NOVEL THERMAL MICROSCOPY METHOD FOR MICROCAPSULES CHARACTERIZATION

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The characterization of the release properties of bioactive delivery systems is very important for achieving a successful formulation of these systems. Due to the size of the microcapsules the final product is usually characterized with bulk methods, analyzing only average properties. A novel method to characterize the release and the melting temperature of single, temperature sensitive hard shell microcapsules is here presented.

The temperature sensitive microcapsules are prepared with the hard fat Witepsol W31 as the shell material and a solution of Enhanced Yellow Fluorescent Protein as the core material. The encapsulation was performed via the melt dispersion technique[1] and a 10% polyvinyl alcohol solution in H_2O was employed in the $W_1/O/W_2$ emulsion as the external water phase. The preparation was performed at 40 °C and stirring at 500 rpm at lab scale. The microcapsules have been characterized by laser scattering, for the measurements of the particle size distribution, and by a novel thermal microscopy method[2] for characterizing the release of the core solution. This method uses tailored laser pulses to trigger the release by melting the shell material. The release is detected by high speed bright field fluorescence imaging. Determination of the melting temperature of the sample with centigrade precision is also possible.

The Particle Size Distribution is not affected by the core material (proven by using various buffers and different concentrations of the protein) and it is characterized by a D_{50} of 140 ± 14 μm and span of 1.4 ± 0.1. The encapsulation and the release of the core material was validated by the thermal microscopy technique. With this technique it is possible to trigger the release by melting the shell material using tailored laser pulses. The melting temperature of the sample with centigrade precision can also be determined. It is furthermore possible to trigger the release of the core solution by rapidly heating the sample above the melting temperature of the shell material with a single laser pulse.

This novel thermal microscopy method has been validated for the analysis of the release and the melting temperature of individual microcapsules. These results can also be correlated to bulk properties, studying size-dependent effects.

References:

[1] Bodmeier R., Wang J., Bhagwatwar H.: *J. Microencapsulation* **9**, 89–98 (1992)

[2] Vöpel T., Scholz R., Davico L., Groß M., Büning S., Kareth S., Weidner E., Ebbinghaus S.: *Chemical communications* **51**, 6913-6916 (2015)

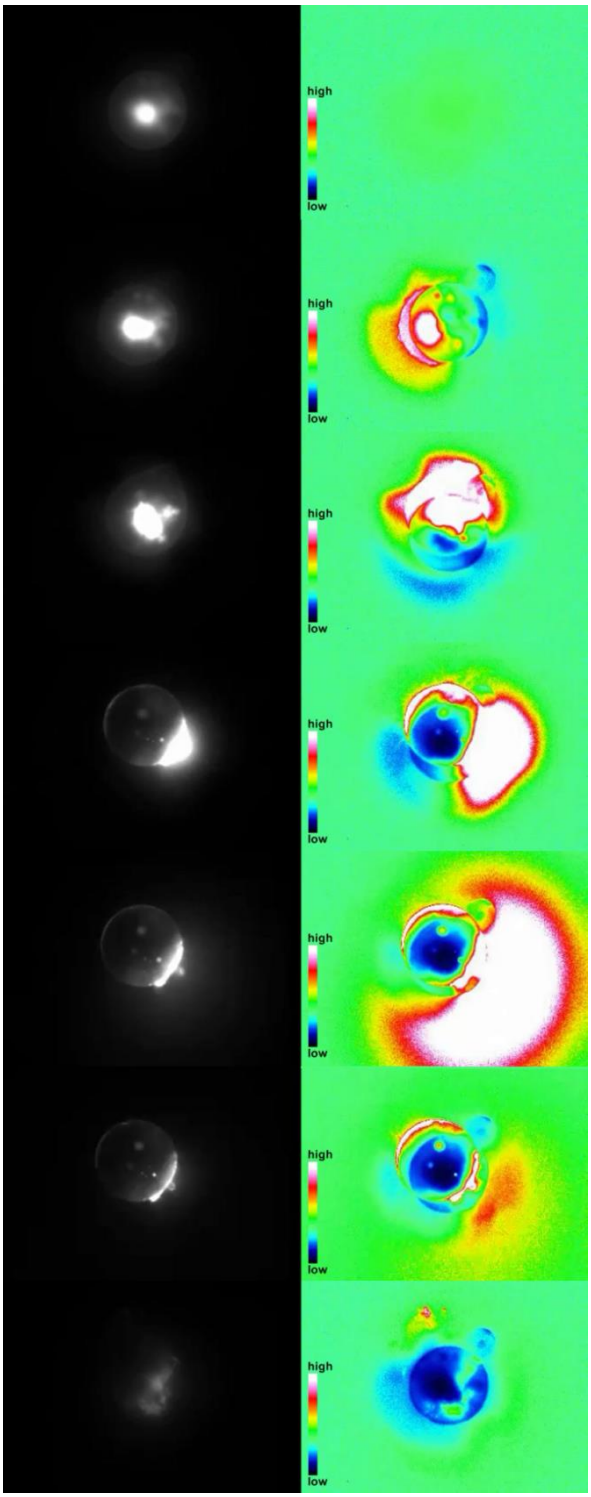

Figure 1 - Time sequence of the release of eYFP via a novel thermal microscopy method
Fluorescence signal of eYFP (left)
Fluorescence intensity normalized to the first frame (right)