Characterization of Isometric Particles and Their Suspensions

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CPPS – Characterization of Particles and Particle Systems

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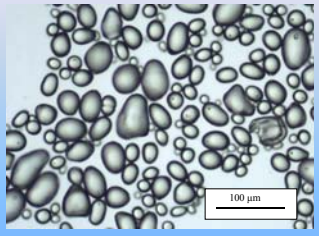
CPPS – Charakterizace částic a částicových soustav

Size characterization of starch

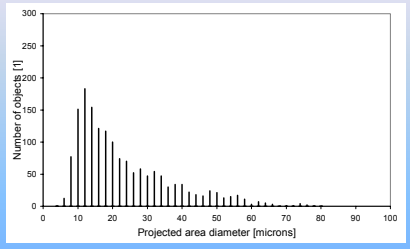
Laser diffraction particle sizer Fritsch Analysette 22

Size characterization of starch



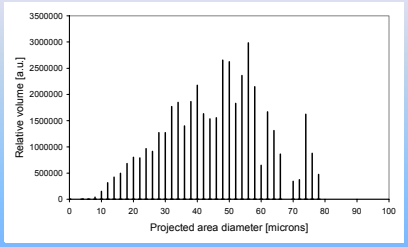
Optical micrograph of native potato starch

Size characterization of starch



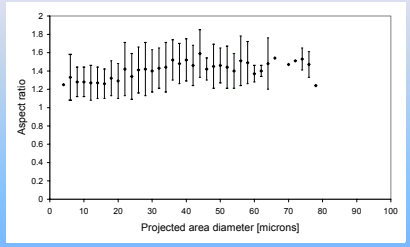
Number-weighted frequency histogram (q_0) of potato starch determined by microscopic image analysis (MIA)

Size characterization of starch



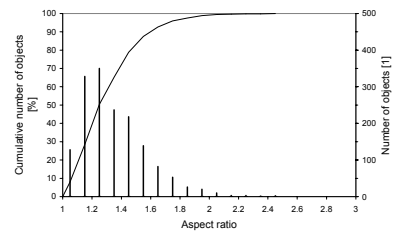
Volume-weighted distribution (q_3) of potato starch (from MIA data via q_0-q_3 transformation assuming a size-invariant aspect ratio)

Size characterization of starch



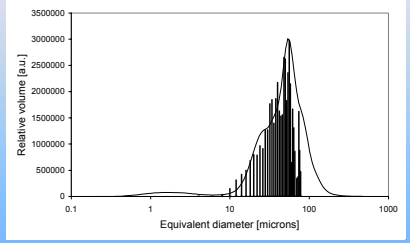
Size dependence of the aspect ratio of potato starch granules (arithmetic mean 1.41 ± 0.09)

Size characterization of starch



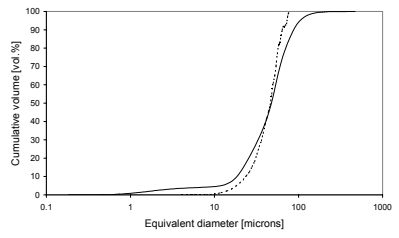
Aspect ratio distribution (cumulative – left, frequency – right) of potato starch (median 1.25, mode 1.25, mean 1.35 ± 0.22)

Size characterization of starch



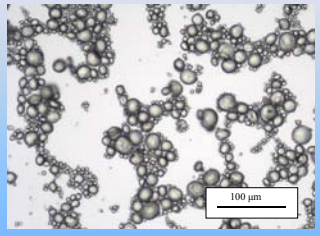
Volume-weighted size distributions of potato starch (q_3 histogram from MIA data, curve measured by LD)

Size characterization of starch



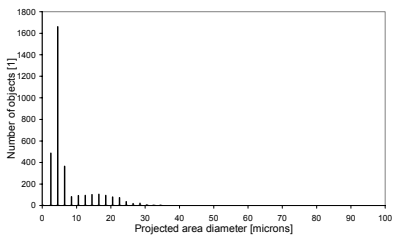
Volume-weighted size distributions of potato starch (q_3 histogram from MIA data, curve measured by LD)

Size characterization of starch



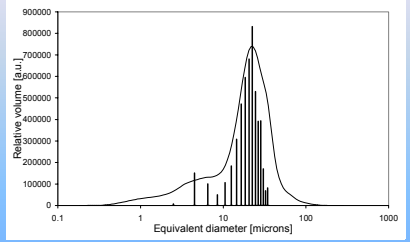
Optical micrograph of native wheat starch

Size characterization of starch



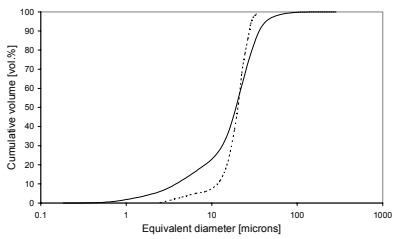
Number-weighted frequency histogram (q_0) of wheat starch determined by MIA

Size characterization of starch



Volume-weighted size distributions of wheat starch (q_3 histogram from MIA data, curve measured by LD)

Size characterization of starch



Volume-weighted size distributions of wheat starch
(Q_3 cumulative curves; dotted – MIA, solid – LD)

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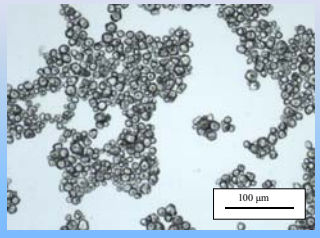
Size characterization of starch



Optical micrograph of native tapioca starch

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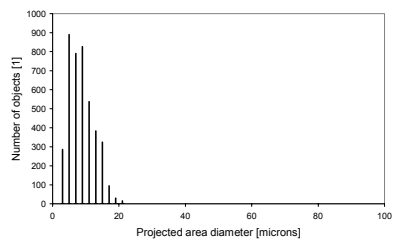
Size characterization of starch



Number-weighted frequency histogram (q_0)
of tapioca starch determined by MIA

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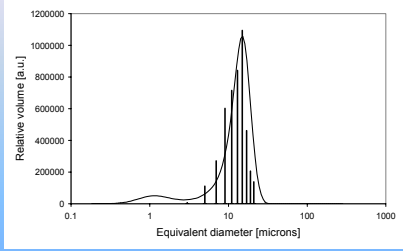
Size characterization of starch



Volume-weighted size distributions of tapioca starch
(q_3 histogram from MIA data, curve measured by LD)

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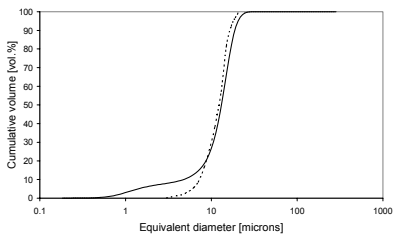
Size characterization of starch



Volume-weighted size distributions of tapioca starch
(Q_3 cumulative curves; dotted – MIA, solid – LD)

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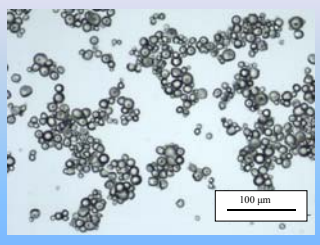

Optical micrograph of native corn starch

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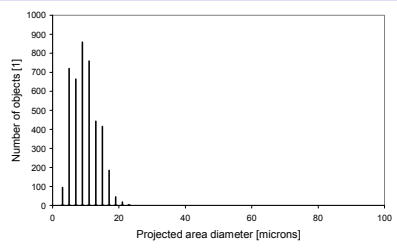
Size characterization of starch



Number-weighted frequency histogram (q_0)
of corn starch determined by MIA

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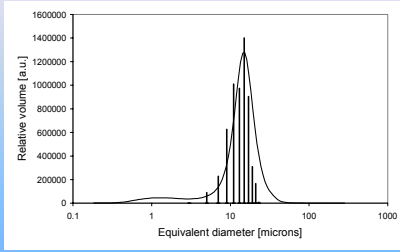
Size characterization of starch



Volume-weighted size distributions of corn starch
(q_3 histogram from MIA data, curve measured by LD)

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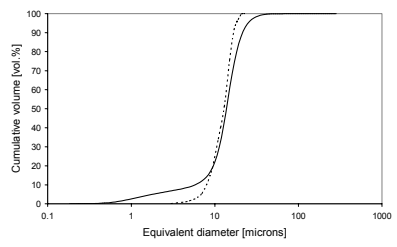
Size characterization of starch



Volume-weighted size distributions of corn starch
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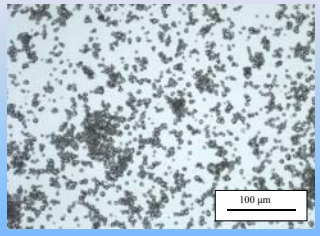

Optical micrograph of native rice starch

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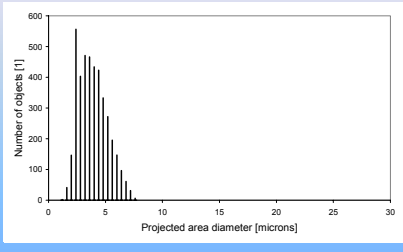
Size characterization of starch



Number-weighted frequency histogram (q_0)
of rice starch determined by MIA

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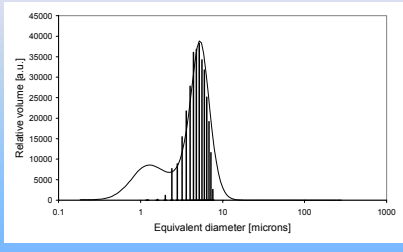
Size characterization of starch



Volume-weighted size distributions of rice starch
(q_3 histogram from MIA data; curve measured by LD)

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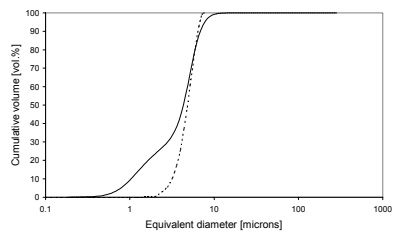
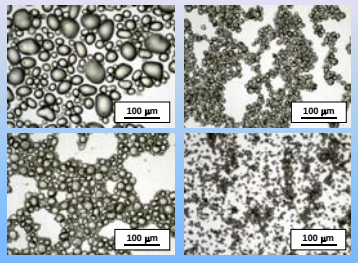
Size characterization of starch



Volume-weighted size distributions of rice starch (Q_3 cumulative curves; dotted – MIA, solid – LD)

Size characterization of starch

Potato Corn

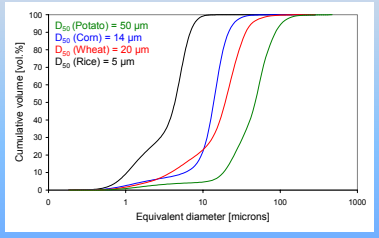


Wheat Rice

Micrographs of potato starch (top left), corn starch (top right), wheat starch (bottom left) and rice starch (bottom right)

Size characterization of starch

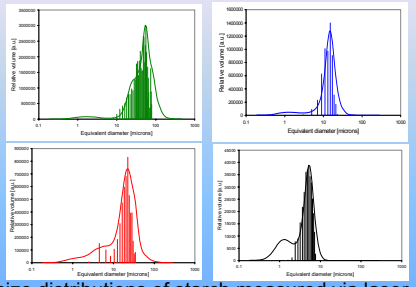
Laser diffraction **particle size distributions** of potato (green), corn (blue), wheat (red) and rice starch (black)



GREGOROVÁ, PABST, BOHAČENKO: *J. Eur. Ceram. Soc.* ***26***, 1121 (2006)

Size characterization of starch

Potato Corn



Wheat Rice

Particle size distributions of starch measured via laser diffraction (curves) and via microscopic image analysis (histograms)

Rheology of suspensions

RV 1 (Haake)

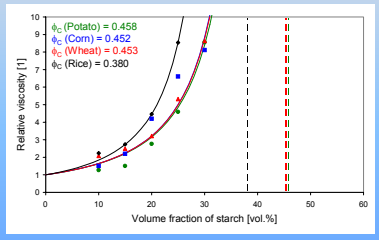
Rotational viscometry: RotoVisco 1 (Haake, Germany) with coaxial cylinder sensor Z41 / DIN 53018 (gap 3 mm), shear rates from 0 to 1000 s^{-1} at room temperature 23 ± 1 °C.

Oscillatory rheometry: RheoStress 80 (Haake, Germany) with coaxial cylinder sensor Z40 / DIN 53019 (gap 1 mm or 8 mm) at frequency 1 s^{-1}, thermostatic heater DC30 (heating 3 °C / min) and cooling unit K15 (cooling 0.5 °C / min).

RS 80 (Haake)

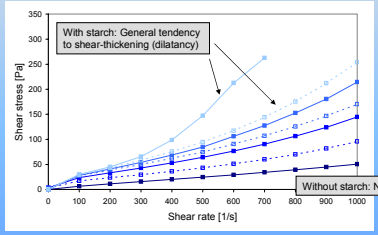
Rheology of suspensions

Relative viscosity of starch suspensions in 60 wt.% sugar solutions in dependence of the starch volume fraction



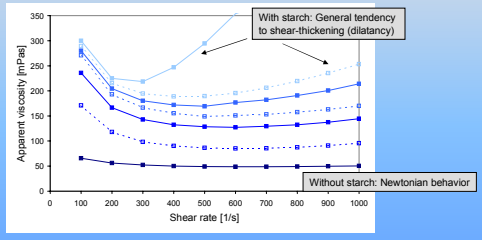
Rheology of suspensions

Flow curves of 80 wt.% alumina suspensions with 0, 5, 10, 15, 20, 25 and 30 vol.% starch (from bottom to top)



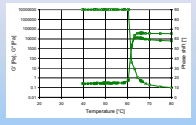
Rheology of suspensions

Viscosity curves of 80 wt.% alumina suspensions with 0, 5, 10, 15, 20, 25 and 30 vol.% starch (from bottom to top)

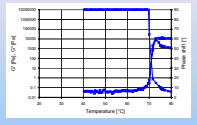


Rheology of suspensions

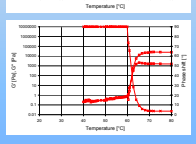
Potato



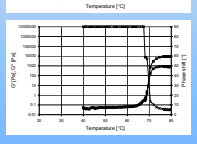
Corn



Wheat

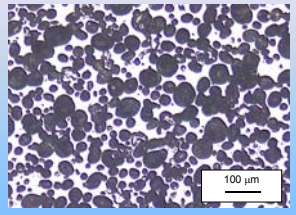


Rice



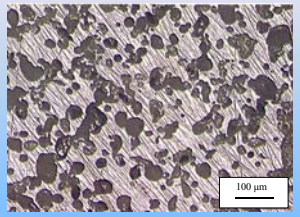
Rheometry of **starch-water suspensions**: storage modulus (empty), loss modulus (full) and phase shift (x)

Microstructure of ceramics



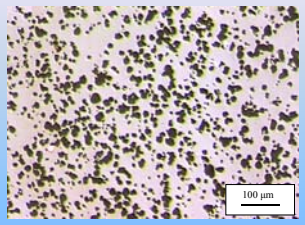
Microstructure of porous alumina ceramics prepared by starch-consolidation casting with potato starch as a pore-forming and body-forming agent

Microstructure of ceramics



Optical micrograph of zirconia ceramics prepared by SCC from a suspension containing 30 vol.% (based on solids) of potato starch

Microstructure of ceramics



Optical micrograph of zirconia ceramics prepared by SCC from a suspension containing 15 vol.% (based on solids) of corn starch

Microstructure of ceramics

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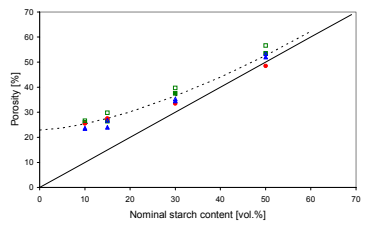
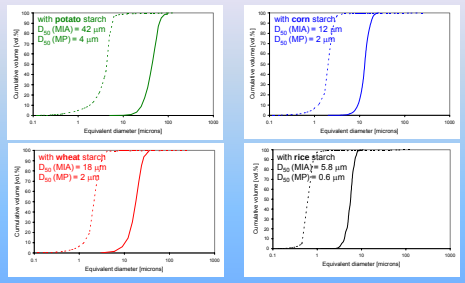


A nominal starch content of 10 vol.% results in a **porosity** more than twice this value (25 ± 1 %). Higher porosities approaching 60 % are difficult to achieve (require low solids contents to guarantee flowability).

Microstructure of ceramics



Pore size distributions measured via microscopic image analysis (MIA, pore body size) and mercury porosimetry (MP, pore throat size).

Acknowledgement

Research programme "Preparation and Research of Functional Materials and Material Technologies using Micro- and Nanoscopic Methods", Czech Ministry of Education, Youth and Sports (Grant MSM 6046137302).

Bilateral (Czech-German) Project Based Personnel Exchange Programme (PPP) "Characterization of Anisometric Particles and the Microstructure of Heterogeneous Materials", DAAD / Germany and Academy of Sciences of the Czech Republic (Grant D2 – CZ 21 / 06-07).

Project "Tvorba předmětu – Charakterizace částic a částicových soustav ", Czech Ministry of Education, Youth and Sports
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