MICROENCAPSULATION OF MODEL ACTIVES IN POLYSACCHARIDE FLUID GELS

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AIM

- The aim of this study is to investigate the encapsulation of model actives within polysaccharide microparticles, produced using the fluid gel route, and to study how to enhance their encapsulation efficiency by changing the production parameters.

MATERIALS AND METHODS

- Sodium alginate (Sigma-Aldrich®) and low acyl gellan gum (SpecialIngredients®) are selected as polysaccharide matrices and Vanillin (Sigma-Aldrich®) is selected as model active.
- Alginate Fluid Gels (AFG) and Gellan Gum Fluid Gels (GGFG) are obtained using a pin-stirrer continuous reactor (Fig. 1):

➢ Alginate gelation is obtained by the addition of $CaCl_2$ through a side stream into the reactor.

➢ Gellan gum gelation is obtained by reducing the temperature from approx. 50°C to 15°C by using a cooling jacket.

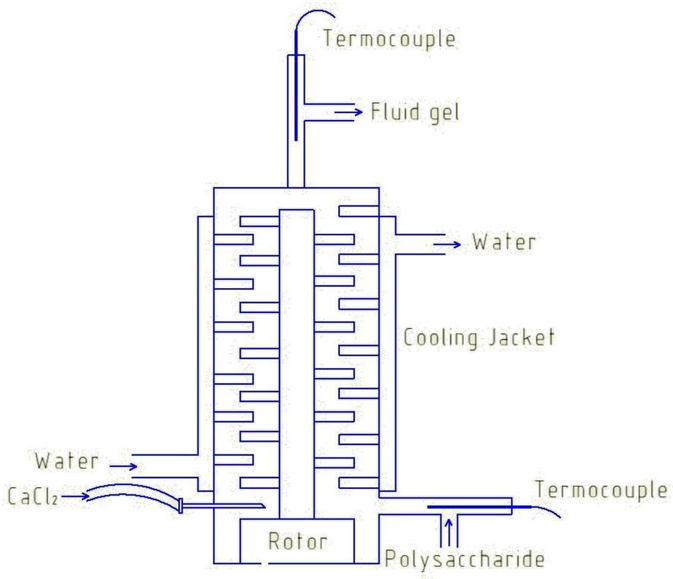

Fig. 1 - Pin-Stirrer reactor

- Viscosity is measured using a rheometer (Malvern Kinexus pro+), equipped with a sand blasted plate geometry (shear rate from 0,1 s^{-1} to 100 s^{-1}).
- UV-VIS spectrophotometer is used for the quantitative determination of Van in aqueous solutions.

➢ A centrifugation procedure is used for the determination of encapsulation efficiency (EE) of Van in AFG.

➢ Release experiments are conducted using water as release medium at R.T. using a cellulose dialysis membrane (Sigma-Aldrich®).

RESULTS

- Viscosity experiments display a reduction of the shear viscosity of AFG by increasing the Van percentage in the sample, while shear viscosity is not affected by the Van concentration in GGFG. (Fig. 2a & 2b)

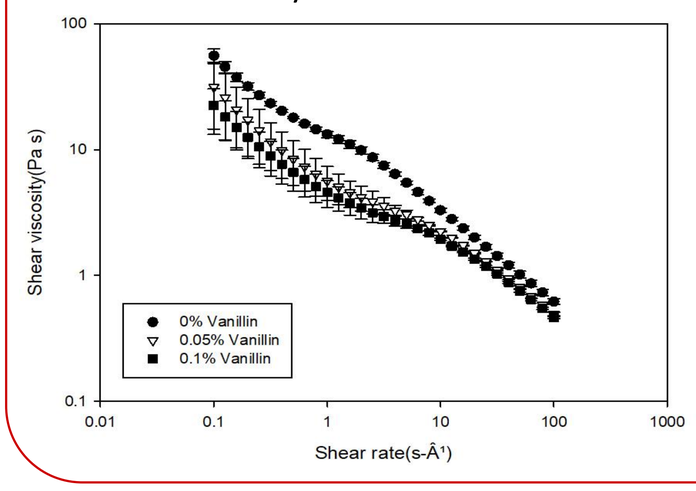

Fig. 2a - AFG shear viscosity graph

RESULTS

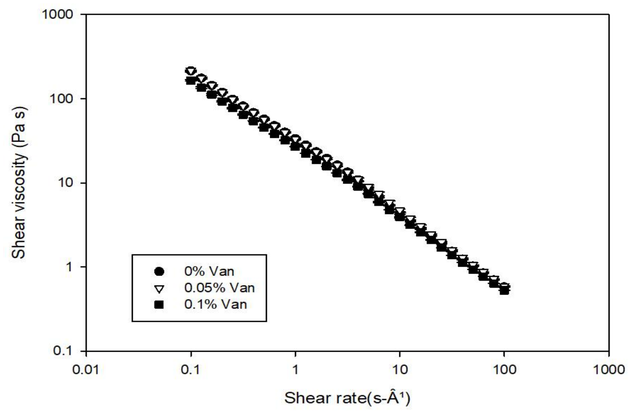

Fig. 2b – GGFG shear viscosity graph

- EE of AFG is not greatly affected by changing the alginate concentration and/or by process parameters, such as flowrates or shear regime applied. However, the EE changes as a function of the storage time (t_s), where t_s is the time elapsed from sample production, as shown in Fig. 3.

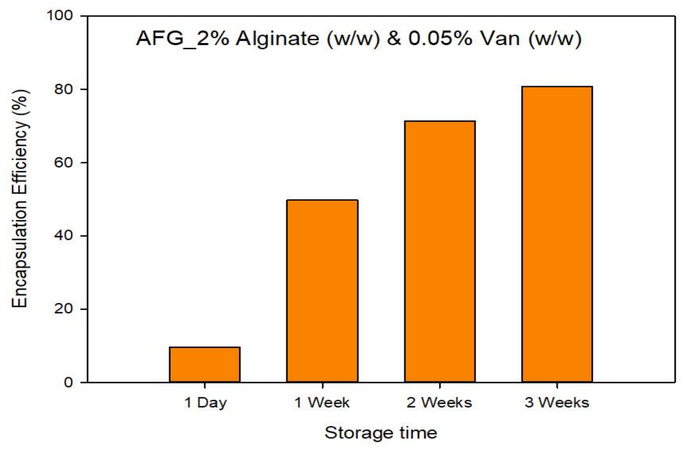

Fig. 3 - EE in AFG as a function of t_s.

- Release experiments, conducted on AFG, show that the amount of Van detected in the release medium changes as a function of t_s, as shown in Fig. 4.

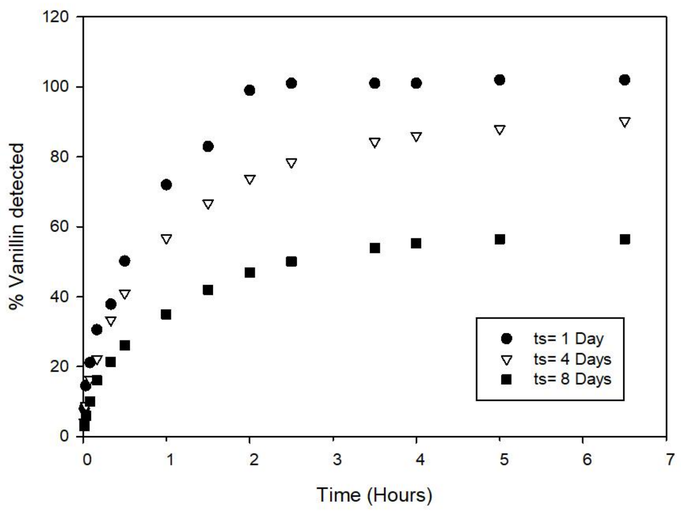

Fig. 4 - % of Van detected in the release medium for AFG

- Release experiments conducted on GGFG show that the concentration of Van detected in solution does not change as a function of t_s (Fig. 5) or by changing the conditions used for the material production.

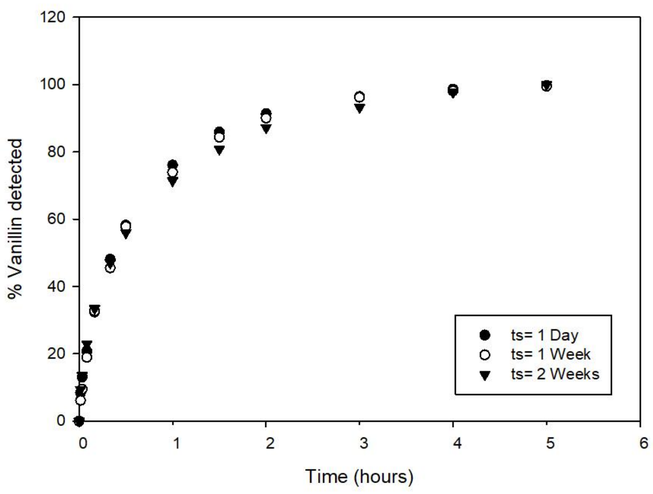

Fig. 5 - % of Van detected in the release medium for GGFG

CONCLUSIONS

- It is likely an interaction between Van and AFG polymer network from the results of the conducted tests. That interaction can be reported to be a function of t_s and that interaction is likely to be responsible for the increase of EE of Van in AFG. This interaction cannot be identified in GGFG, where Van is detected entirely in the release medium during release experiments and t_s does not affect the amount of model active detected. This suggests that no encapsulation of Van in gellan gum particles is feasible.
- **Future Development:** The behaviour of Van within AFG is currently to be further investigated, in order to assess if the nature of these interactions is between Van and alginate polymer chain and/or between Van and calcium ions.