

# RECRYSTALLIZATION OF HONEY – CAUSES AND PREVENTION

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# WHAT IS HONEY CRYSTALLIZATION?



- Formation and growth of sugar crystals  
→ granulation
- Main sugars in honey, which will crystallize: Glucose, Melezitose
- Periods of (re-)crystallization: few days (very rapid) to > one year (slow)
- Appearance of honeys
  - Liquid, stable
  - Crystallized
  - Liquid, unstable (tendency to crystallize)

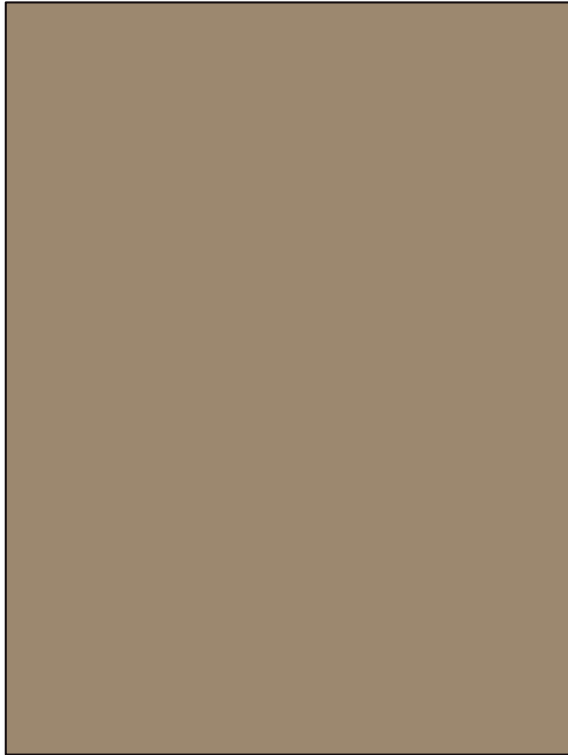
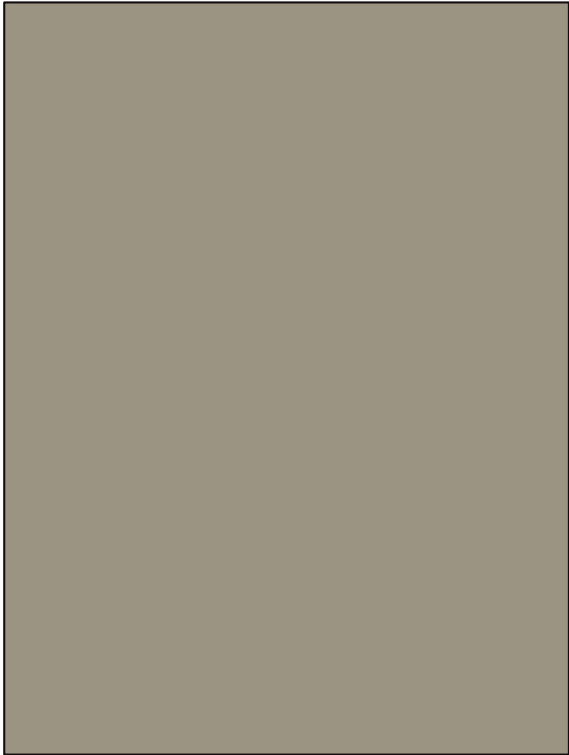




# PROBLEMS OF HONEY CRYSTALLIZATION

- Muddy appearance (turbidity) → reduced customer acceptance
- Phase formation → microbiologically unstable
  - Water content in liquid layer: 1 – 2 % higher than in complete product
  - higher number of yeast cells
- More complicated technological processing (blending, bottling)

# APPEARANCE OF CRYSTALLIZED HONEYS



# INTRINSIC INFLUENCING FACTORS

- Saturation point of glucose in honey: 32 %  
→ exceeded significantly in many blossom honeys
- Glucose contents in honey:  $\approx 25 - 39 \%$
- Fructose contents in honey:  $\approx 29 - 47 \%$
- Water contents in honey:  $\approx 14.0 - 20.0 \%$
- The higher the G/W, the higher the tendency to crystallize rapidly
  - G/W ratios:  $\approx 1.3 - 2.8$
  - $> 2.1 \rightarrow$  fast crystallization
- The lower the F/G, the higher the tendency to crystallize rapidly
  - F/G ratios:  $\approx 0.95 - 1.70$
  - $< 1.20 \rightarrow$  fast crystallization

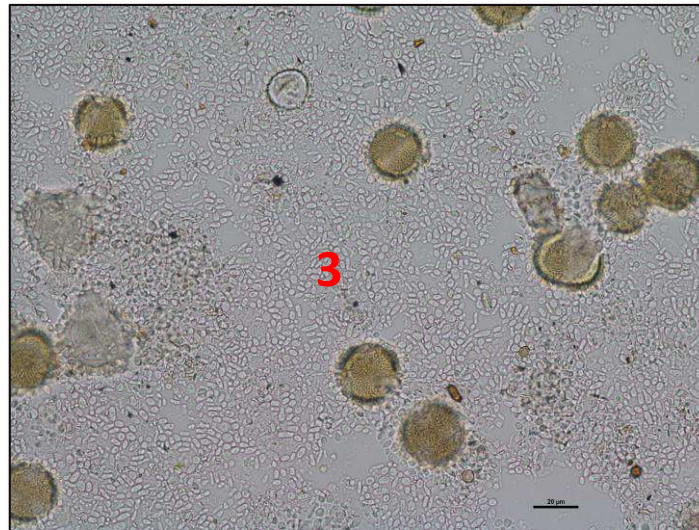
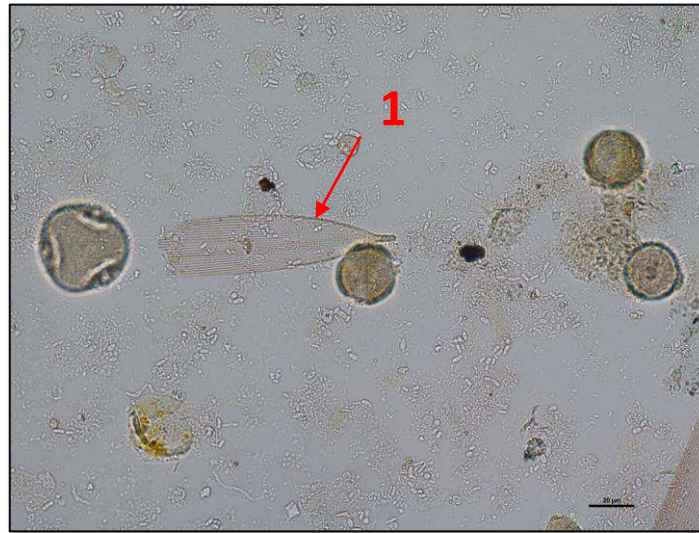




# SEDIMENT PARTICLES



- Small particles = starter crystals
- Honey-typical particles:
  - Parts of bee bodies (1)
  - Plant components (2)
  - Pollen
  - Yeasts (3)
  - Starch (4)
  - Sugar crystals





# EXTERNAL INFLUENCING FACTORS - STORAGE TEMPERATURE

- „Low“ temperature:
  - Low viscosity → reduced mobility of sugar molecules
- „High“ temperature:
  - Crystals liquefied
  - Degree of supersaturation of glucose decreased

temperature [°C]	crystallization tendency
< 4	slow
14 - 16	very fast
> 25 - 30	slow

# STORAGE TEST



- Test: force crystallization under specific conditions
  - Reference samples: liquid blossom honey (F/G 1.19, G/W 1.94)
  - Spiking with 10 % glucose syrup (G/W 1.90), Storage at 15 °C

**without glucose addition**



**Start**

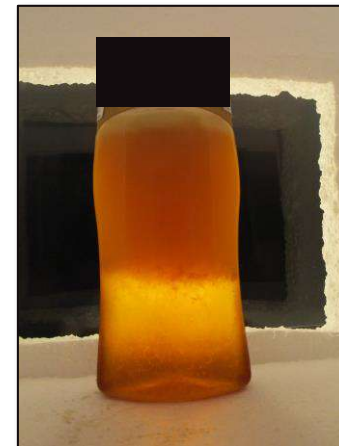


**after 2 days**



**after 7 days**

**with glucose addition**







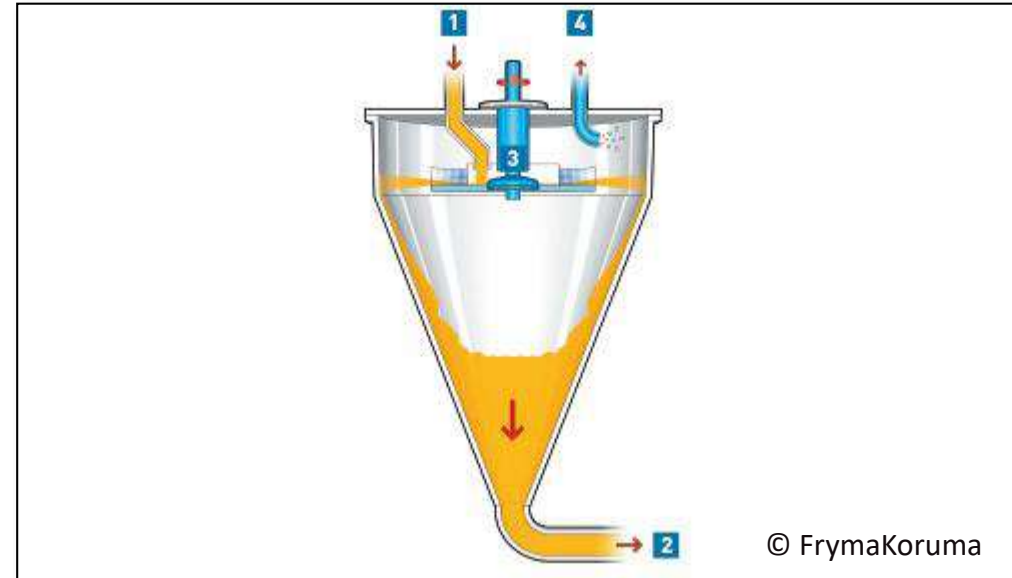
# HONEY PROCESSING - HEATING

- Makes honey more flowable
  - Dissolves many crystals
  - Bloating of rough particles
- 
- Avoid generation of HMF
  - Prevention of melting wax: melting temperature is 54 °C → will pass filters and re-crystallize fast

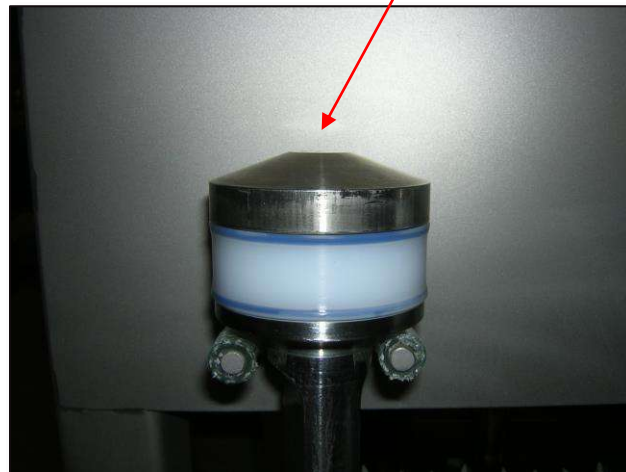
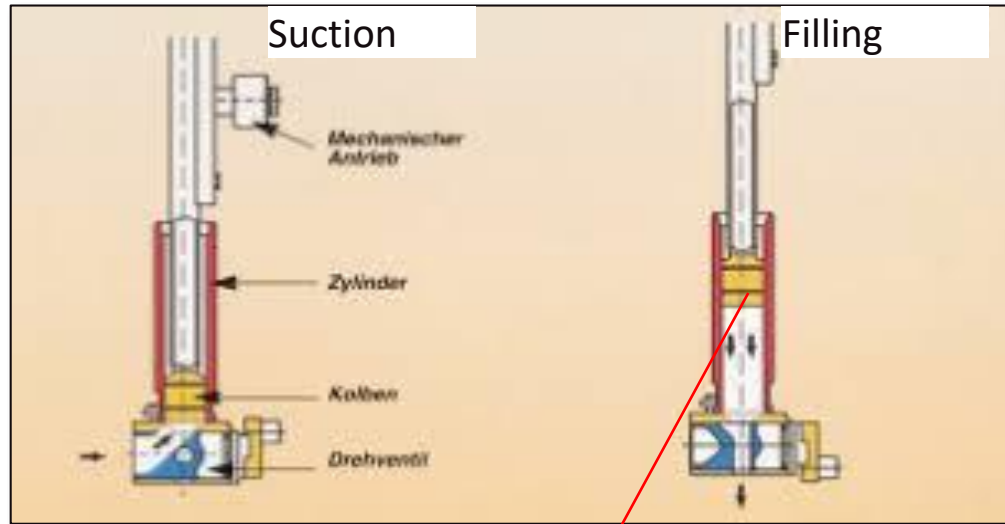
# HONEY PROCESSING - VENTILATION



- Removal of air bubbles: Use of vacuum evaporators
  - Air temperature: 70 °C
  - Slow flow rate
  - Constant honey layer on the bottom



# HONEY PROCESSING - BOTTLING

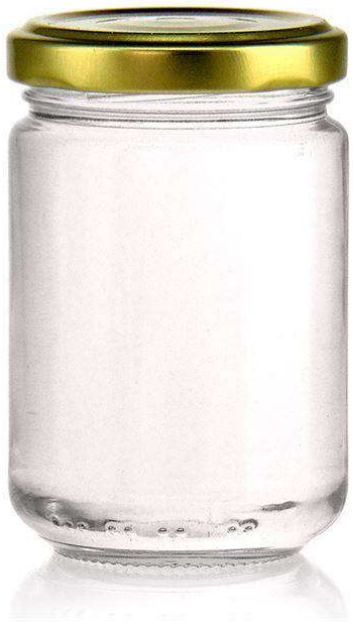


- Leakage of seals of piston fillers: important reason for incorporation of air bubbles  
→ must be checked and replaced regularly

# PACKAGING



- Edges and structures will promote crystallization
- Material: plastic > glass





# FORECAST OF CRYSTALLIZATION

- Analytical test results of fructose, glucose and moisture
- Applying polarized light: Intertek-prototype
- Store honey sample at  $\approx 15\text{ }^{\circ}\text{C}$



- Usage decision of honey batch: liquid or creamed honey
- Quality control after bottling

# POLARIZED LIGHT



visual perception



with instrumental detection



# SUMMARY

- (Re-)crystallization is a complex process
  - Influenced by many parameters
- Avoiding crystallization:
  - Raw honey: low G/W, high F/G
  - Optimize process conditions: remove everything which promotes crystallization
  - Storage under optimal temperature
  - Use optimal packaging
- Forecast of crystallization:
  - Test pre-shipment samples for F/G and water
  - Applying polarized light
  - Make use of Intertek Inspections for honey processing

