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Investigation of alkyl polyglucoside / fatty alcohol mixed surfactant ability to form lyotropic liquid crystals in formulated systems

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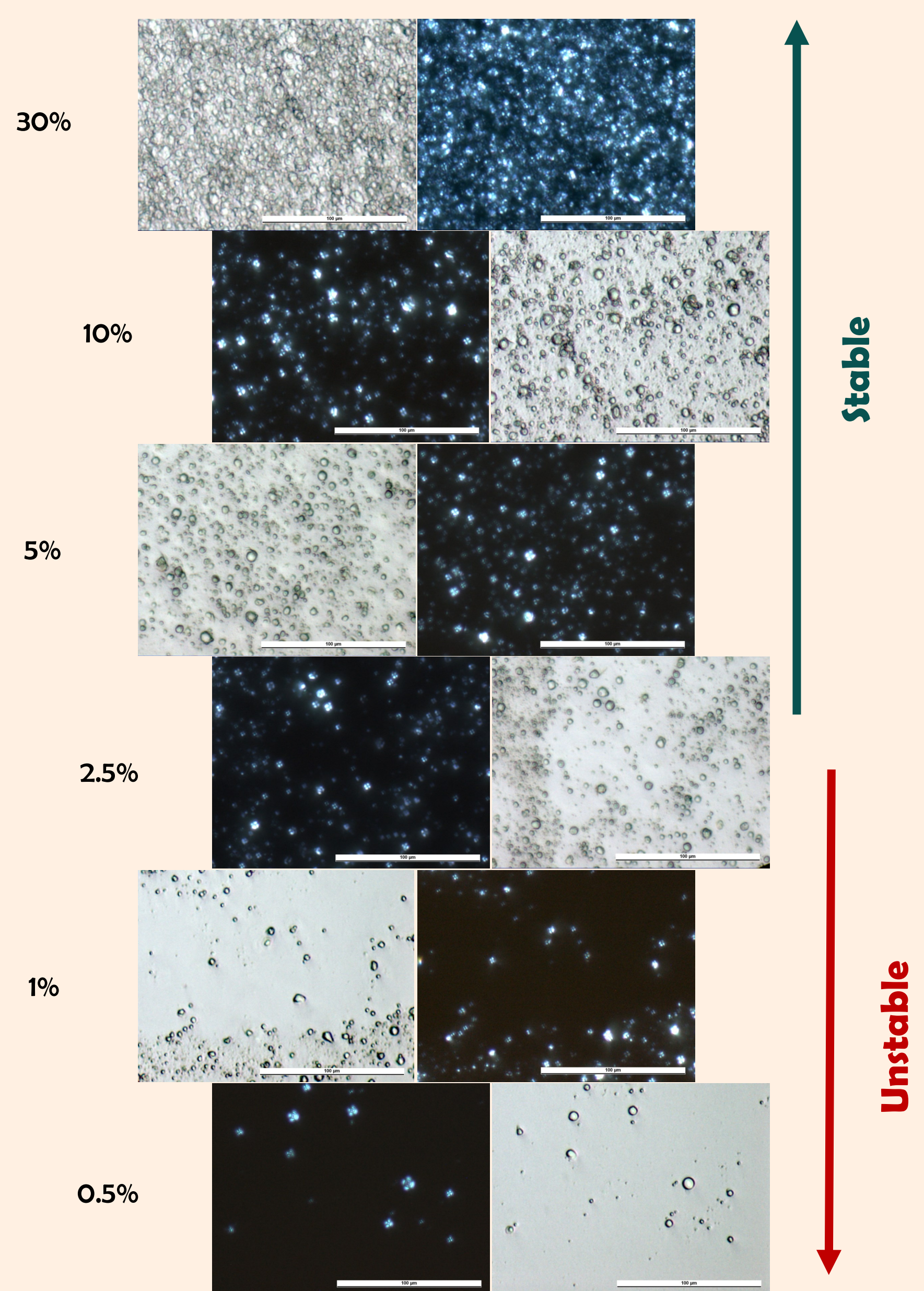
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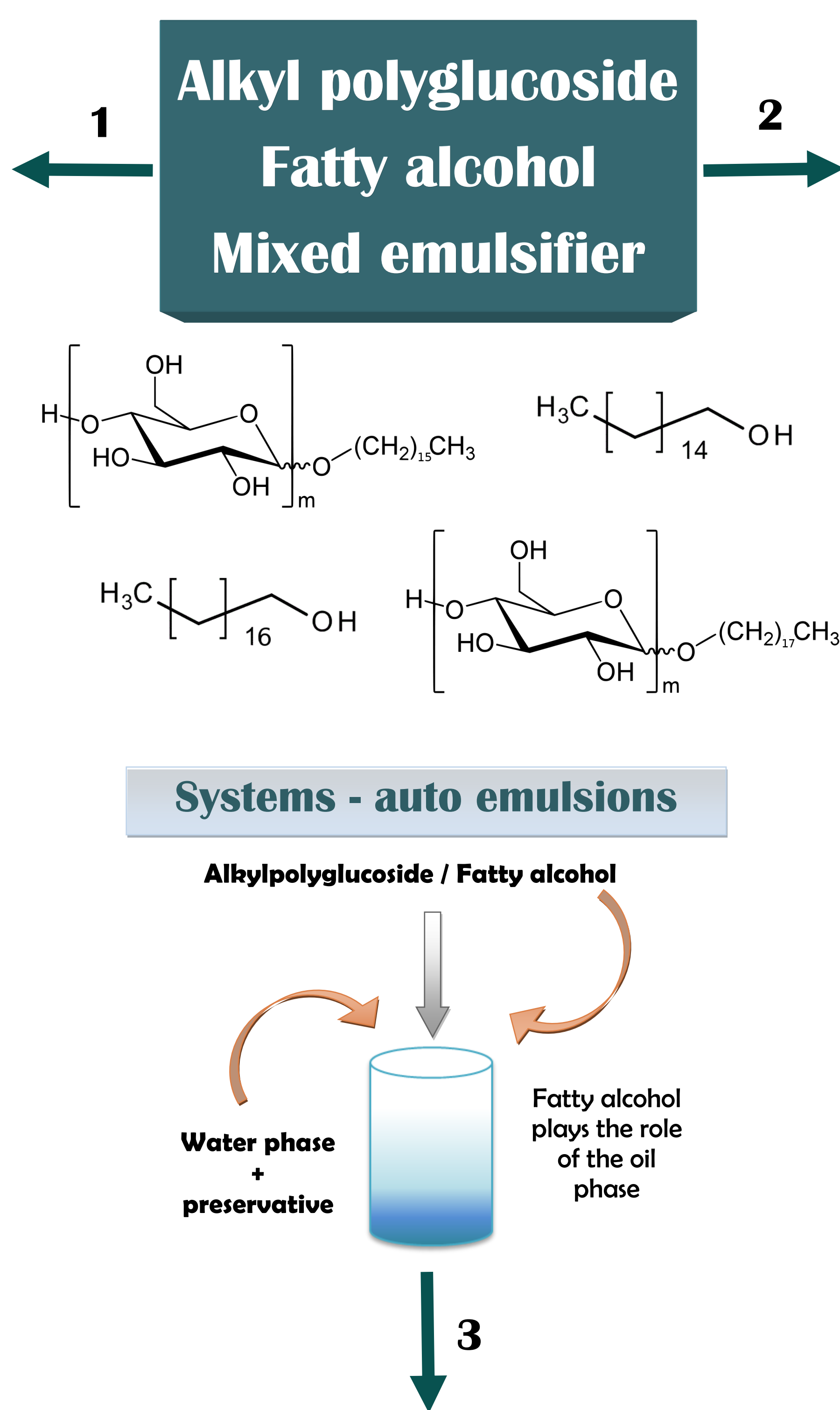
Characterization of the behavior of the mixed emulsifier C₁₆-C₁₈ APG/C₁₆-C₁₈OH and its ability to form lyotropic liquid crystals depending on :

The concentration of the mixed surfactant in solution

To investigate the APG/FA emulsifying capacities



Stability does not depend on the presence of the liquid crystals, but on its quantity



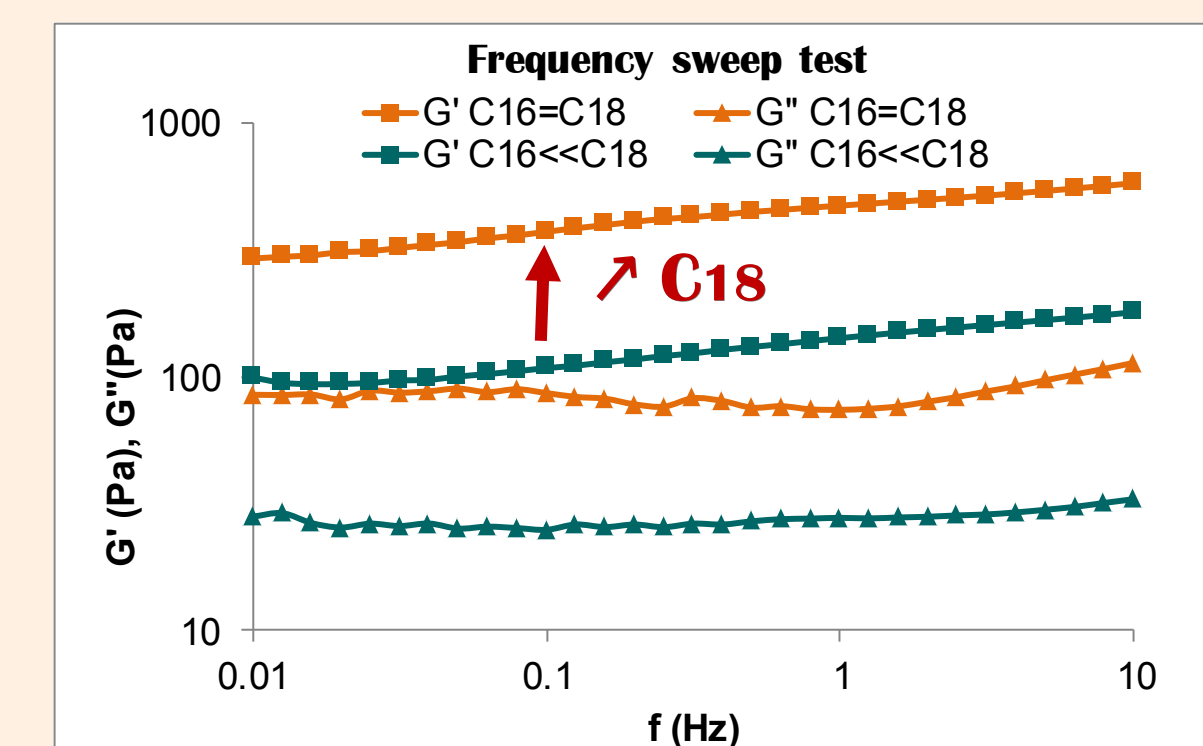
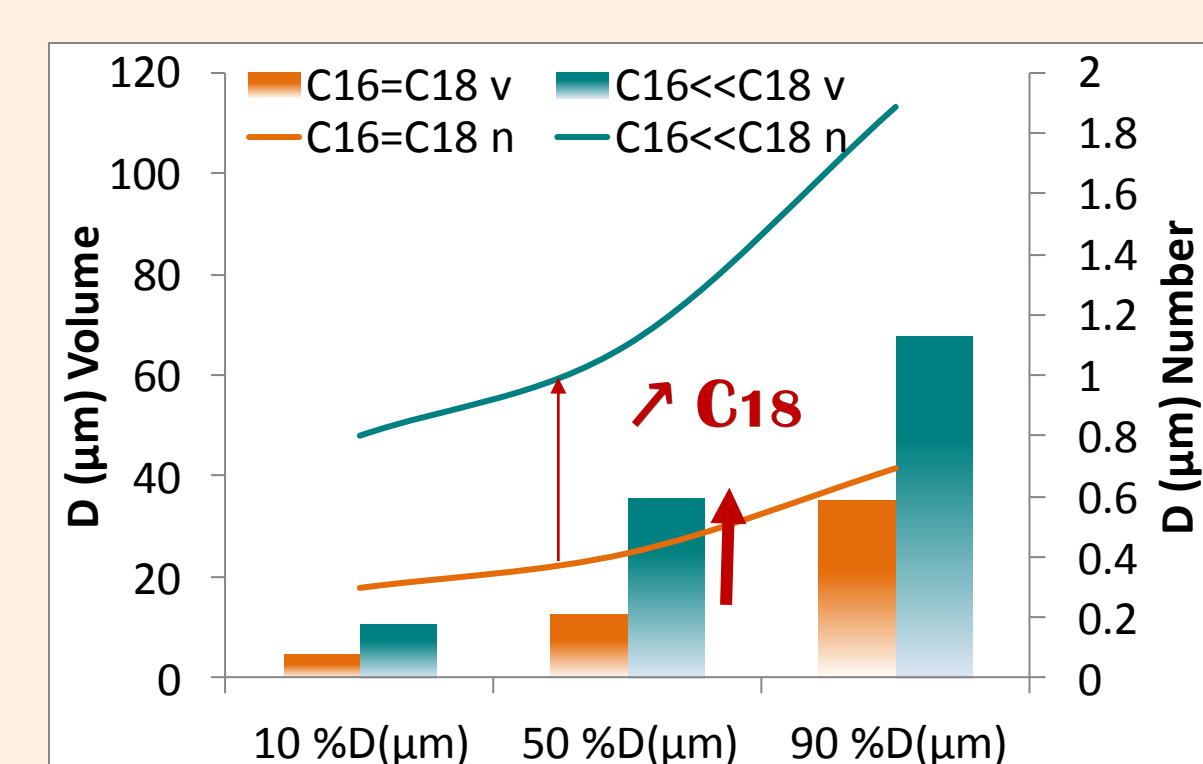
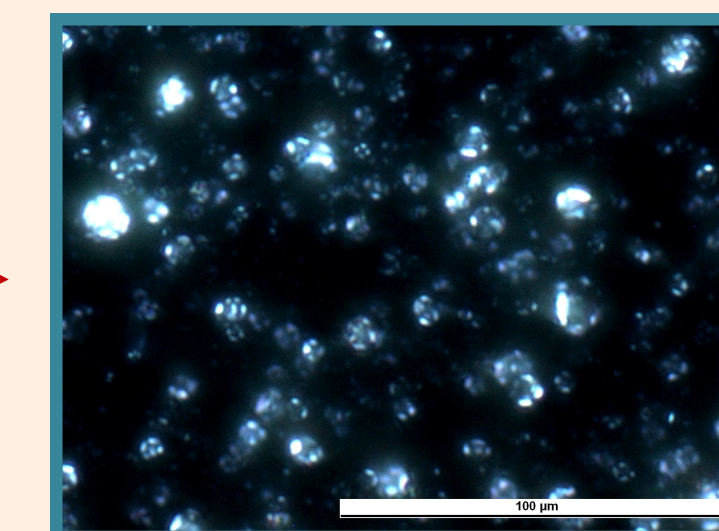
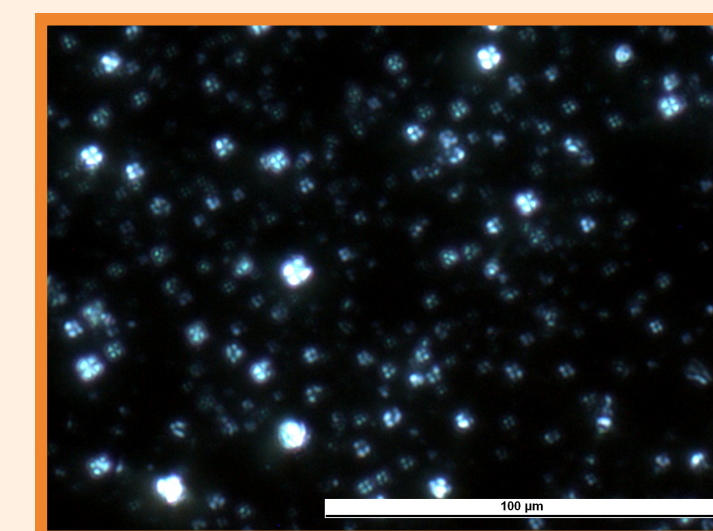
The ratio of the alkyl chains C₁₆/C₁₈ for APG and FA

To describe the importance of the alkyl chain length in the molecular organization

Two systems analyzed:

C₁₆=C₁₈ APG/FA

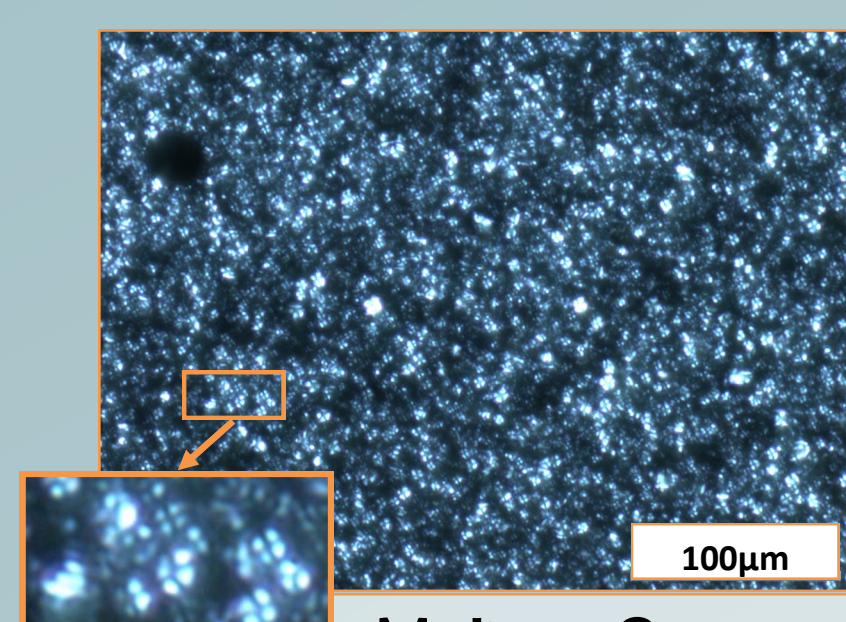
C₁₆<<C₁₈ APG/FA



Increasing the ratio of C18 increases the size of the droplets
C₁₆=C₁₈ forms finer droplet sizes and more organized network
Both systems → lamellar phase behavior (G' parallel to C₁₆)
C₁₆<<C₁₈ over the analyzed range of frequencies

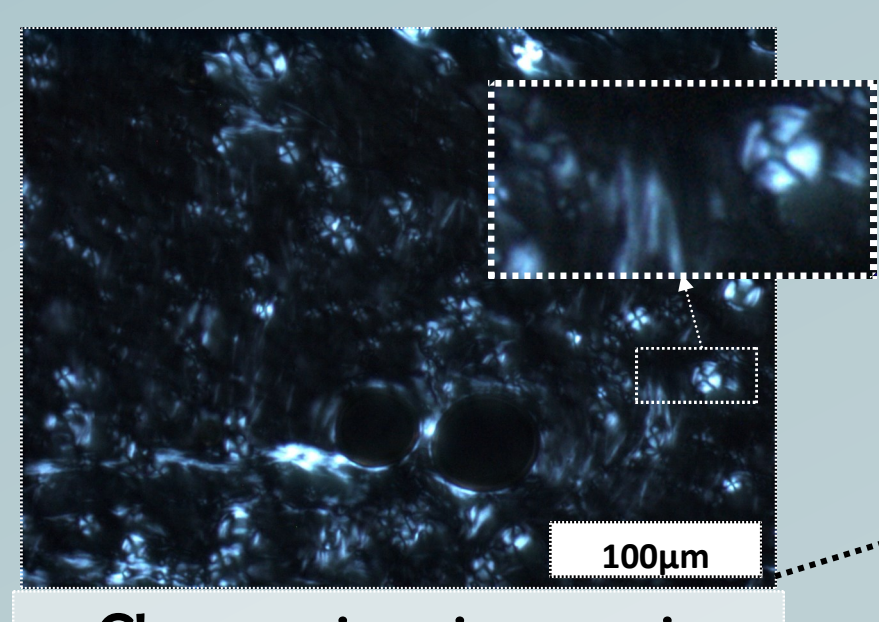
The quantity, the size and the behavior of the lamellar phases are changed once C₁₈ quantity in the C₁₆/C₁₈ ratio rises

APG<FA



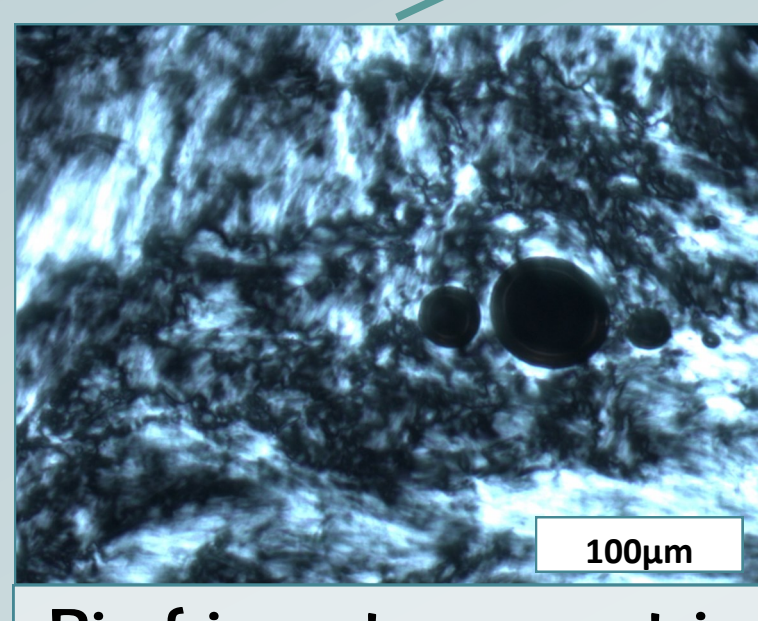
Maltese Crosses under polarized light - lamellar organization¹

APG=FA



Changes in microscopic appearance: distorted Maltese crosses near to oily streaks. Simultaneous presence of L_β & H₁

APG>FA

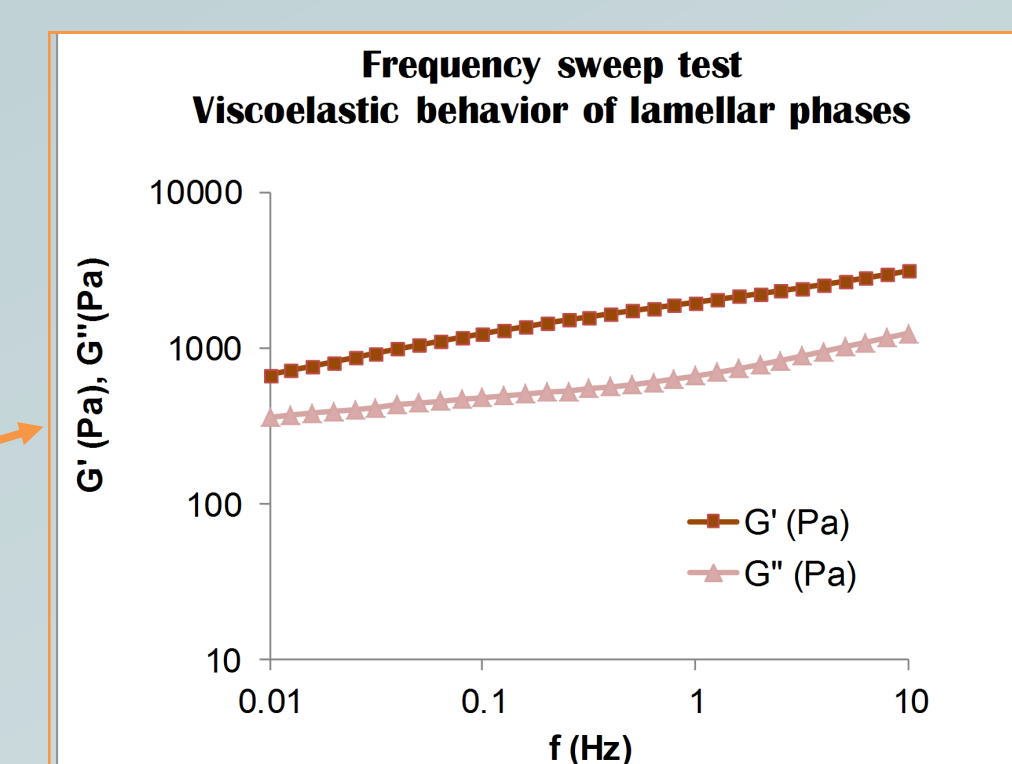
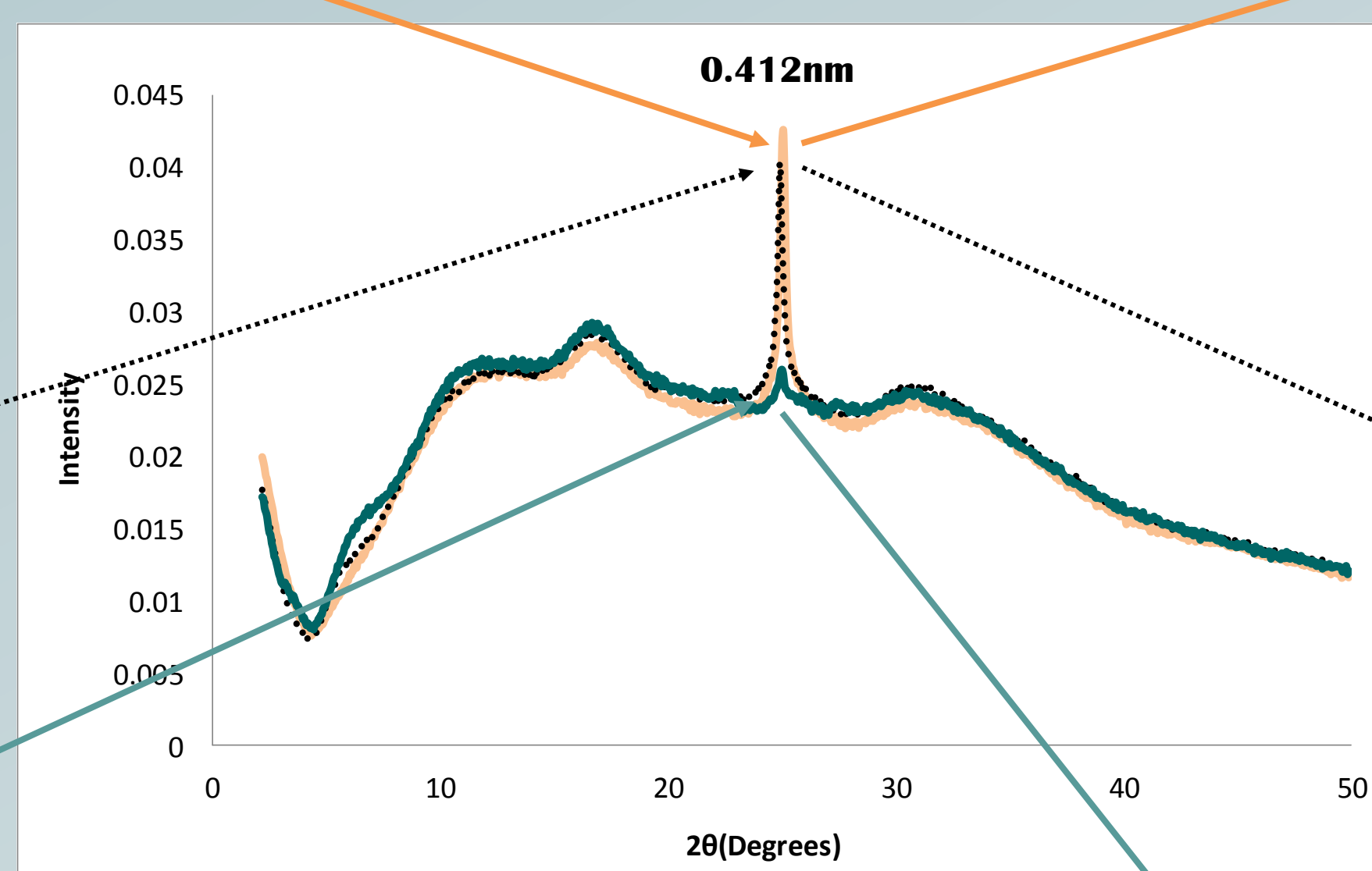


Birefringent asymmetric structures = hexagonal phases²

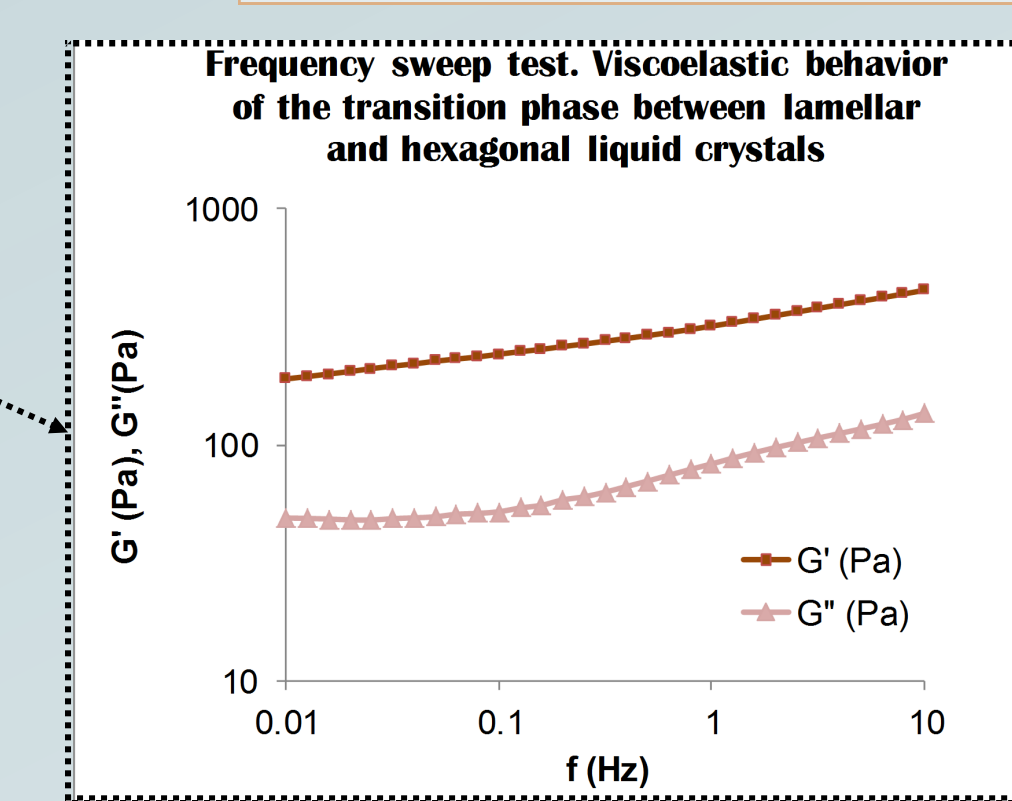
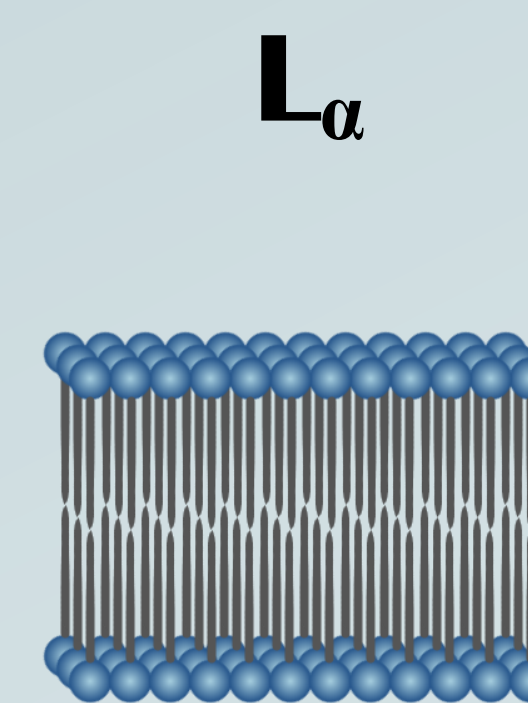
The C₁₆-C₁₈ APG/C₁₆-C₁₈OH ratio

The C₁₆-C₁₈ APG/C₁₆-C₁₈OH ratio, in order to evidence the properties provided by each raw material

Intensive peak at 0.412nm - L_β formation³



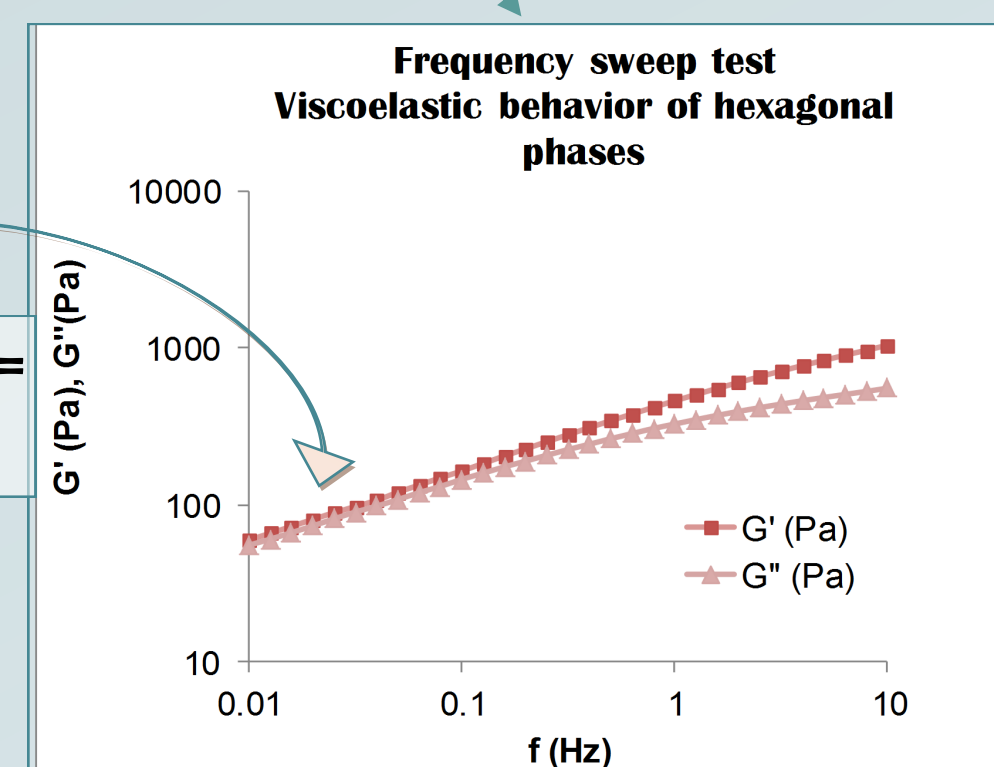
G' parallel to G'' - behavior of lamellar phases^{4,5}



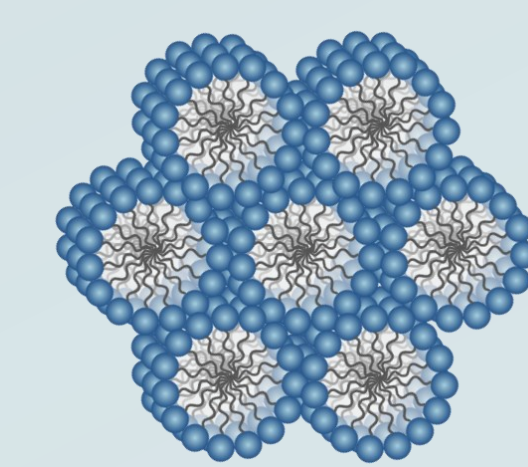
G' parallel to G'', still the behavior of lamellar phases, but the system is less elastic (G') and viscoelastic (tan δ) than lamellar L_β phase

L_β+H₁

Cross point of two moduli G' & G'' hexagonal phases behavior⁶



H₁



Conclusion

Conditions of lyotropic liquid crystals formation for the APG/FA mixed emulsifier:

- The quantity of liquid crystals is directly linked to emulsifiers concentration in auto-emulsion;
- The APG/FA ratio variation gives access to different types of liquid crystals;
- The alkyl chain length for the mixed emulsifier has a significant impact on the auto-emulsions microscopic and macroscopic properties.

References

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