A NOVEL EXUDATION TEST METHOD

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nexoleum

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Introduction

- Continued pursuit for sustainable solutions → new PVC plasticisers and additives
- Challenge: properly evaluate materials and compare properties
- Exudation
  - Highly relevant
  - Current existing tests: limited or in-house
- New exudation test method:
  - Quantitative
  - Comparative
  - Sensitive
  - Reliable

Exudation

- Definition

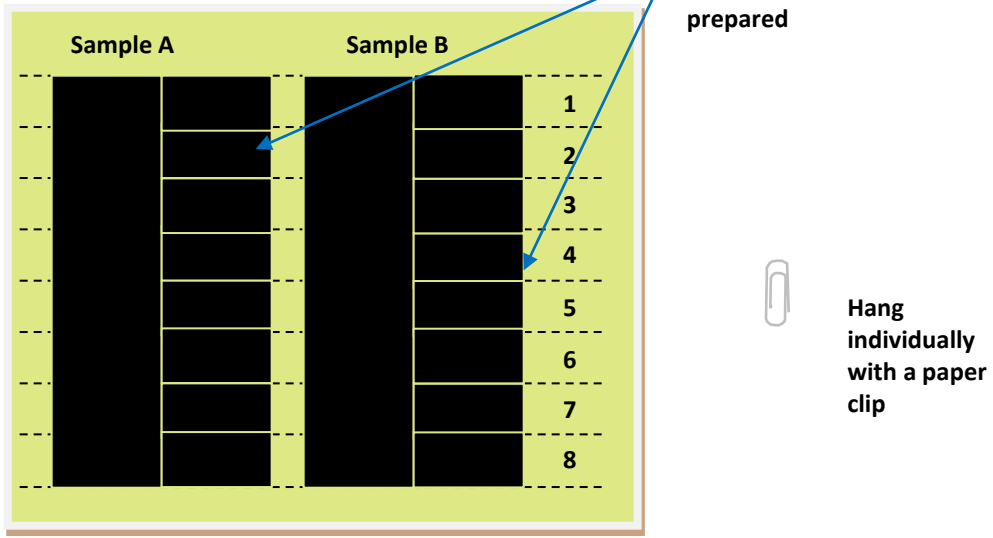
Methodology

Basic principles

- Various measurements explored
  - Visual
  - Weight
  - Gloss
  - Surface Tension
- Three laboratories
  - All test specimens prepared at once
  - Different conditions
  - Different operators
- Various raw materials
  - Industry standards
  - Well known poor performers

Methodology
Sample preparation

- Samples for weight and surface property measurements

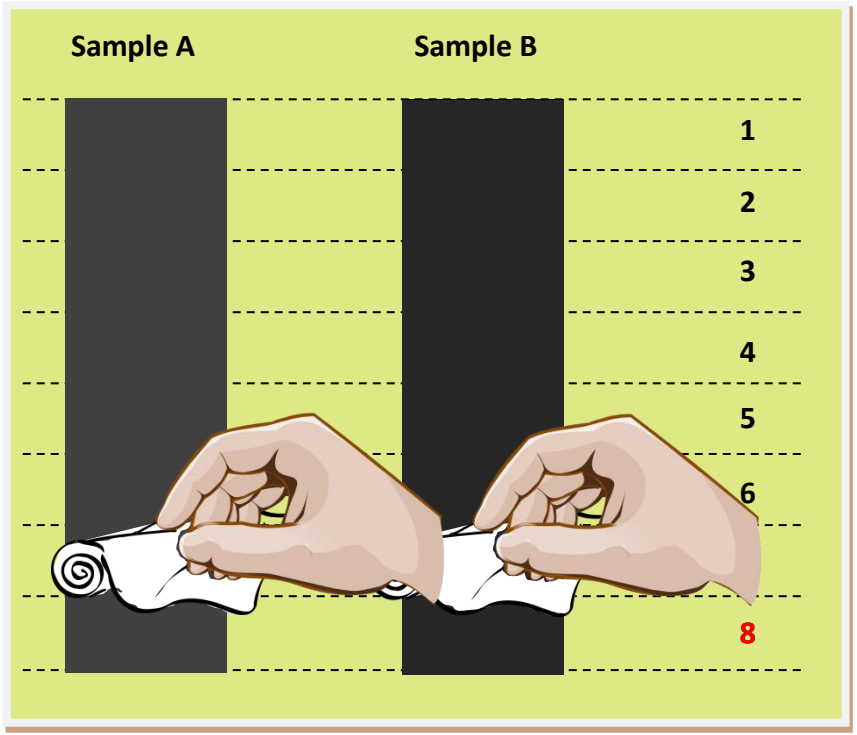


Methodology

Procedures

- Preparation of “gradient” visual evaluation

Start: Nov/01



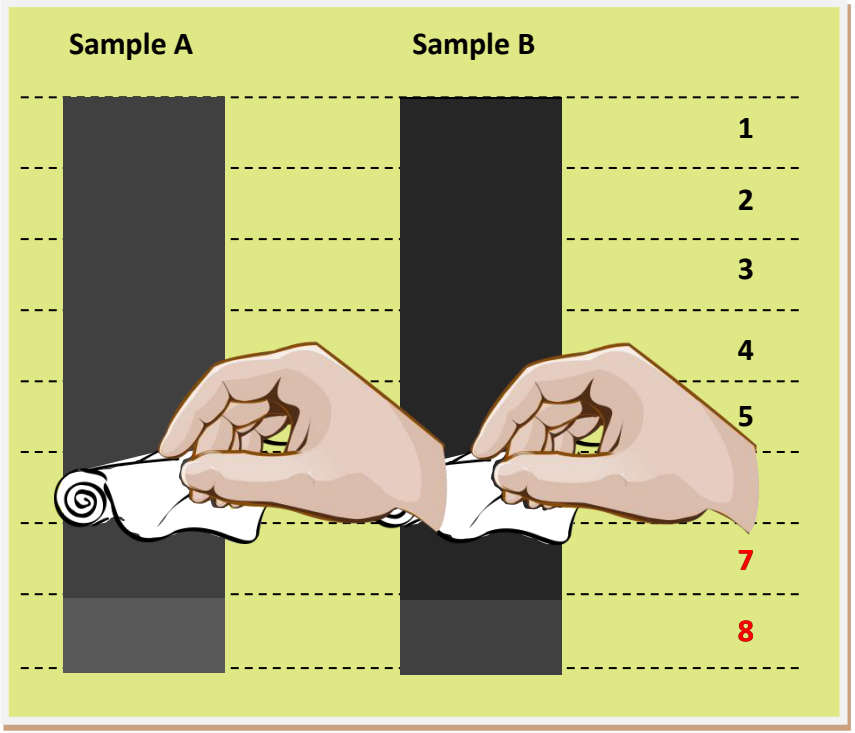
Nov/08

Methodology

Procedures

- Preparation of “gradient” visual evaluation

Start: Nov/01



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Methodology

Procedures

- Preparation of “gradient” visual evaluation

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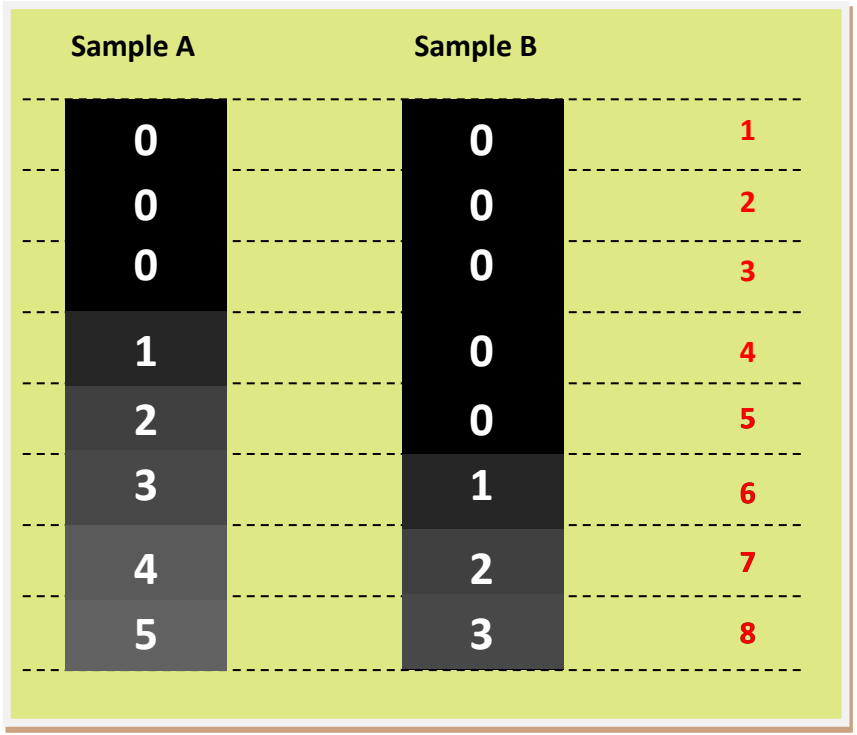


A score from 0 (no visual exudation) to 5 (maximum visual exudation) was assigned to each “cell” at the end of the experiment,

Methodology

Measurement procedures

- Mass measurements:
  - Each week, weigh corresponding test sample before and after cleaning
  - Mass variation is noted
  - Value is calculated in g/m^2 exudate
- Gloss and surface tension* measurements:
  - Each week, corresponding test sample is submitted to gloss meter and surface tension determination
  - Value is noted
- Visual evaluations:
  - After the end of 8 weeks, a score from 0 to 5 is given based on comparative evaluation of all test samples
  - Value is noted

* Obs.: Surface tension measurements yielded no difference in measurement for all tested samples, therefore results were not considered in the discussion

Experimental design

- Sample size:
  - Strip width: 10 cm (split in two parts with 5 cm)
  - Strip length: 24 cm
  - Cell size: 3 x 4 cm
- Formulations:
  - Resin: 100 phr (type according to design)
  - Plasticiser (according to design)
  - CaZn Stabilizer: 1.5 phr
  - Black master batch: 7 phr

- Design (2^k):
  - For each plasticiser, 8 samples:
    - Thick and Thin sheets
      - Emulsion resin sample thickness: 0.25 and 0.50 mm
      - Suspension resin sample thickness: 0.50 and 1.00 mm
    - Low and High phr
      - Emulsion resin, plasticiser phr: 60 and 80
      - Suspension resin, plasticizer phr: 40 and 80
    - Emulsion and Suspension resins
      - Emulsion Resin: Norvin EP121 LM
      - Suspension Resin: Norvin P 1000

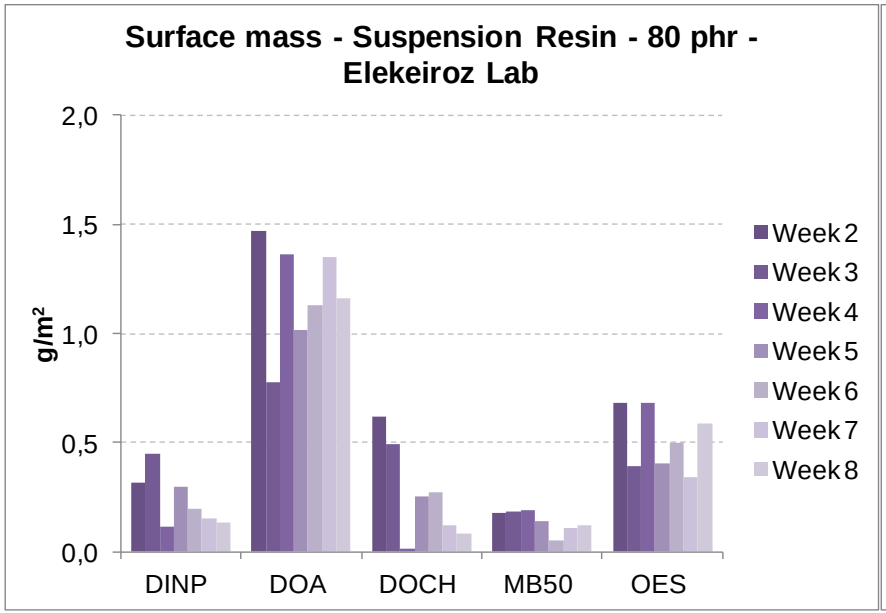
Results

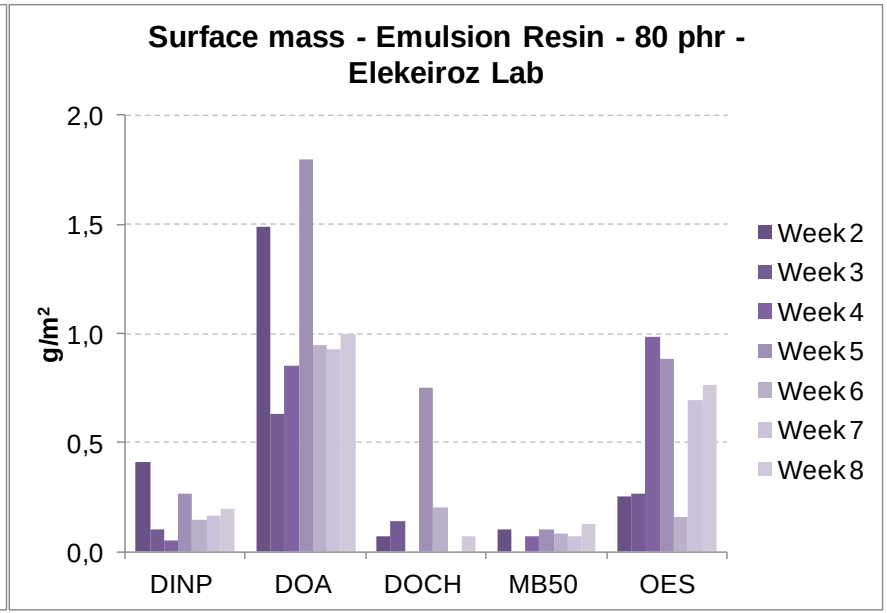
- Heavy exudation example

Results

Exudation comparison

- Surface mass measurement (emulsion and suspension resin)



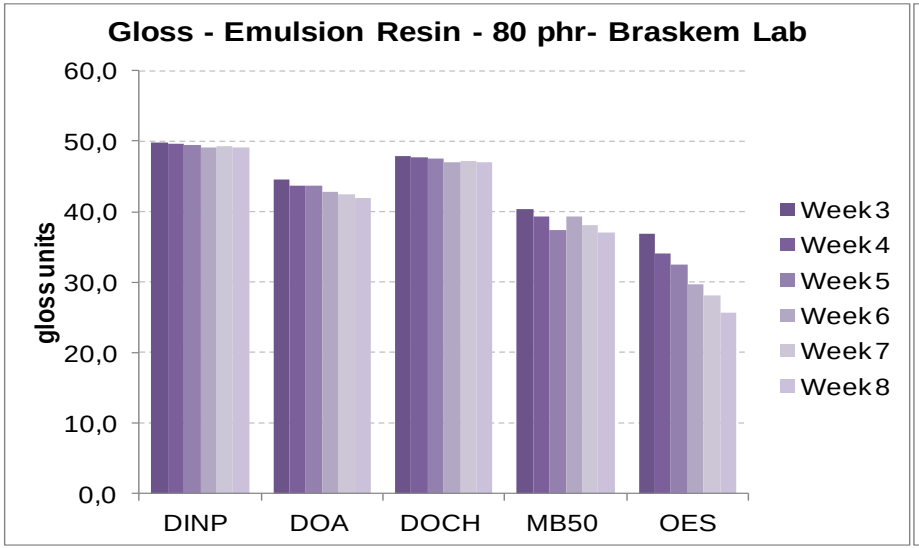


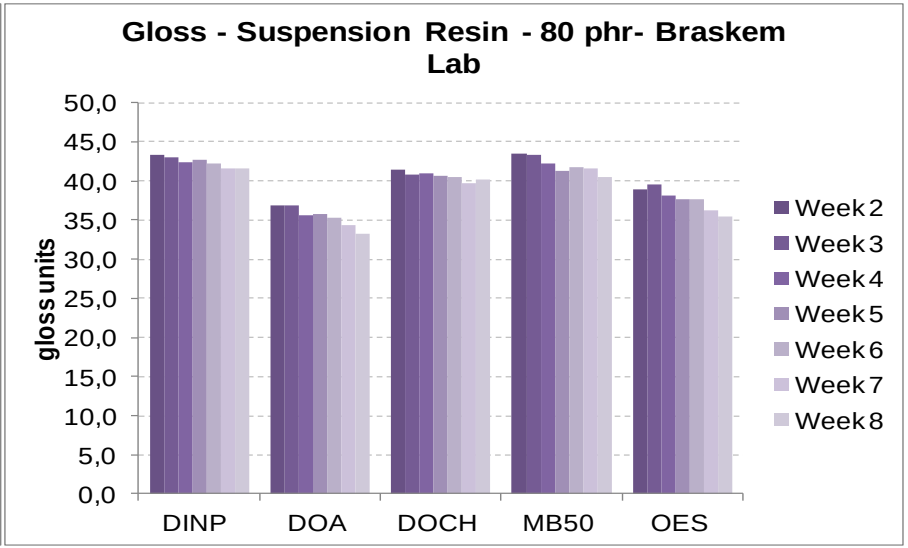
Obs.: Consistency of results for both types of resin

Results

Exudation comparison

- Surface gloss measurement (emulsion and suspension resin)



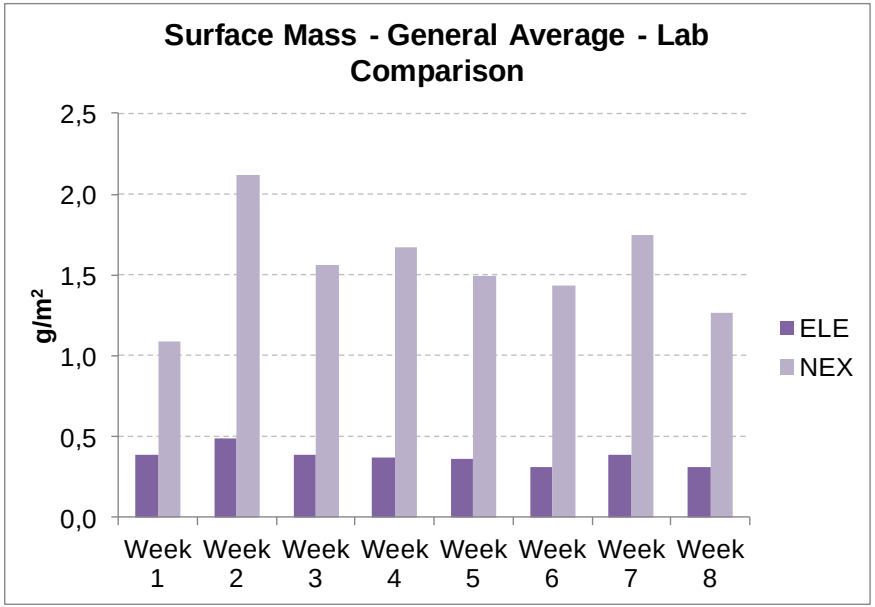


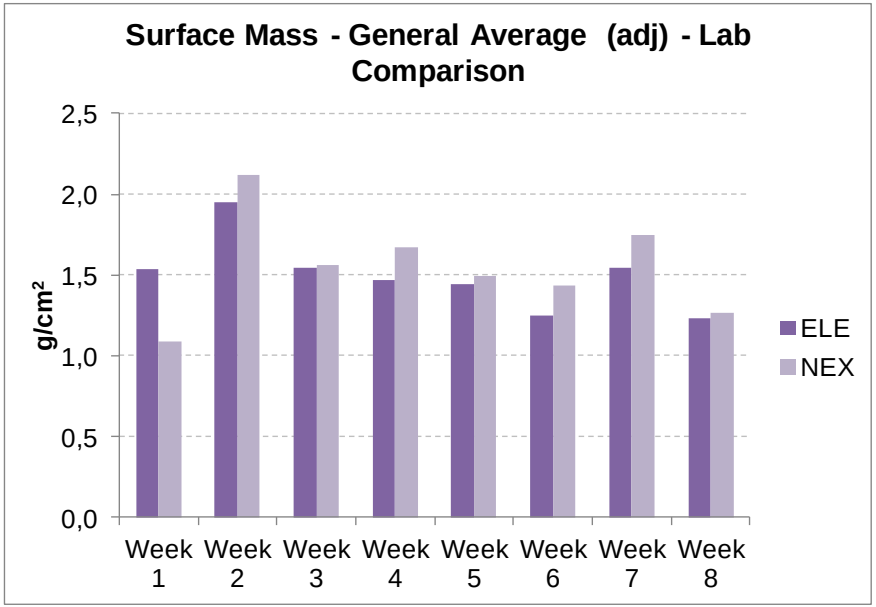
Obs.: Less consistency. Gloss is affected by “type” of exudation: hazy, greasy, waxy

Results

Exudation comparison

- Surface mass measurement (different laboratories)



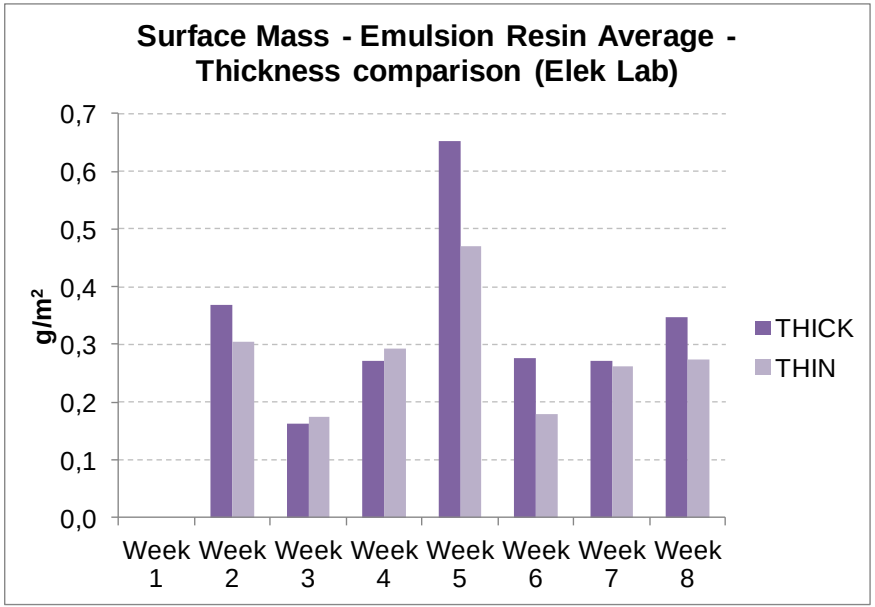


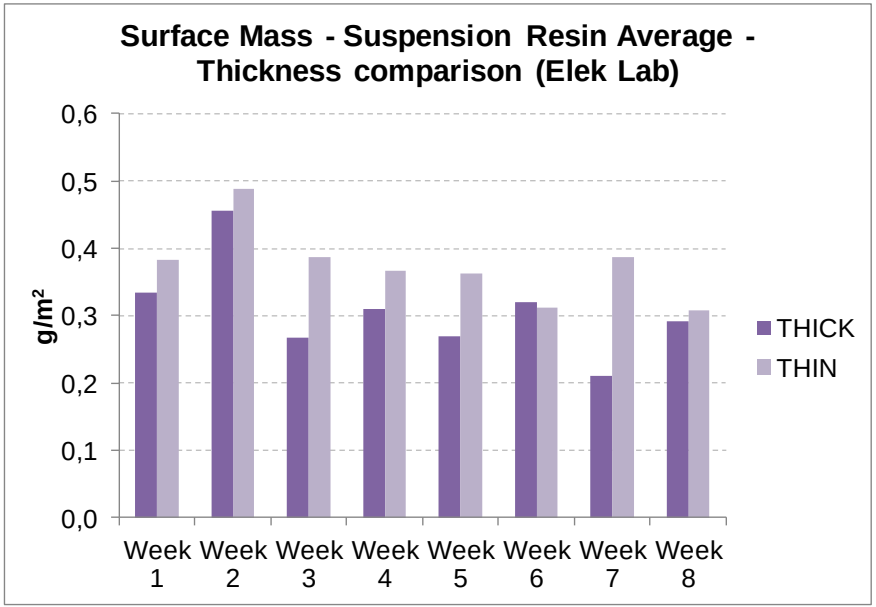
Obs.: Nexoleum lab ran under no temperature control. Elekeiroz @ 23°C, 50% humidity.

Results

Exudation comparison

- Surface mass measurement (different thickness)



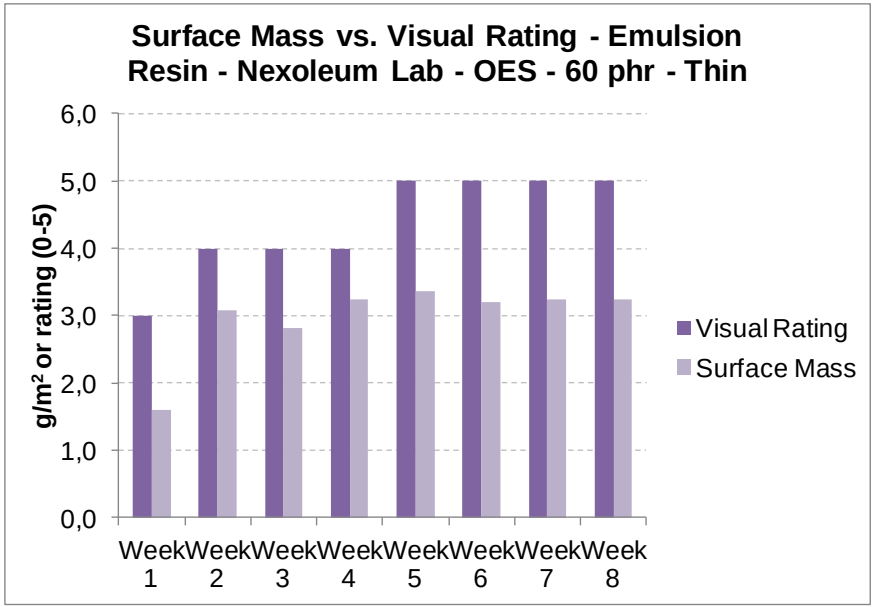


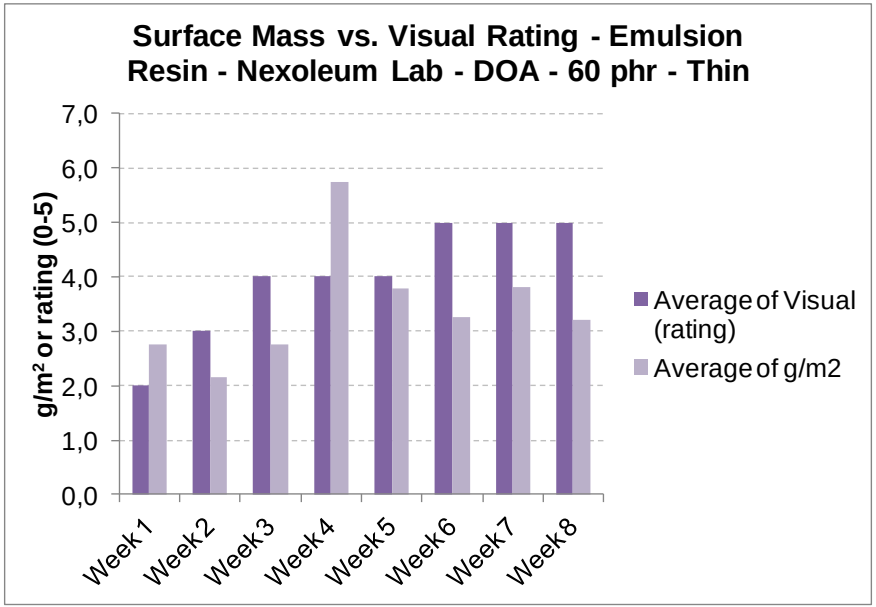
Obs.: Thickness appears to have very little effect on exudation

Results

Exudation comparison

- Surface mass measurement compared to visual rating





Obs.: Visual rating results fairly consistent with mass measurements

Conclusions

- Findings
  - Temperature and air movement greatly impact exudation
  - Thickness of the sample has little effect on exudation
  - Gloss and surface tension do not seem reliable as measurement tools
  - Visual observations are supplemental
  - Best and most consistent results obtained with surface mass measurements
  - Test has greater utility as a comparative tool
- Next steps
  - Initial results based on small sample, more data should be gathered to improve statistical significance
  - Interesting potential to be considered as a standard for exudation evaluations
    - Consistency of initial results
    - Simplicity of procedures
    - Key impact factors identified

THANK YOU