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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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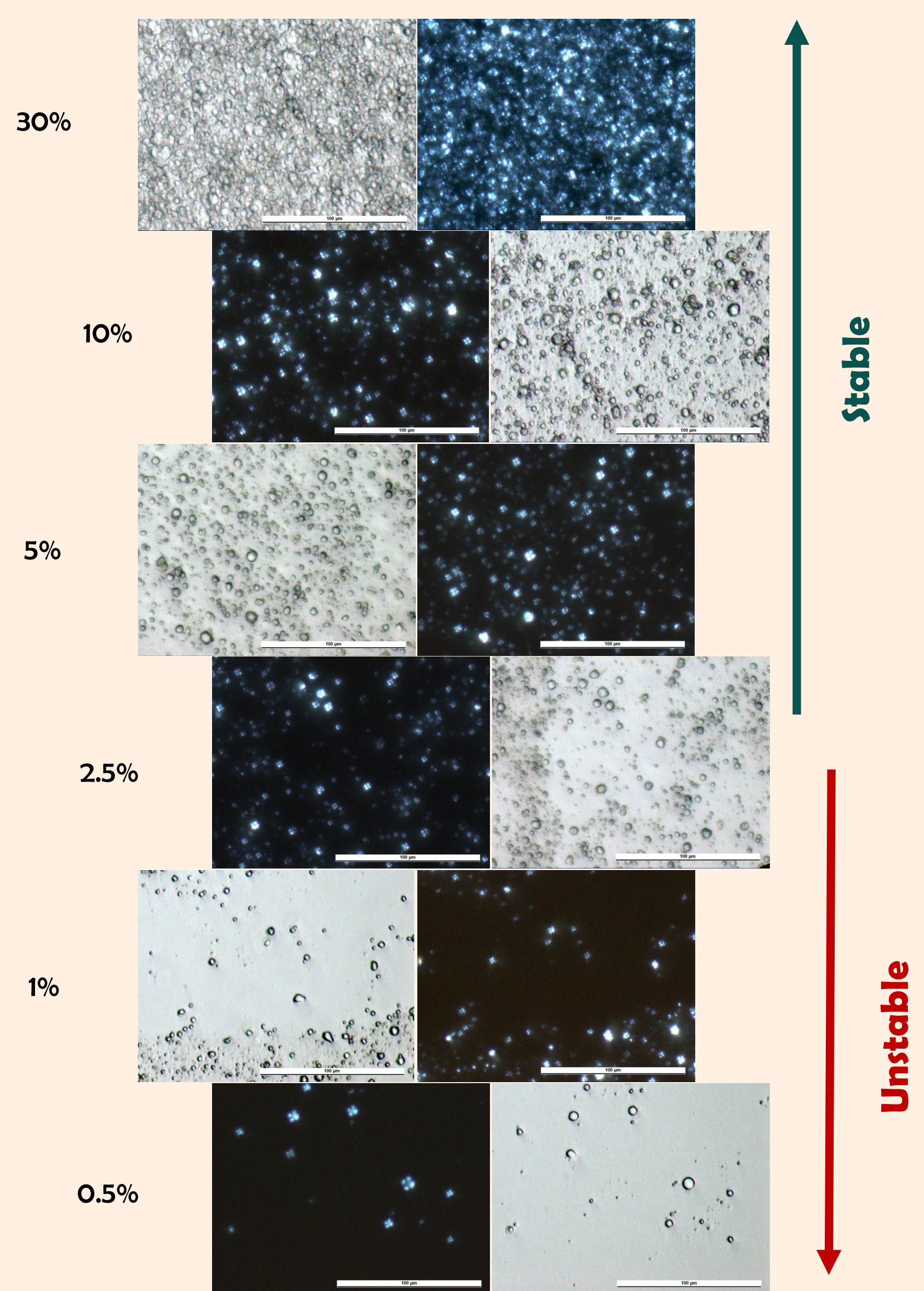
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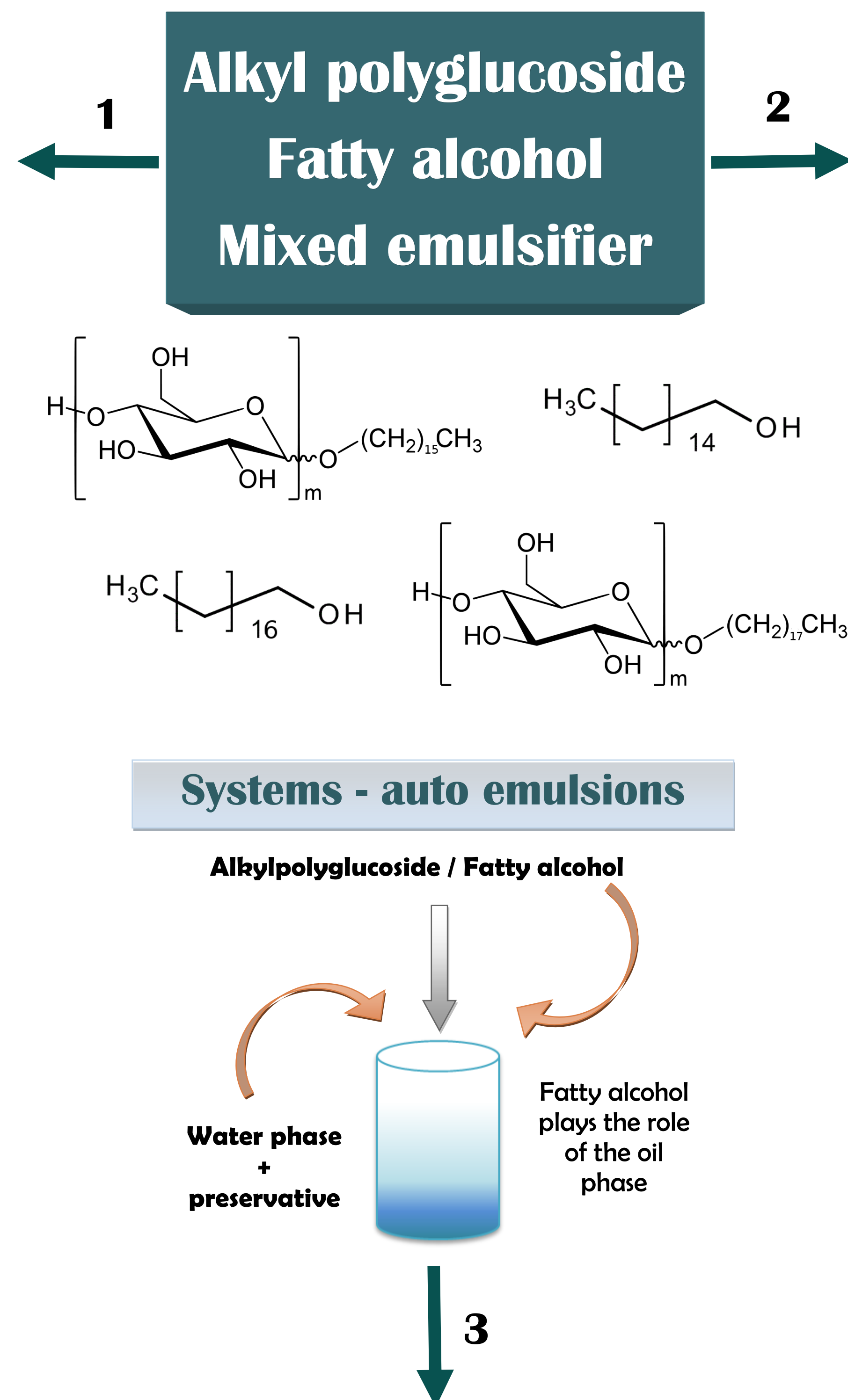
## Characterization of the behavior of the mixed emulsifier C<sub>16</sub>-C<sub>18</sub> APG/C<sub>16</sub>-C<sub>18</sub>OH and its ability to form lyotropic liquid crystals depending on :

### 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



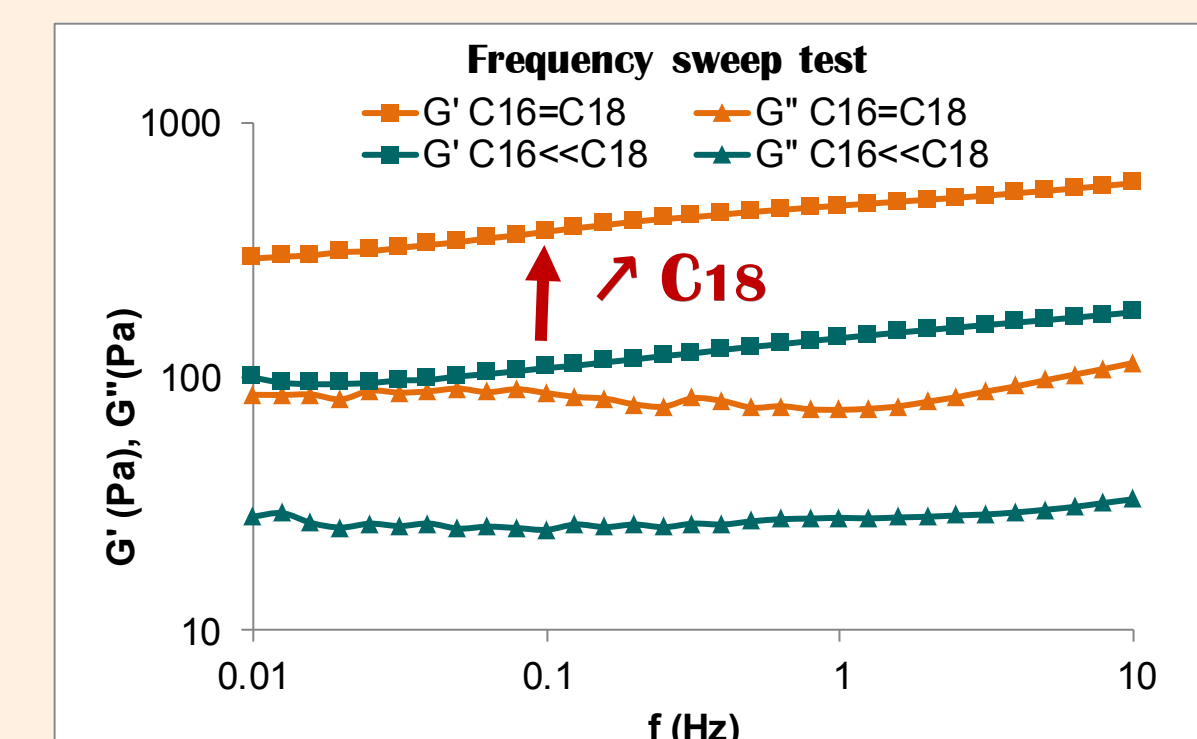
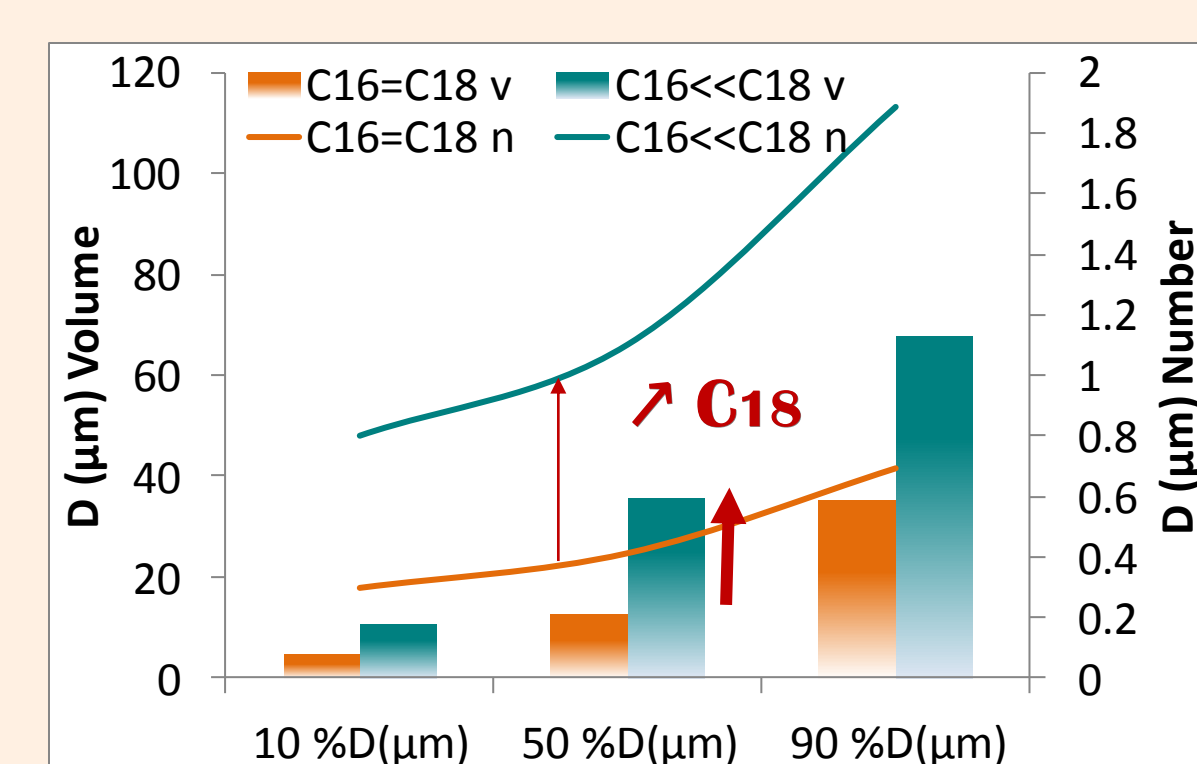
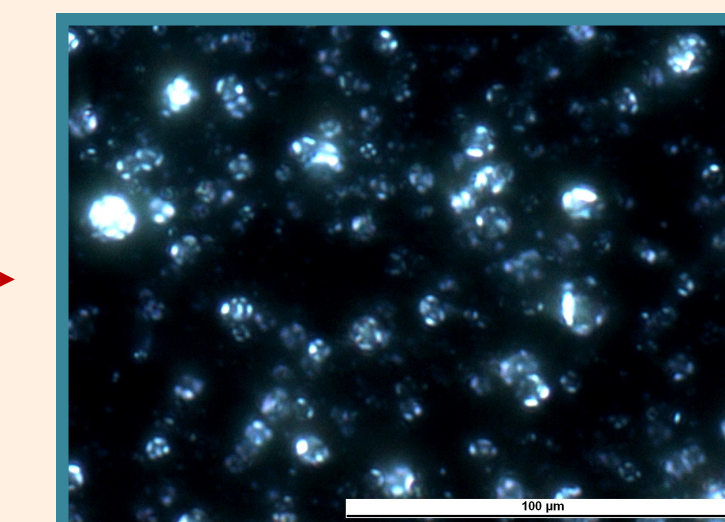
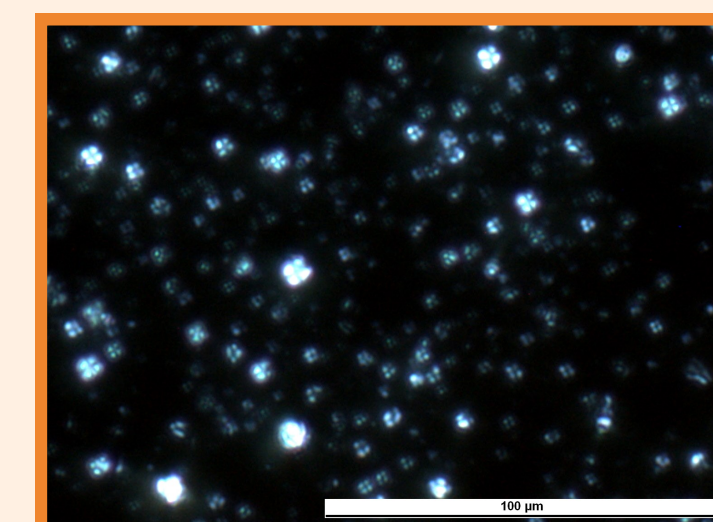
### The ratio of the alkyl chains C<sub>16</sub>/C<sub>18</sub> for APG and FA

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

Two systems analyzed:

C<sub>16</sub>=C<sub>18</sub> APG/FA

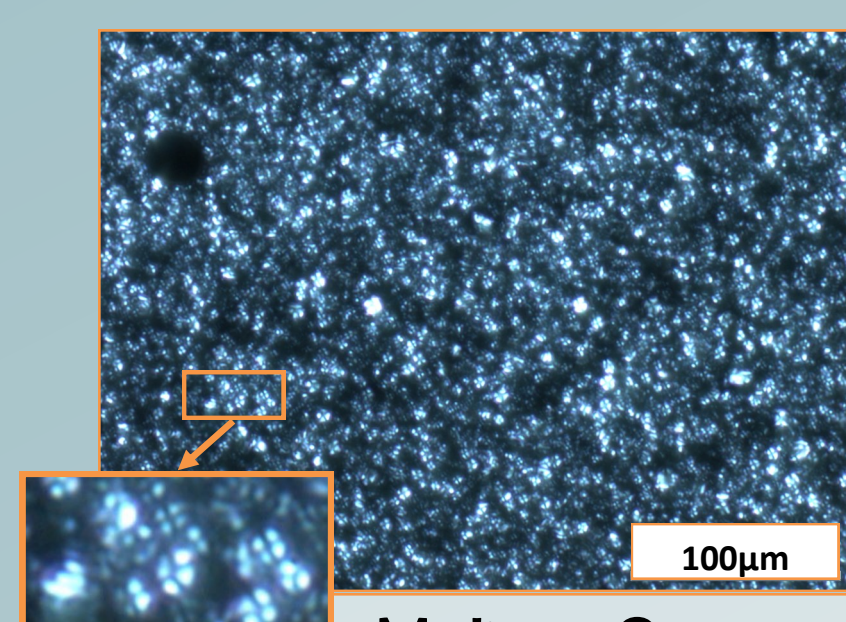
C<sub>16</sub><<C<sub>18</sub> APG/FA



Increasing the ratio of C18 increases the size of the droplets  
 C<sub>16</sub>=C<sub>18</sub> forms finer droplet sizes and more organized network  
 Both systems → lamellar phase behavior (G' parallel to G'')  
 C<sub>16</sub>=C<sub>18</sub> G' and G'' ∝ to C<sub>16</sub><<C<sub>18</sub> over the analyzed range of frequencies

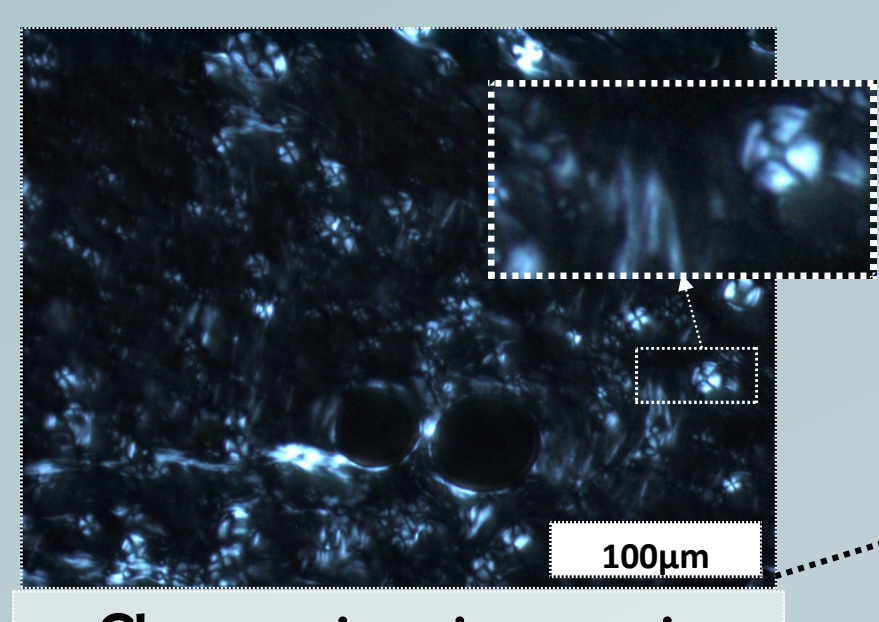
The quantity, the size and the behavior of the lamellar phases are changed once C<sub>18</sub> quantity in the C<sub>16</sub>/C<sub>18</sub> ratio rises

APG<FA



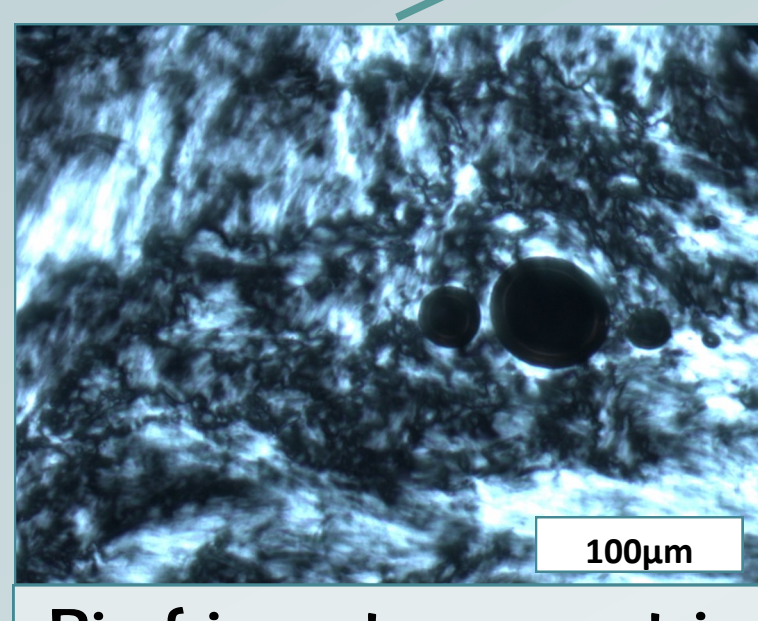
Maltese Crosses under polarized light - lamellar organization<sup>1</sup>

APG=FA



Changes in microscopic appearance: distorted Maltese crosses near to oily streaks. Simultaneous presence of L<sub>β</sub> & H<sub>1</sub>

APG>FA

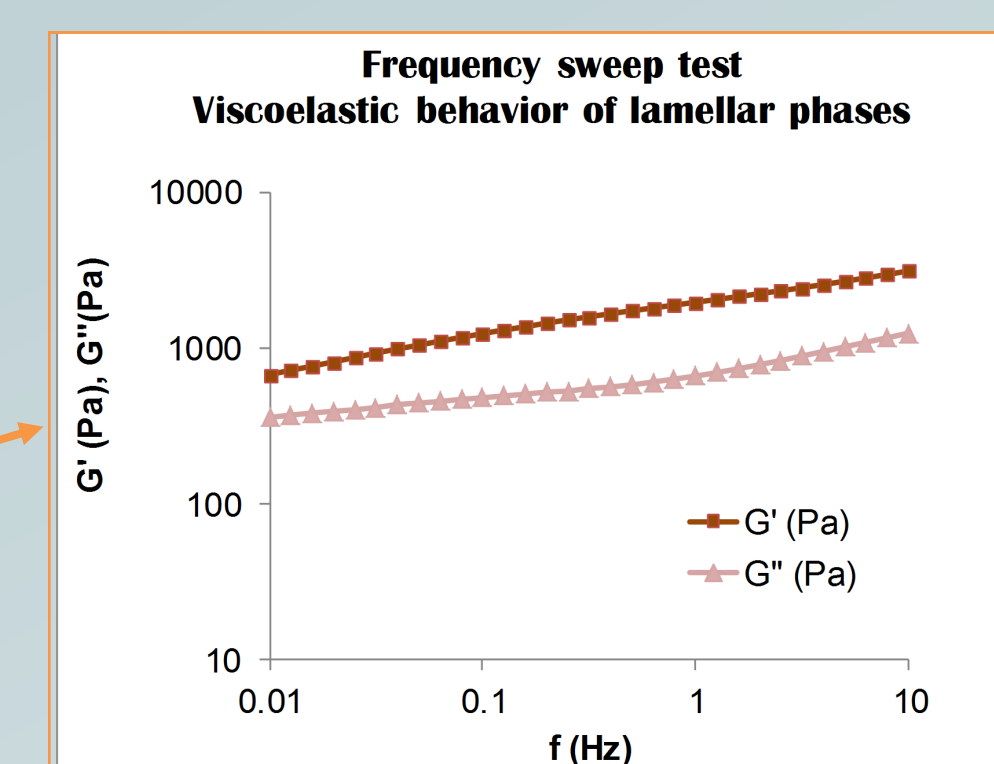
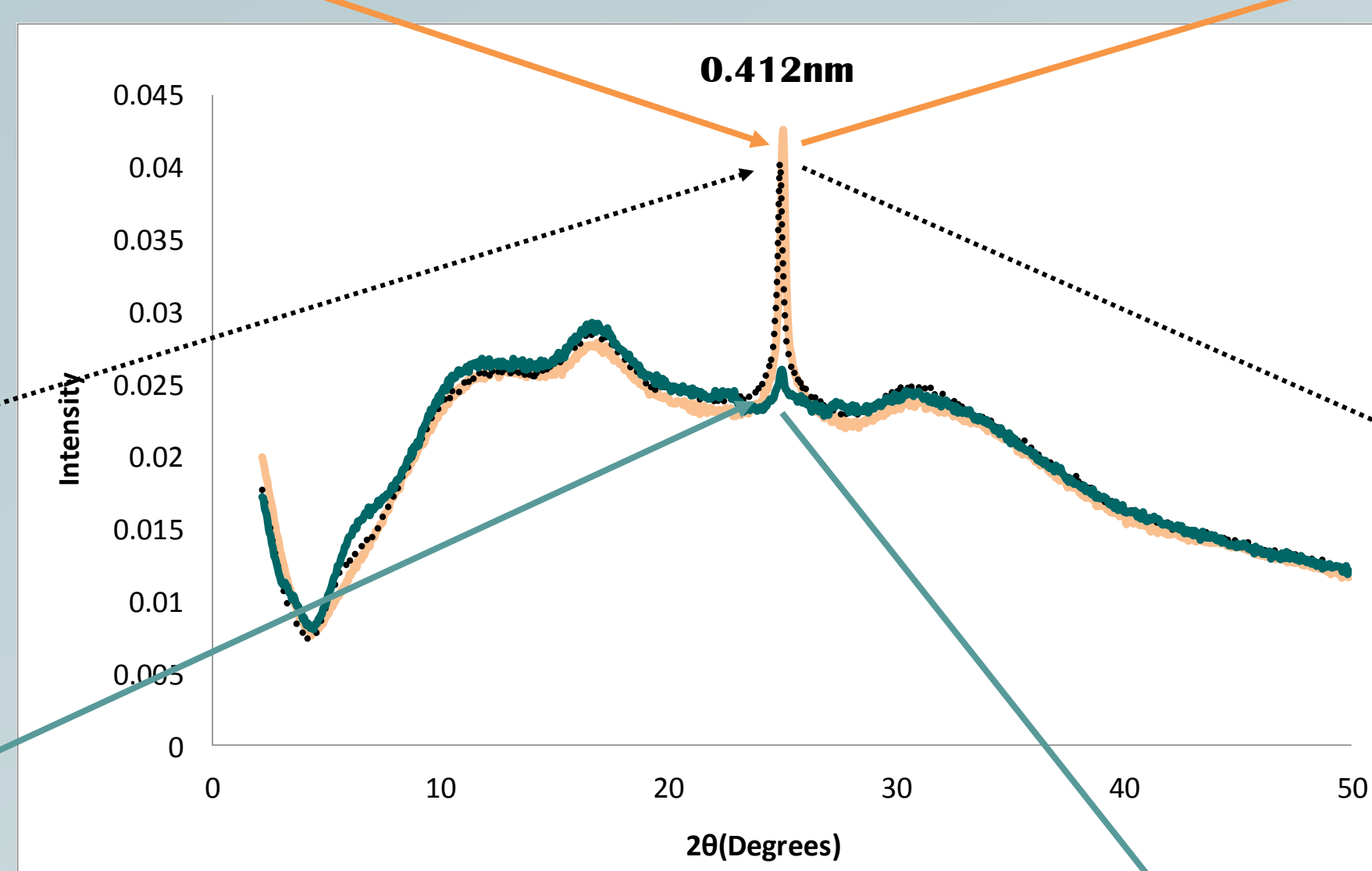


Birefringent asymmetric structures = hexagonal phases<sup>2</sup>

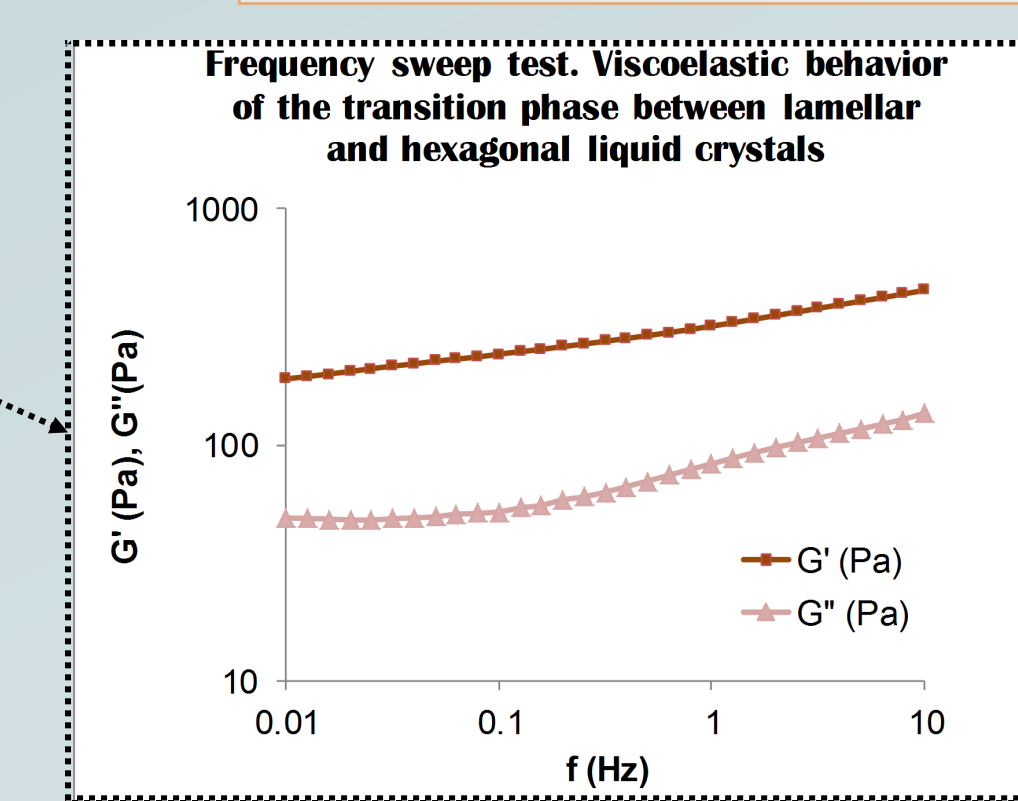
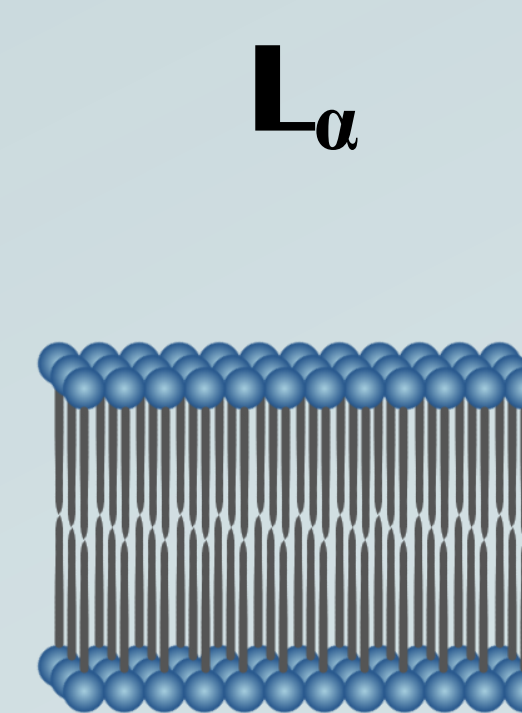
### The C<sub>16</sub>-C<sub>18</sub> APG/C<sub>16</sub>-C<sub>18</sub>OH ratio

The C<sub>16</sub>-C<sub>18</sub> APG/C<sub>16</sub>-C<sub>18</sub>OH ratio, in order to evidence the properties provided by each raw material

Intensive peak at 0.412nm - L<sub>β</sub> formation<sup>3</sup>



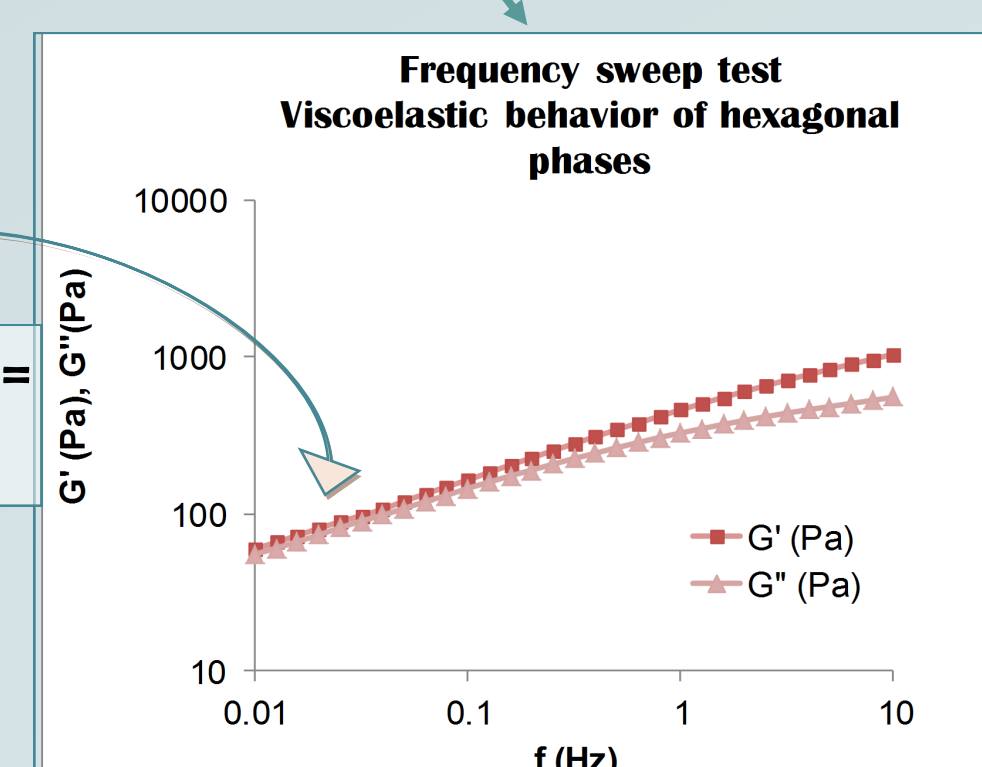
G' parallel to G'' - behavior of lamellar phases<sup>4,5</sup>



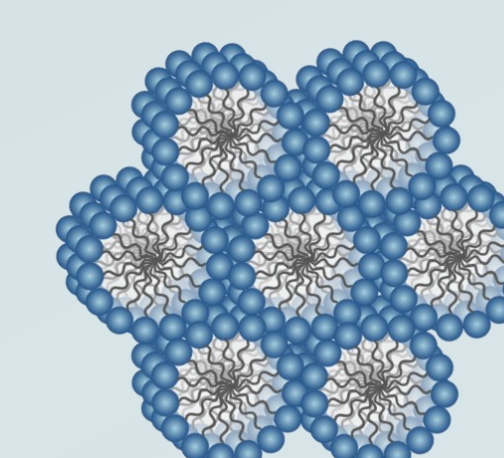
G' parallel to G'', still the behavior of lamellar phases, but the system is less elastic (G') and viscoelastic (tan δ) than lamellar L<sub>β</sub> phase

L<sub>β</sub>+H<sub>1</sub>

Cross point of two moduli G' & G'' hexagonal phases behavior<sup>5</sup>



H<sub>1</sub>



## 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.

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