



# Kelco

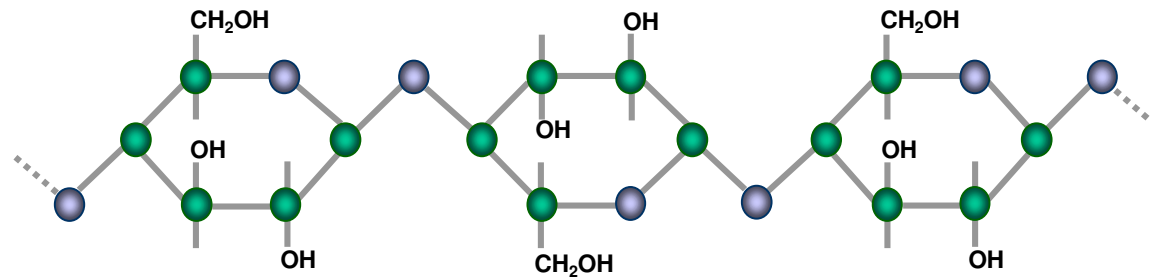
## ***Basic chemistry of CMC***

[www.cpkelco.com](http://www.cpkelco.com)

- Finifix      Industrial/technical CMC
- Cekol      Food/Pharma CMC
- Cellufix      Easy dispersible industrial CMC
- Cellcosan      Industrial CMC with high DS
- Nymcel      Cross linked pharmaceutical CMC
- Celflow      Modified CMC

# CMC: Carboxymethyl Cellulose

Cellulose  
(wood/cotton)

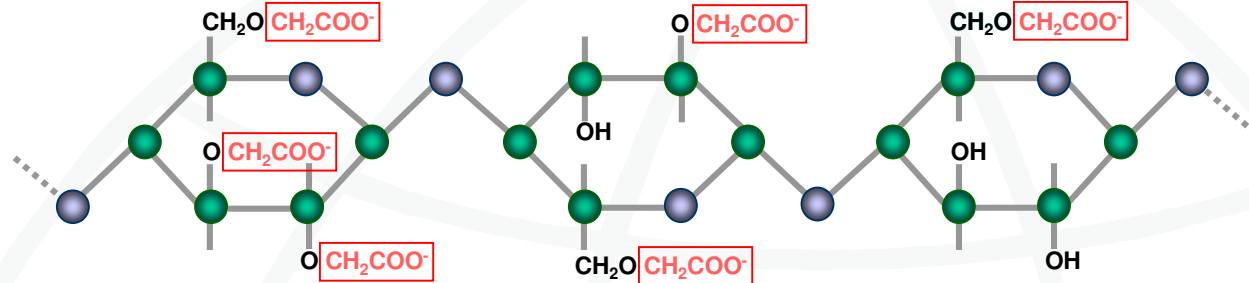


Sodium Hydroxide

Monochloro acetic acid

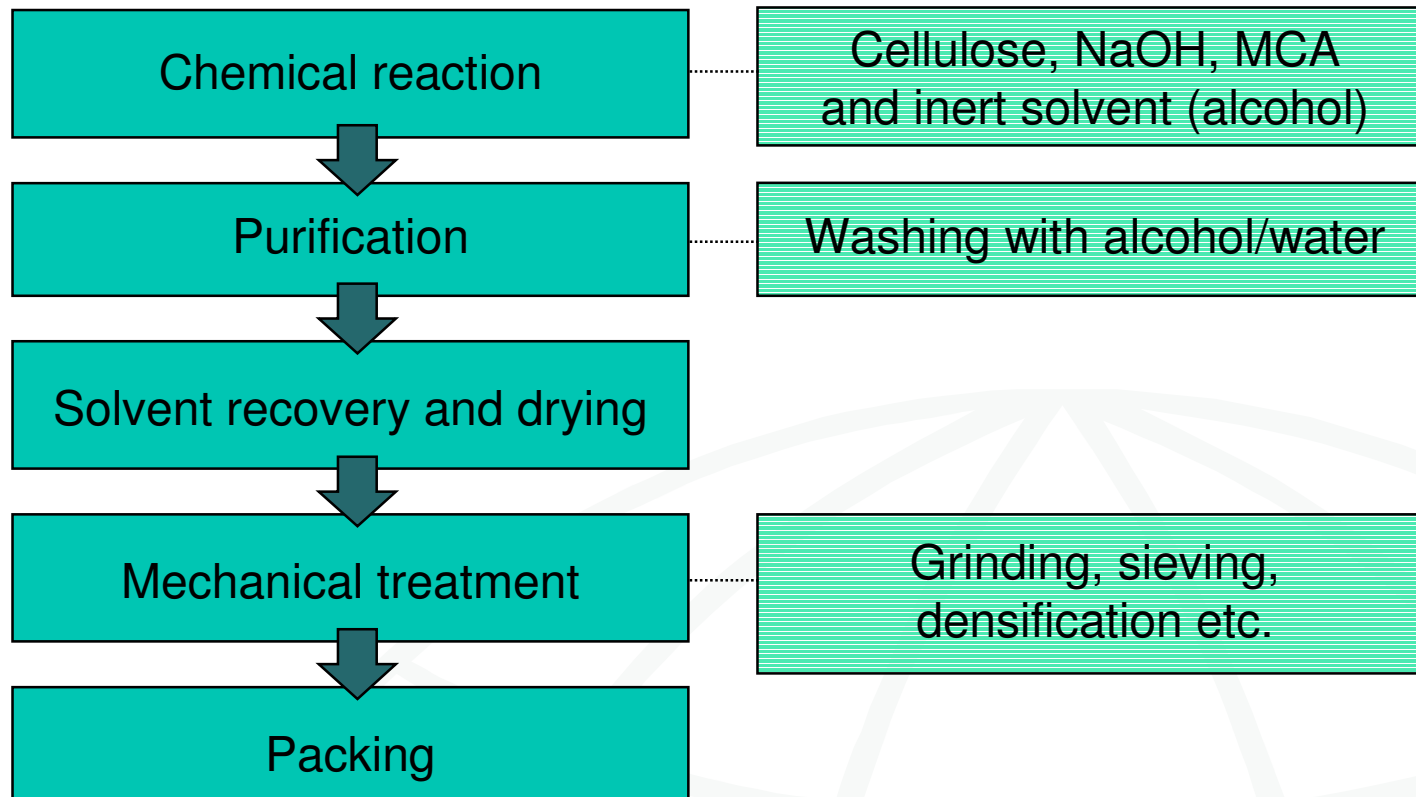


CMC



+ sodium chloride and sodium glycolate

- **Cellulose ether produced by chemical modification of cellulose**
- **CMC= Sodium CMC, Cellulose gum, Sodium Carmellose**
- **Anionic poly electrolyte**
- **White to off-white fibrous powder**
- **Cold water soluble**



- **Technical**

55 - 75%  
(remaining is salt)

Paper, Detergents, Oil drilling



- **Purified**

>98.0%  
>99.5%

Paper, Textile, Paint  
Food, Pharma & Personal Care

**Chemical parameters**

- Molecular weight / viscosity
- Degree of substitution
- Molecular design
- Cellulose source

**Physical parameters**

- Powder / granules
- Bulk density
- Surface modification

**Process parameters**

- Reaction time
- Reaction temperature

- Rheology
- Water binding capacity
- Stability
- Interaction with other components
- Adhesion
- Dissolution speed
- Processing
- Dispersibility
- .....

- **Increasing molecular weight:**

→ higher viscosity

→ more pseudoplasticity

→ less stable

- **Increasing DS:**

→ more stability

→ more clarity

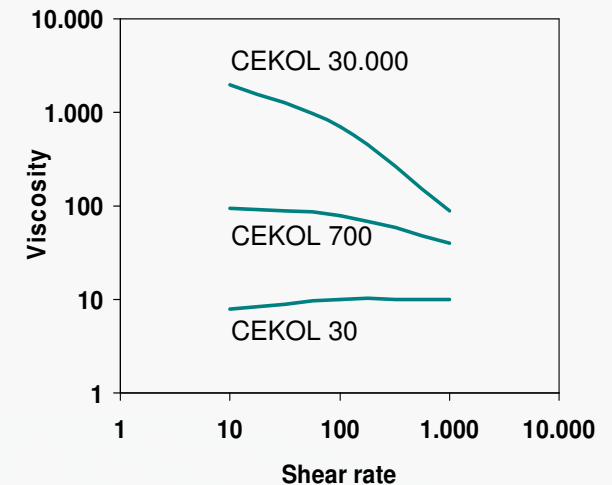
→ more water interaction

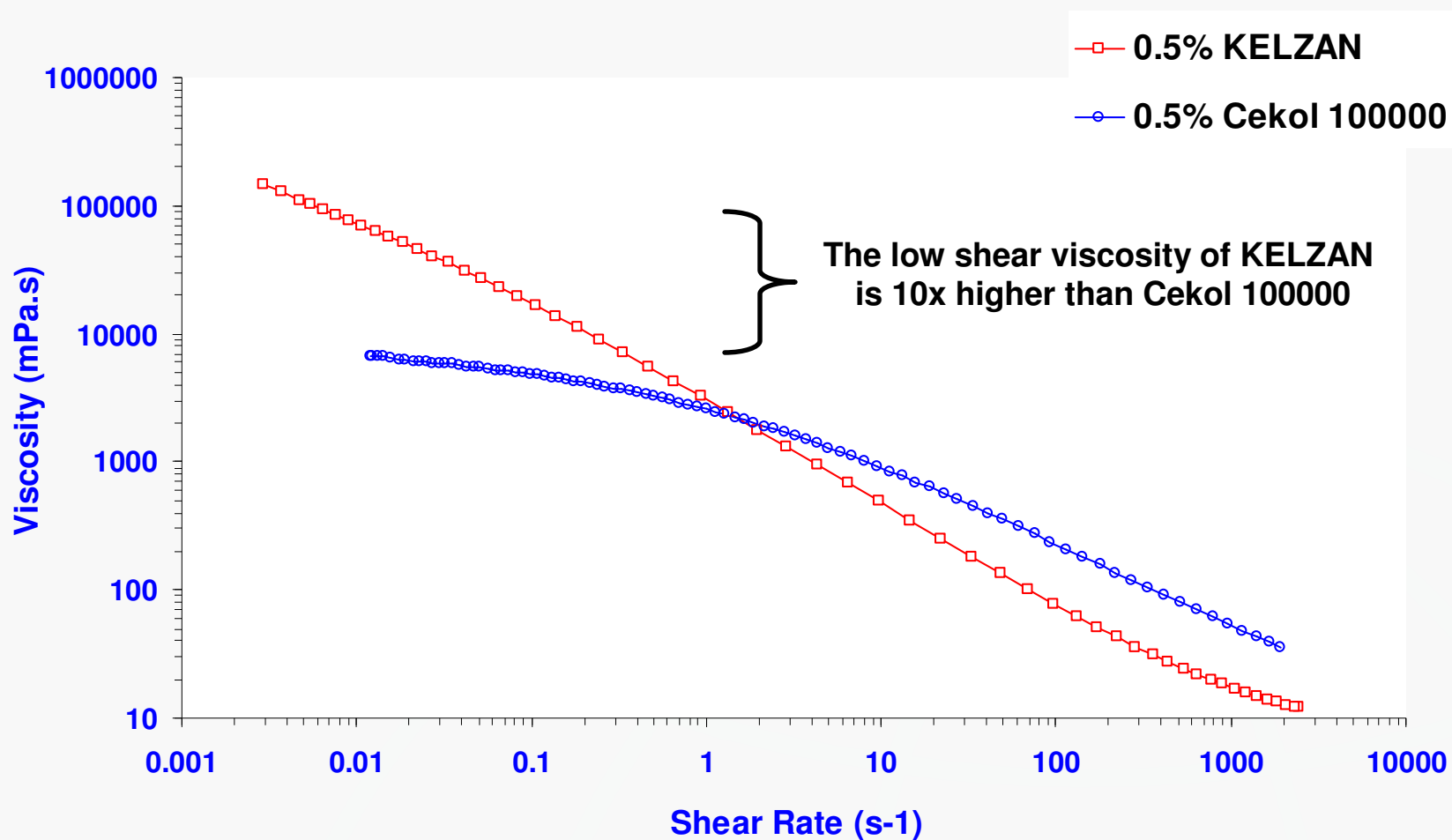
→ less thixotropy

→ less interaction with a.o. glycerol

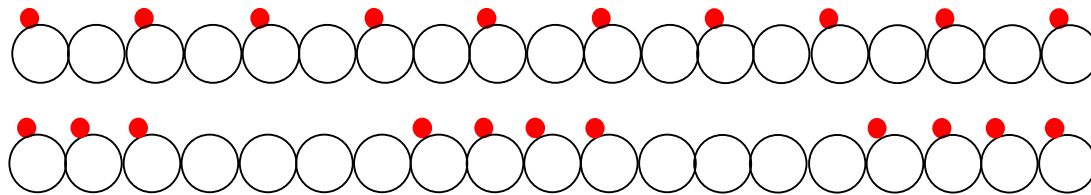
-In theory, maximum DS is 3.0 and minimum is 0.0 (=cellulose)

-Commercially between 0.40-1.50, typically between 0.60-0.90





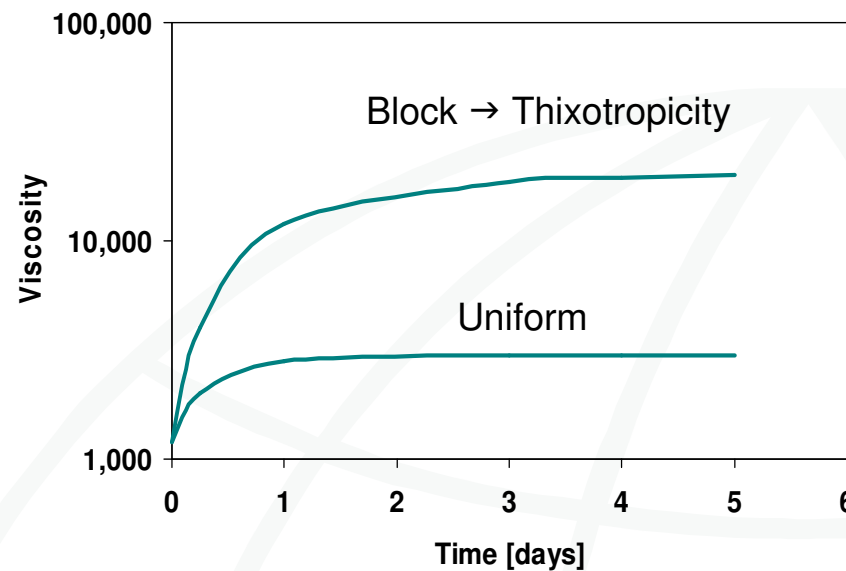
# Distribution of Substitution

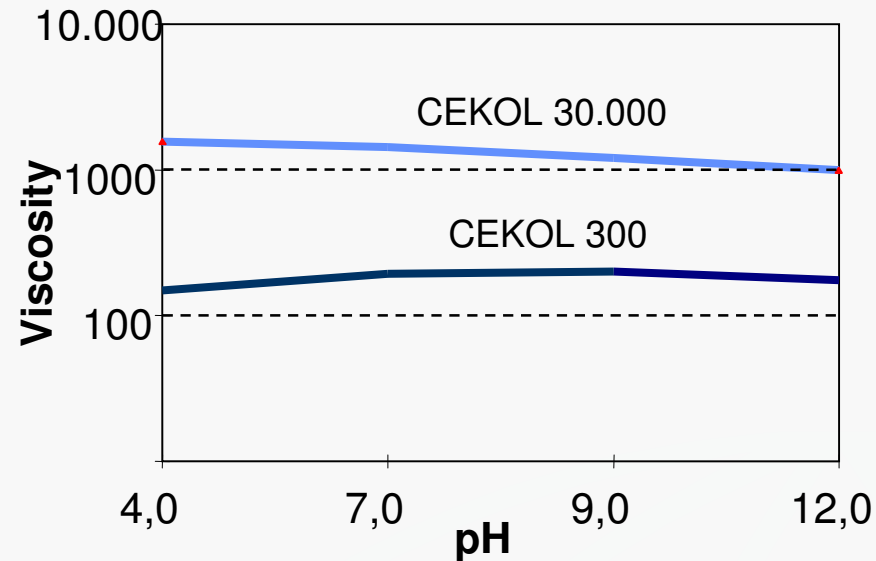


uniform

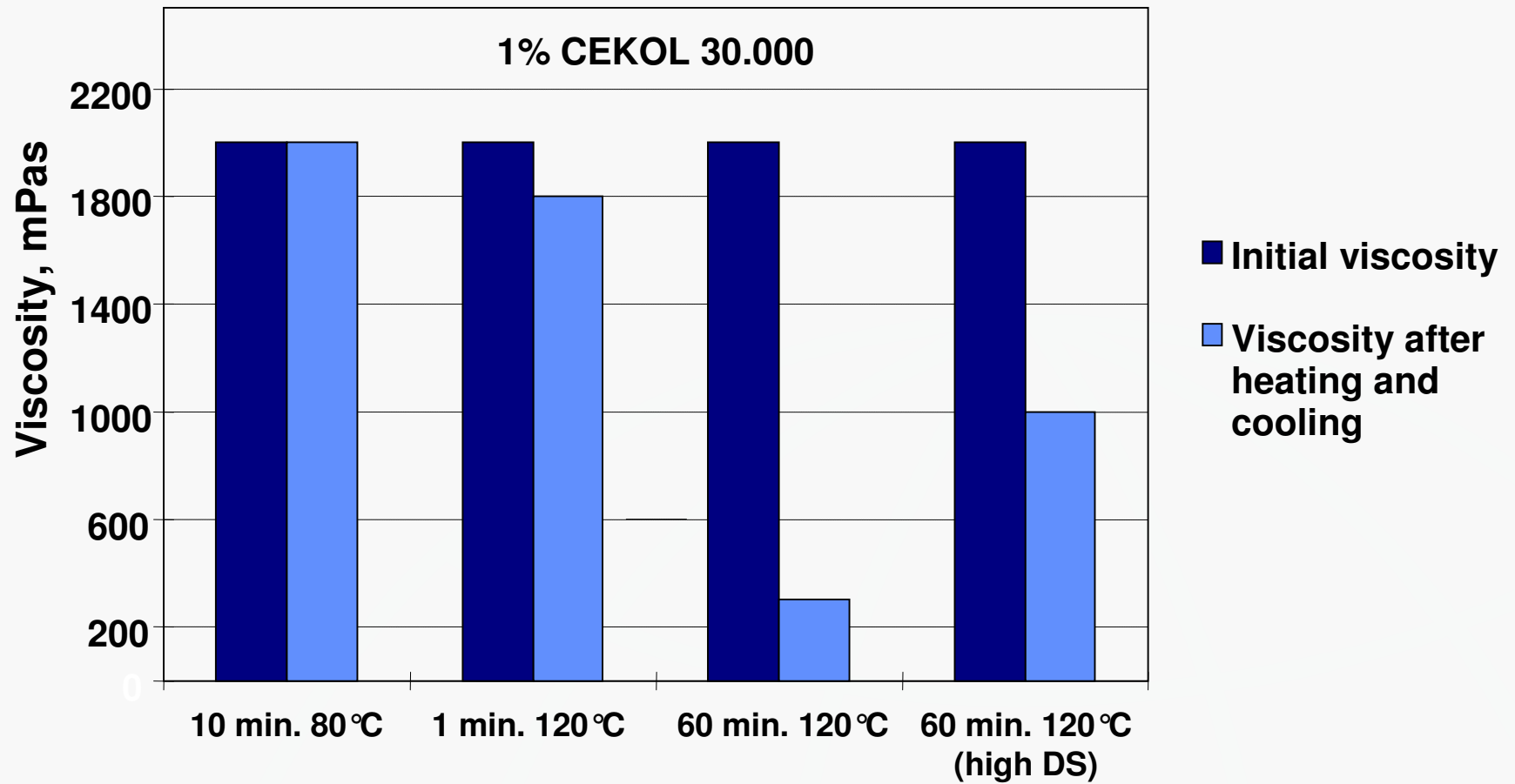
(both DS = 0,5)

block wise

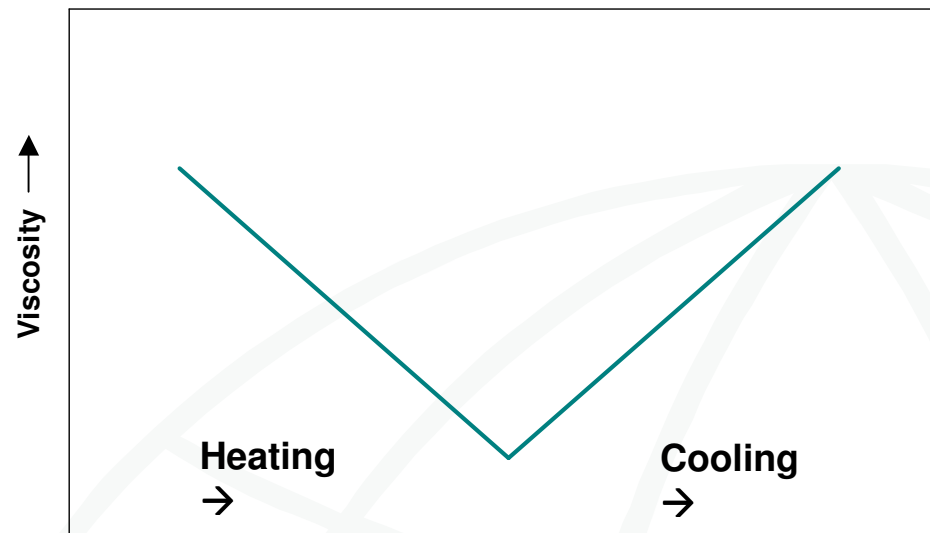




- **pH < 3-4:** → gelly particles (acidic CMC)  
→ viscosity drop and precipitation in time
- **pH > 12:** → viscosity drop in time



**Viscosity is reversible when heating and cooling  
(to a certain extend)**



- Every CMC factory has its own fingerprint with regard to the particle size distribution. It is impossible to exactly copy a competitive product (works both ways)
- Even within the same production line, the particle size distribution depends on viscosity, DS and CMC content of a grade.
- Cekol 30.000 from Sweden is somewhat different from:
  - Cekol 30.000 from Holland
  - Cekol 30 from Sweden
- It is is very difficult to give general specifications on particle size

- Smaller particles dissolve faster, but good mixing is required!!  
Granular particle disperse very easy but it takes longer to dissolve
- Fine powder (P-grade) or granules (G-grade) are produced by either sieving or grinding.
- Also coated CMC grades available for improved dissolution behaviour

- Finland produces industrial grades and its standard particle is bigger than Sweden and Holland as this is generally desired by the industry:

<u>P-grade from</u>	<u>&gt;0.075 mm</u>
-Sweden	max 20%
-Holland	max 20%
-Finland	max 30%

- These typical values are workable for most customers. When the volume allows it, it is possible to make customer specifications on different sieves.

## ***Basic properties of CMC***

- Viscosity: Newtonian to 'pseudoplastic'
- Thickening properties
- Stabilising
- Water retention
- Good film forming (Transparent films, tablet coating)
- Anti re-deposition (Detergents)
- Tablet disintegrant (Control tablet dissolution)
- Binding (Welding rods, Car batteries)