

Desalination of medieval wall paintings with hydrogels

Julie Bartholdy











Fotos: Roberto Fortuna, The National Museum og Denmark

PTU E Poutice desalination of medieval wall paintings





Pore size distribution (MIP) in lime plaster vs. poultices





Foto: Isabel Brajer

Data for poultice materials: Lubelli, B., & van Hees, R. P. (2010). Desalination of masonry structures: Fine tuning of pore size distribution of poultices to substrate properties.

DTU E Desalination with cellulose poultice



Desalination of lime plaster with cellulose poultice



low saltcontent high

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Hydrogels

Highly hydrophilic polymer networks

High water retention

Superficial wetting and desalination

Extracts salts by diffusion

DTU Desalination with hydrogels





Salt content %(w/w) in wall paintings of Sejerø Church Whitewash (0-0,3mm) plaster (0,3-7 mm) and bricks (7-30 mm)





Desalination of lime plaster with agar gels



low

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DTU Desalination with hydrogels







DTU Medieval wall painting replicas







DTU Lime plasters, optical microscope Varying binder content

Medieval (Sejerø) B:A (v/v) 1,9:1 (B=35%) Porosity: 35,2%*



MM1.1 B:A (v/v) 3,0:1 (B=75%) Porosity: 42% MM1.3 B:A (v/v) 1,0:1 (B=50%) Porosity: 30%

All photomicrographs: Field of view 7.7 mm.

*Result from Mette Midtgaard, not Sejerø

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DTU EXAMPLE Lime plasters, water absorption coefficient (WAC) with contact sponge

Varying binder content and mixing technique





DTU EXAMPLE Lime plasters, water absorbtion coefficient (WAC) with contact sponge

Varying binder content and mixing technique









Varying binder content and mixing technique

Cross sections, 5000x magnification



Production of lime plasters for laboratory specimens

Conclusions

- With binder-rich mortars (MM1.1 and JB1.1) similar micro structure (visible in optical microscope) to those of medieval plasters is achieved
- Close correlation between water absorption rates (WAC) and binder content
- The mixing technique influence on the crystal shapes and pore size distribution





DTU Production of lime plasters for laboratory specimens

Fine-tuning replicate lime mortars developed by Mette Midtgaard:

- Increasing binder content
- Mixing procedure wet hot mixed vs. dry hot mixed

New replicate lime mortars

MM1.1: wet hot-mix. Mixing ratio B:A:W (w/w) 1:1:3 MM1.3: wet hot-mix. Mixing ratio B:A:W (w/w) 1:3:3 JB1.1: dry hot-mix, mixing ratio B:A:W (w/w) 1:1:1,7

Binder: Milled quicklime (CL90-Q (R5. Psv)) from Faxe Aggregate: Quartz sand <1 mm

Tested after 1 year and 8 months of carbonation

Compared with medieval lime plasters from Sejerø and Lillerød

Thanks to Mikael Martlev for mixing mortars



