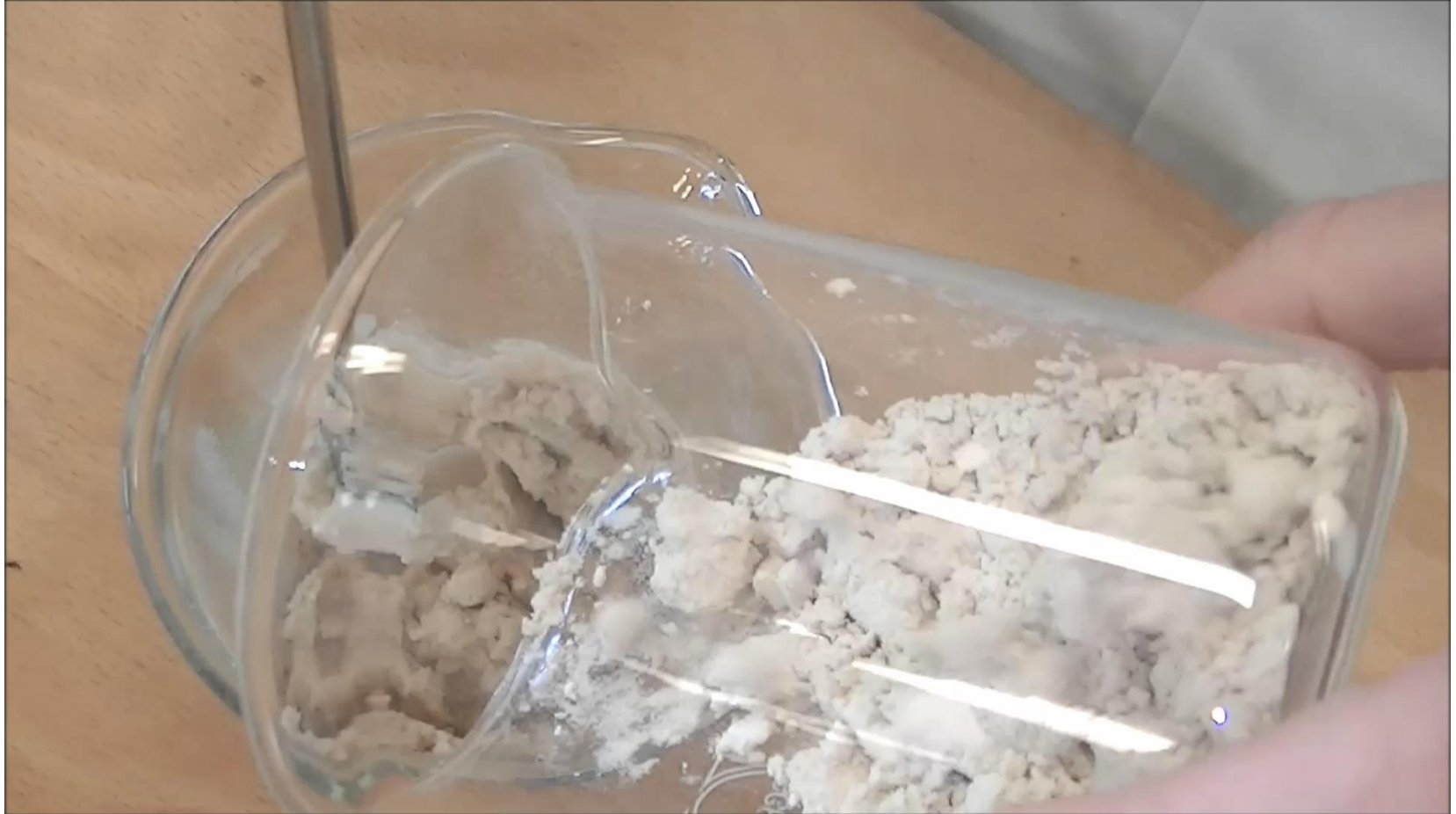
SPI



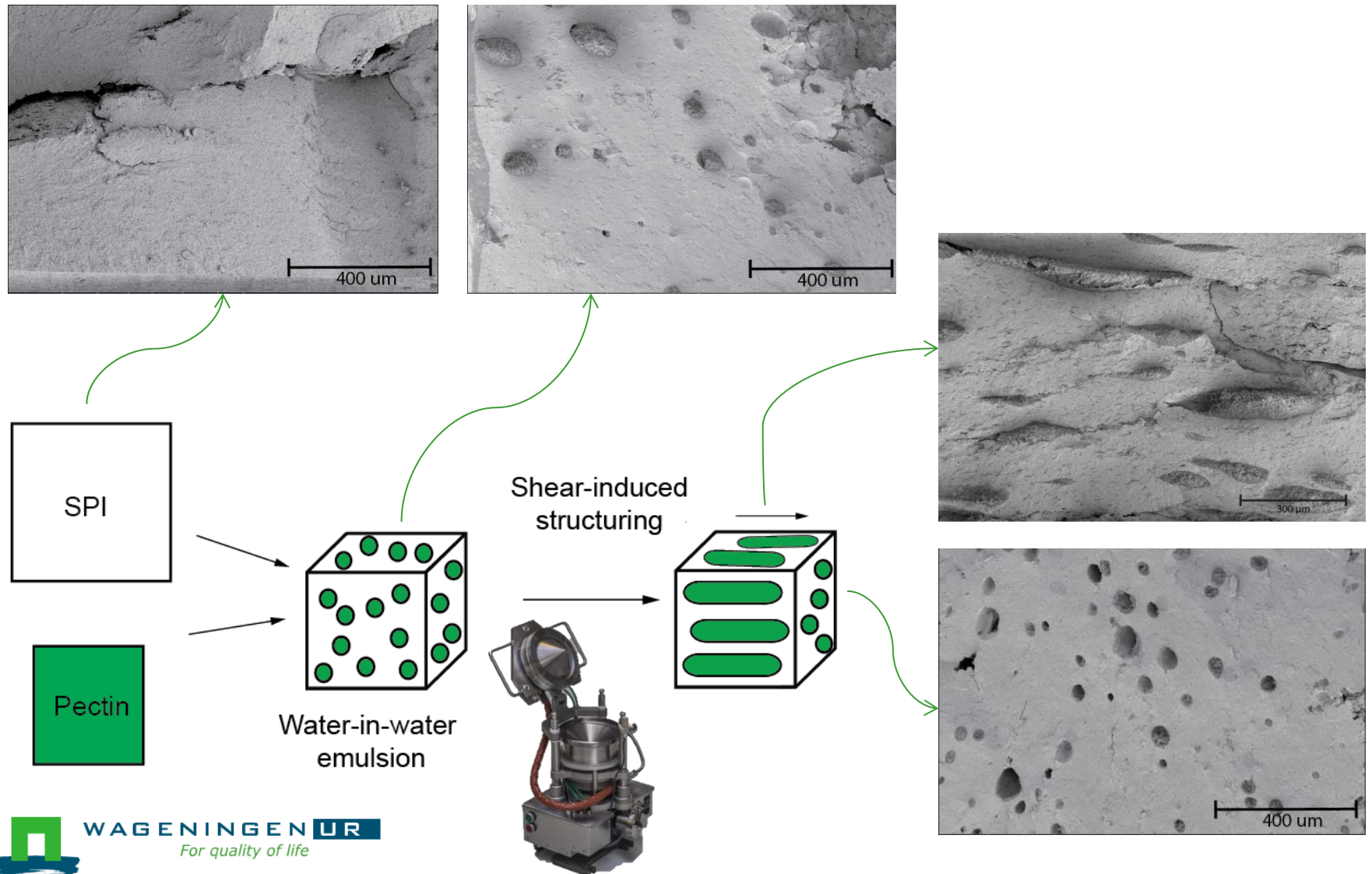
SPI + Pectin



Movie



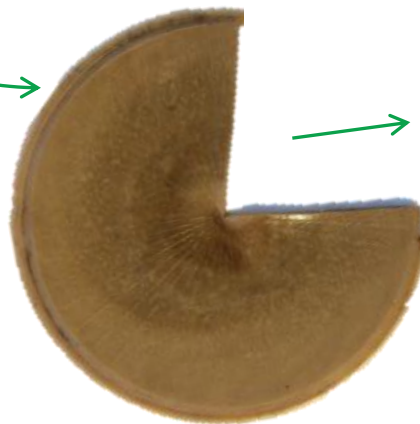
Microstructure (SEM)



Quantification anisotropy

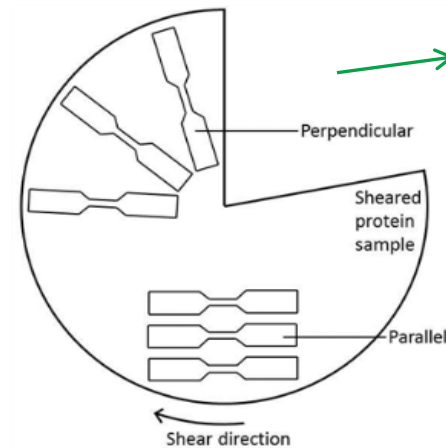
Important process variables for shear-induced structuring

- Heating temperature
- Shearing time
- Shear rate

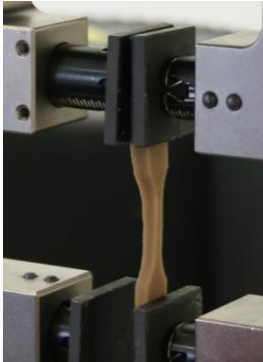


Tensile strength analysis

- Parallel
- Perpendicular

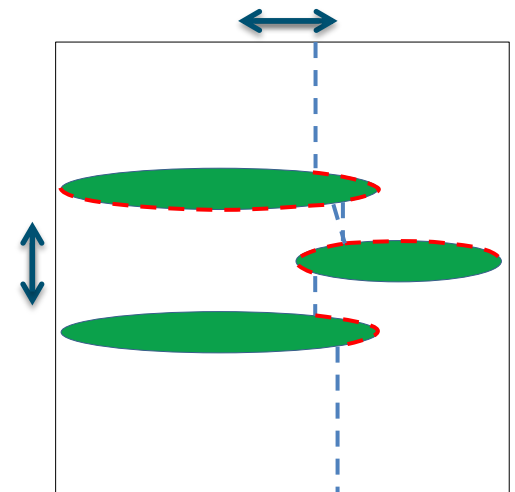
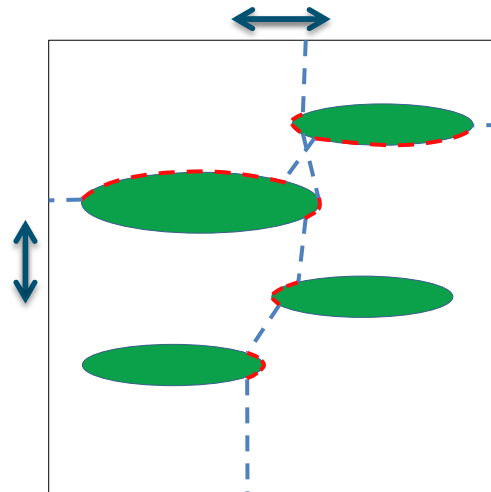
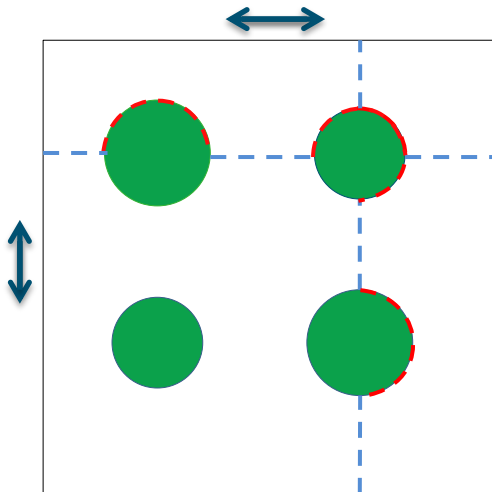
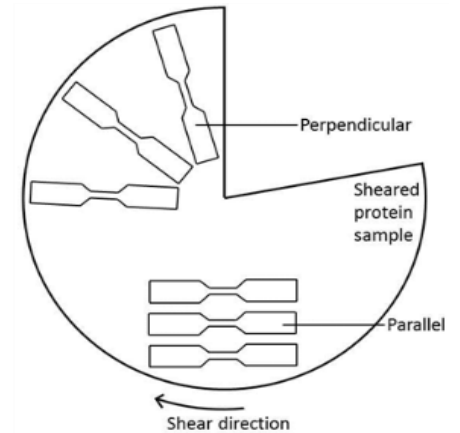


Tensile strength analysis



Tensile strength analysis

- Pectin phase *or* interface between pectin/SPI is **soft**



1) Temperature

120 °C

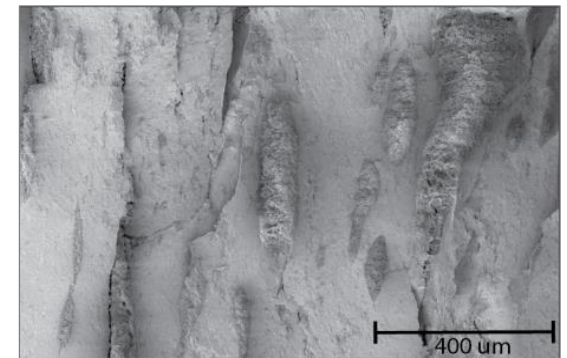
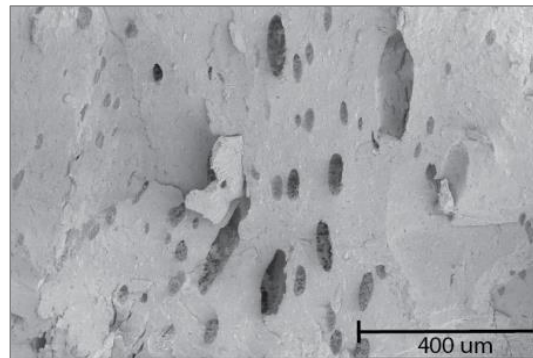
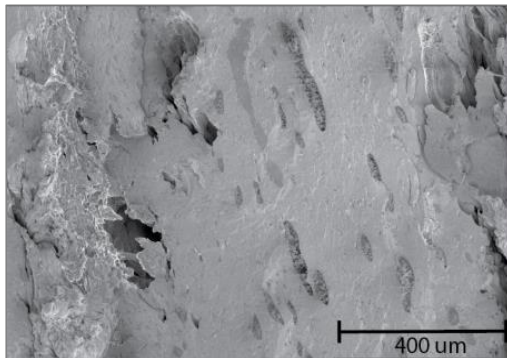
130 °C

140 °C

Macrostructure

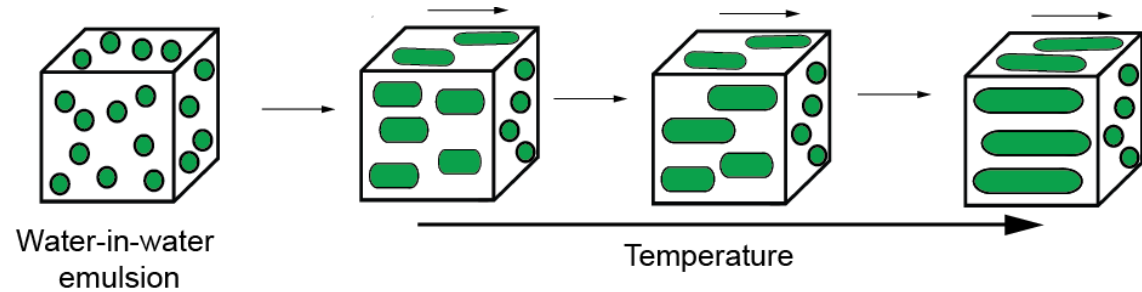


Microstructure

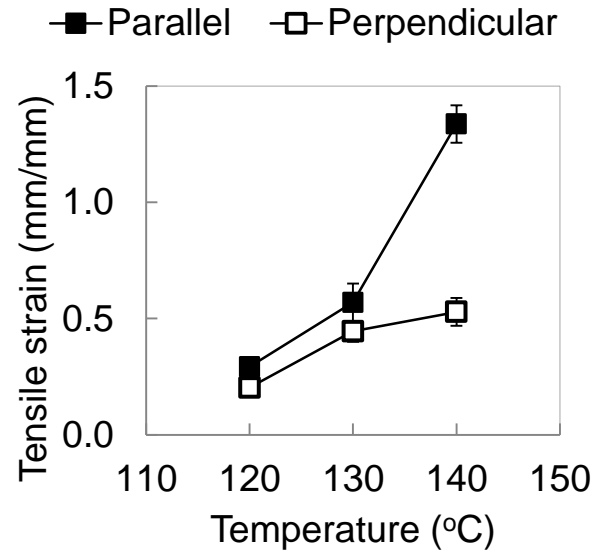
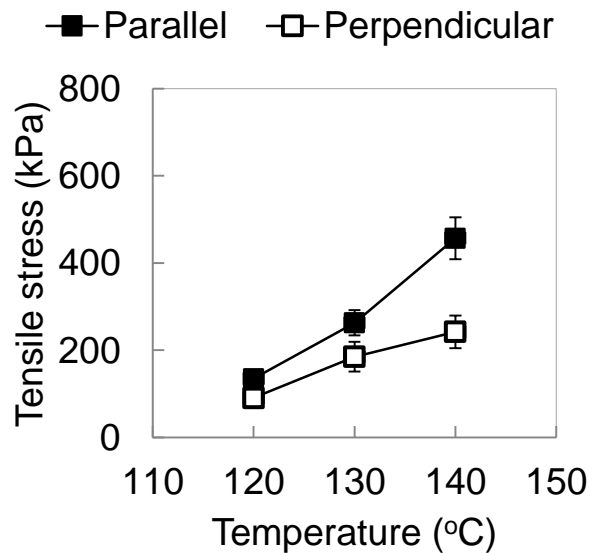


1) Temperature

Microstructure



Tensile strength analysis



2) Shearing time

3

5

10

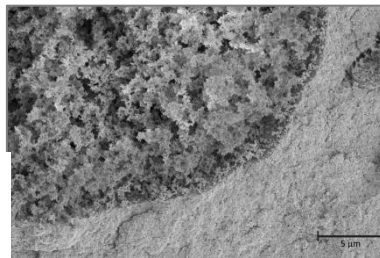
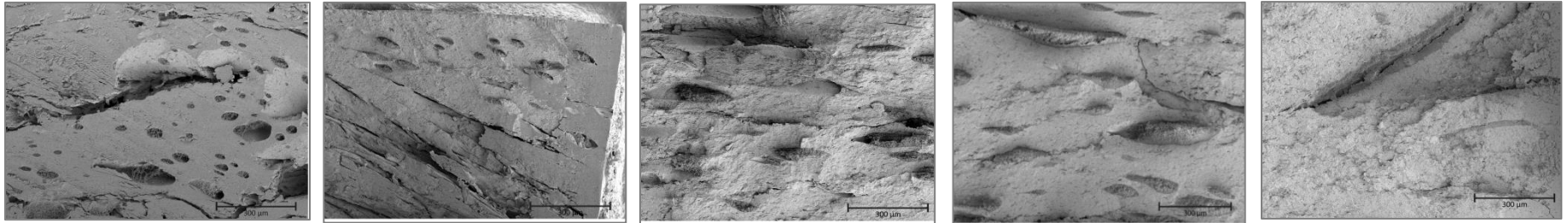
15

30 (min)

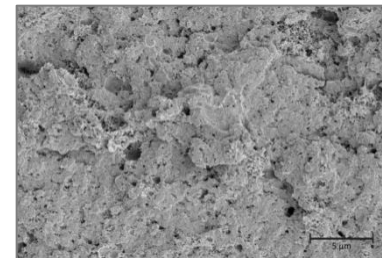
Macrostructure



Microstructure

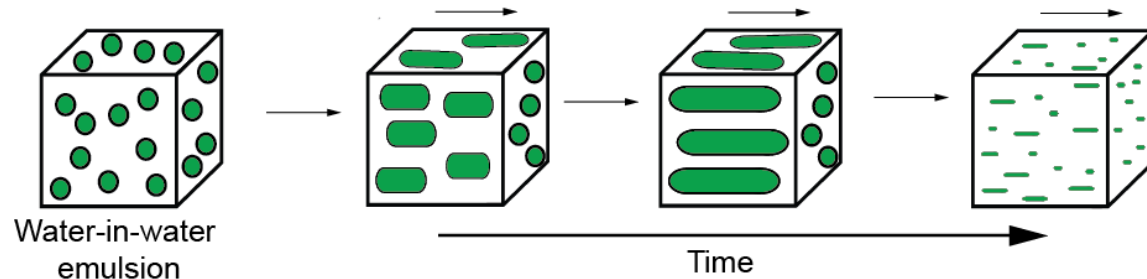


Pectin dispersed
through the
continuous soy phase

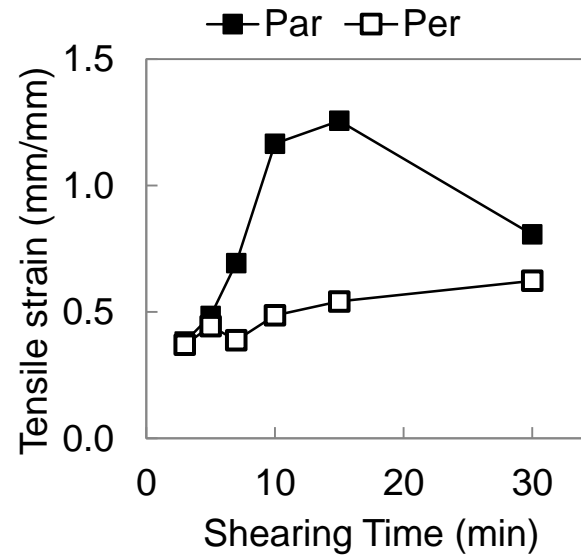
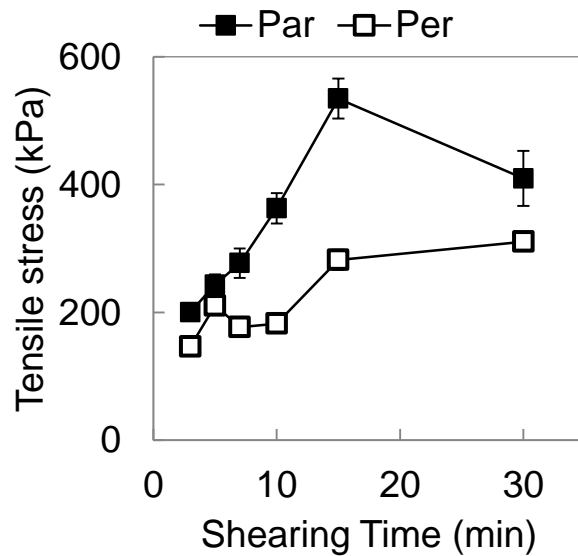


2) Shearing time

Microstructure



Tensile strength analysis



3) Rotational speed

0 RPM

10 RPM

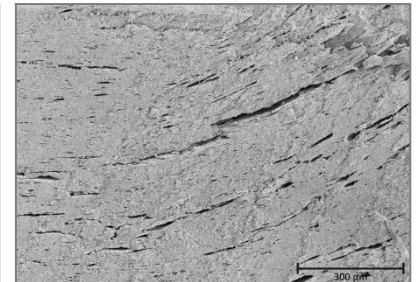
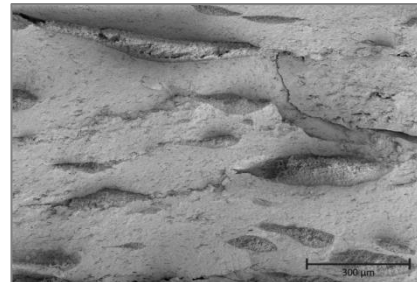
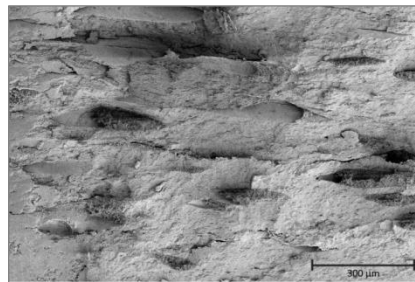
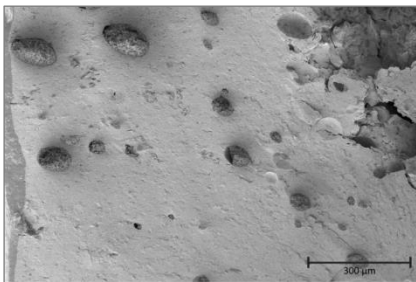
30 RPM

100 RPM

Macrostructure



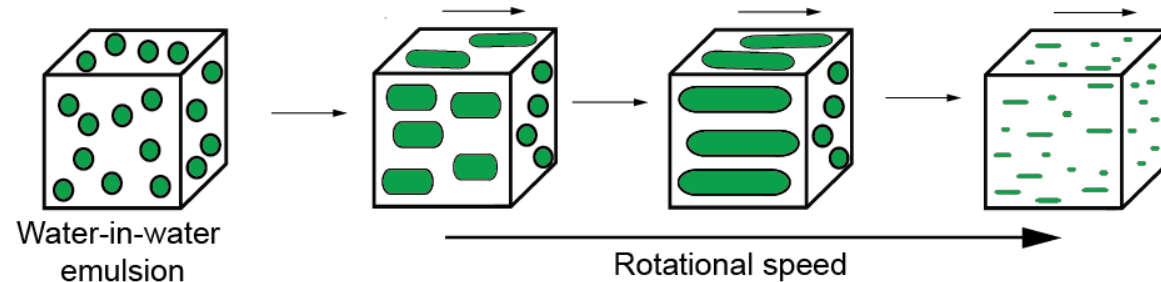
Microstructure



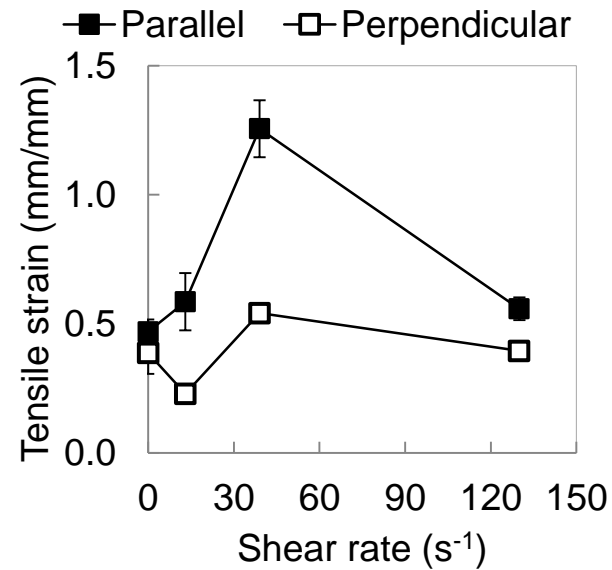
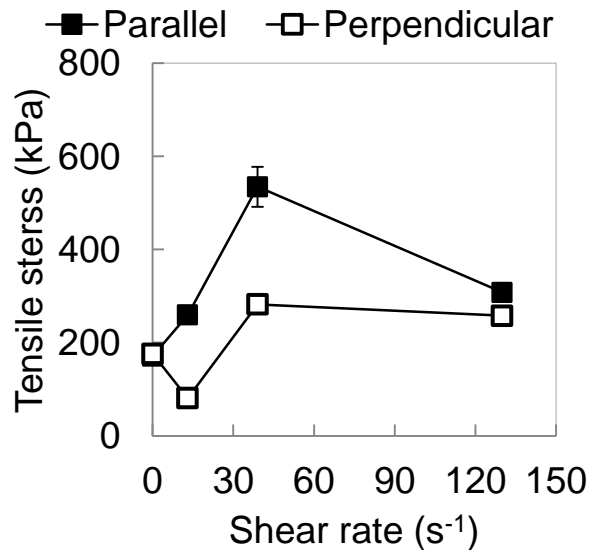
Pectin dispersed
through the
continuous soy phase

3) Rotational speed

Microstructure



Tensile strength analysis

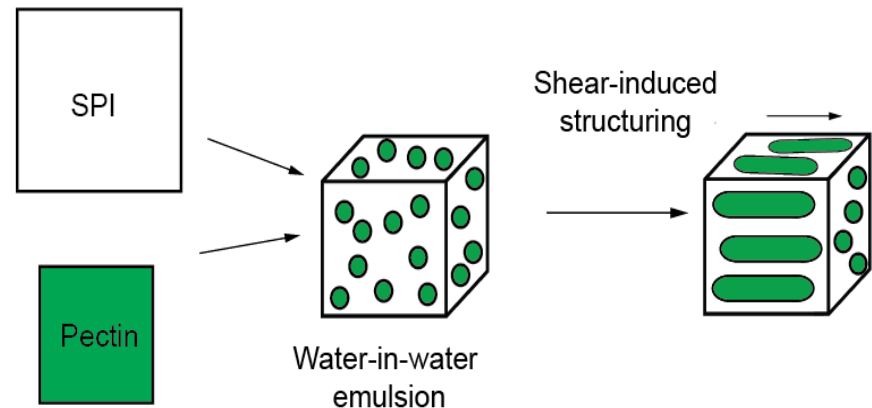


Conclusion



- Shear-induced structuring of a water-in-water emulsion, consisting of a pectin/soy blend, leads to the formation of fibrous structures
 - Pectin will form the dispersed phase, and SPI the continuous phase.
- Under shear flow pectin forms elongated droplets, the degree of deformation and hence fibrousness can be tailored with

- Heating temperature
- Shearing time
- Rotational speed



Thank you for your attention

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birgit.dekkers@wur.nl