Encapsulates to deliver great flavours to food products

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INTRODUCTION

Delivering great and authentic flavour experiences for consumers requires ways to deliver both taste and aroma at the moment of use, e.g., during cooking or eating. Especially for aroma components it is a challenge to control the delivery, since these components can easily be lost during processing, shelf life and use of the product. For that reason flavour encapsulation is identified as a key technology to address this (Zuidam and Heinrich, 2009).

The total flavour encapsulation market is estimated to be about 2-2.5 US$ billion, and it is growing faster than the total flavour market due to many benefits they can provide. Within Unilever flavour encapsulates are used to incorporate flavour properly in food products, to improve flavour stability, and to provide controlled release of flavour with time.

About 80-90% of the flavour is encapsulated by spray-drying. Other types of encapsulates include ones made by spray-chilling, melt extrusion, melt injection, fluid bed coating, cyclodextrins, microspheres and complex coacervates.

This contribution will briefly discuss the different types of flavour encapsulates and general considerations for using these within different food products and applications. In more detail, the flavour release upon cooking will be discussed. Commercial flavours may retain not so well as flavourings from natural fresh ingredients during cooking, resulting in loss of flavour perception. Design of flavour encapsulates that may act as a reservoir from which flavour slowly releases upon cooking might be an option to reduce this gap and even outperform retention from natural ingredients.

MATERIALS AND METHODS

Spray-dried lemon flavour obtained from Symrise was first granulated and then coated in an Aeromatic-Fielder™ Multiprocessor MP1 fluid bed from GEA Pharma Systems Ltd (see http://www.aeromatic-fielder.com).

Aroma release of samples into the headspace was measured real-time by PTR-MS (Proton Transfer Reaction - Mass Spectrometry), see figure 1 and Lindinger et al., 1998. The PTR-MS equipment used was a so-called High-Sensitivity PTR-MS from Ionicon Analytik Innsbruck, Austria. To minimize the experimental error the sampling of the headspace was performed in a very controlled environment where all relevant parameters were monitored. The aroma release profiles of different encapsulates were measured in a 3-neck round bottom, submerged in an oil bath of 80°C. A stopper was placed in the middle opening and was used for introducing the sample. One of the smaller openings was used to hold the purge flow tube. The other small opening was used to connect the outlet of the 3-neck round bottom flask to the inlet-tube of the PTR-MS.

Figure 1: Set up for controlled aroma release measurement of encapsulates by PTR-MS.

The first minute of PTR-MS measurement recorded the base line without sample, and after 1 minute the sample was introduced in the flask via a small aluminium cup. A typical sample weight was approximately 20 mg of spray-dried lemon flavour. To compare equal flavour loads the sample weights of the different encapsulates were increased to correct for their coating weights and plotted against the same flavour amount. The PTR-MS measurements lasted for 30 minutes and recorded ion trace 137 and 81, respectively the MW of limonene + 1 (from the proton) and its major fragment ion. The obtained data of the different encapsulates were combined together in an excel sheet and plotted against time.

RESULTS AND DISCUSSION

Examples of the use of flavour encapsulates within Unilever food products are spray-dried flavours for the savoury business (e.g., Knorr) or the use of melt extrudates in Lipton tea bags. These examples provide the benefits of easier handling and stabilization.

Another benefit of the use of flavour encapsulates might be controlled or sustained release upon boiling in water. Within Unilever we have found that, for example, the release of garlic flavour from spray-dried encapsulates is much quicker than from the crushed garlic plant cells under such a condition (see figure 2).

Encapsulates that could provide a controlled or sustained release should not dissolve in water (immediately). We have granulated spray-dried lemon flavour and have coated these granules by fluid bed coating with a water-insoluble polymer. Figure 3 shows that the lemon release from the coated granulates was much more retained than the lemon release from spray-dried encapsulates in water at 80°C. Similar release benefits could also be obtained from commercial samples (see figure 4). However, these benefits were only there at equal flavour loads but not at equal costs. This latter hampers the commercial application of flavour encapsulates for controlled release purposes upon cooking.

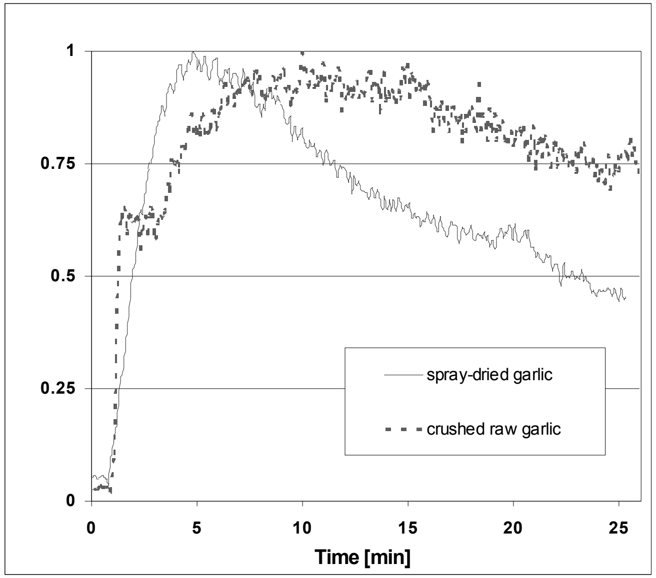

Figure 2: Garlic release from spray-dried encapsulates or crushed raw garlic in water at 80°C as measured by PTR-MS. The maximal response was set at 1.

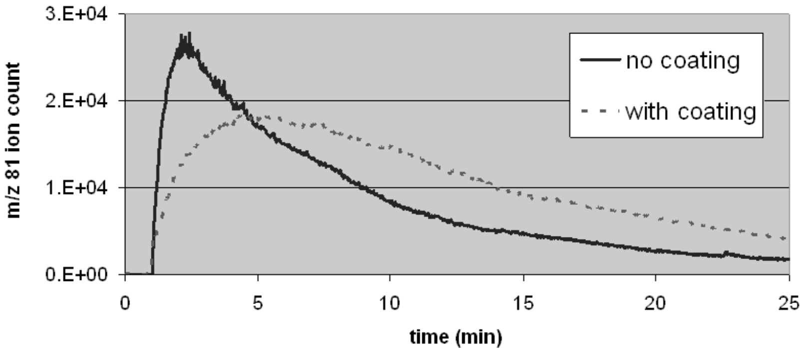

Figure 3: Absolute flavour release from granulated spray-dried lemon flavour with or without a water-insoluble coating at 80°C and equal flavour load as measured by PTR-MS.

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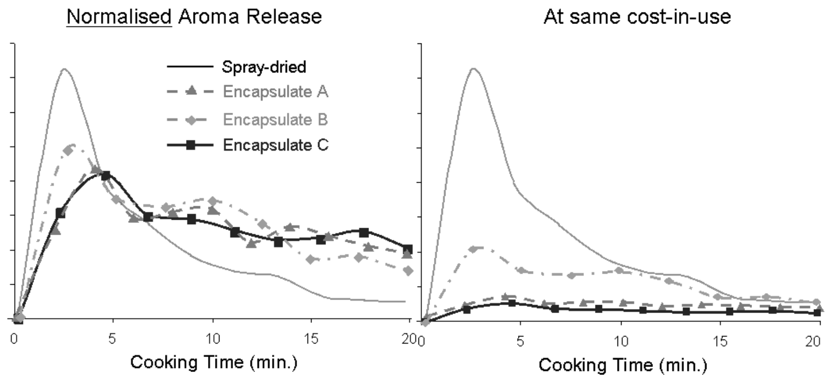

Figure 4: Flavour release from spray-dried and commercial encapsulates in water at 80°C as measured by PTR-MS. The release curves were normalized as such that the area under the curve was the same for each sample. The left picture shows the results at equal flavour load, and the right picture shows the results at equal costs. These data were kindly provided by our colleagues S. Coïc and D. Taal.

CONCLUSIONS

Flavour encapsulates are widely used for food production, for example, for easy handling and stabilisation. Controlled or sustained flavour release upon boiling is a challenging but possible task. Unfortunately, the additional costs currently hampers extensive commercialisation of such encapsulates.

REFERENCES

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