O2-3 **Release of aroma compounds from a complex matrix like a biscuit**

De Hoog E.H.A.[1#], Müller-Maatsch J.T.L, Burseg K.M.M, De Kok P.M.T, de Roode B.M.
[1] NIZO food research, Ede, The Netherlands
els.de.hoog@nizo.nl

INTRODUCTION AND OBJECTIVES

Controlling aroma release is of importance in product development. Partitioning between the hydrophobic and hydrophilic phases is the thermodynamical drive of redistributing aroma molecules over a product after preparation. Factors influencing the diffusion of the molecules to reach the equilibrium in partioning as well as the rate of head space concentration build-up during consumption of a product is subject of extended literature (Taylor 1996, Gibbs 1999, De Roos 2006, Burseg 2009).

In our study, we explored aroma release in three different stages of the life cycle of a biscuit, i.e., baking, storage and eating. Compared were three different encapsulation methods for applying a flavoured oil in the product: as a free oil, as an emulsion stabilised with sodium caseinate, or as an emulsion spray dried with maltodextrin. The content and release of the component limonene was followed through baking, storage and consumption.

MATERIALS AND METHODS

Biscuits were prepared with an orange oil containing the aroma limonene. The flavoured oil was added in three ways, but in all batches the same amount of oil was used.

Table 1: Encapsulation methods for applying a flavoured oil to a biscuit's dough.

batch 1	free oil
batch 2	emulsion stabilised with sodium caseinate
batch 3	emulsion spray dried with maltodextrin

The limonene content in the biscuits was determined using GC-MS. The partitioning of the limonene between the headspace and the biscuit was analysed with PTR-MS. To this end the biscuits were stored in a bottle for at least 12 hours to equilibrate with the air prior to analysis. The aroma release during eating a biscuit was measured with PTR-MS with three panellists and in triplicate. Panellists were instructed to chew a biscuit with closed mouth, swallow after 30 s, and the breath was continued to be monitored for an additional 30 s. To describe the release curves a model was used.

$$I(t) = \frac{a * time}{b + time} \text{ for t} < 30 \text{ Seconds}$$

$$I(t) = \frac{c * time}{d + time} \text{ for t} \geq 30 \text{ Seconds}$$

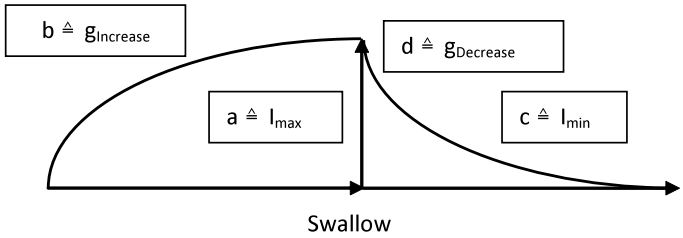


Figure 1: Schematic representation of the model for analysis of *in-vivo* aroma release measurement.

RESULTS AND DISCUSSION

Baking

The aroma loss during baking is the highest in the batch 1. The most efficient protection against aroma loss is provided by emulsification with sodium caseinate (batch 2).

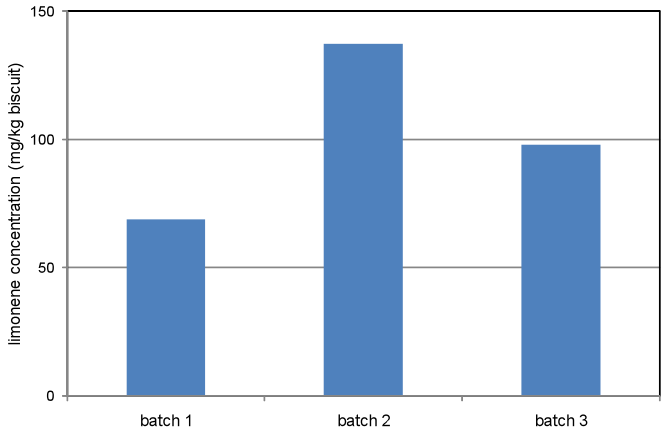


Figure 2: Concentration of limonene in biscuit after baking.

Storing

The concentration of limonene in the headspace after equilibration was highest for batch 1, lower for batch 2 and the lowest for batch 3. The storage time and the storage temperature (5°C, 25°C, 45°C ; data not shown) did not influence this order.

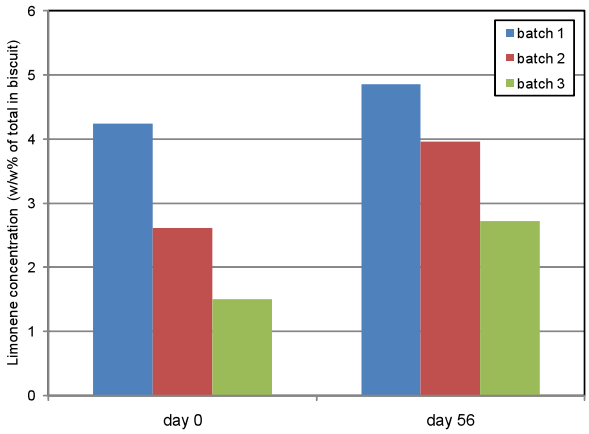


Figure 3: Concentration of limonene in headspace before and after storage for 56 days at 25°C.

Eating

The aroma release was varying between the three batches. The maximum released intensity was significantly higher for batch 2, and the gradient in this increase was significantly higher for batch 2 in comparison with batch 3. The lingering curve (after swallowing) was slightly different between the batches. The measured intensity 30 s after swallowing was significantly higher for batch 2.

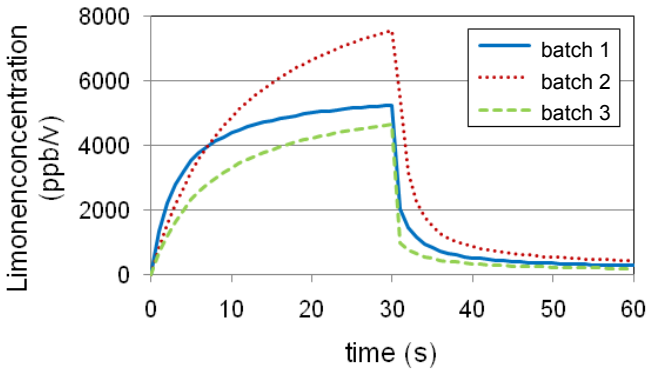
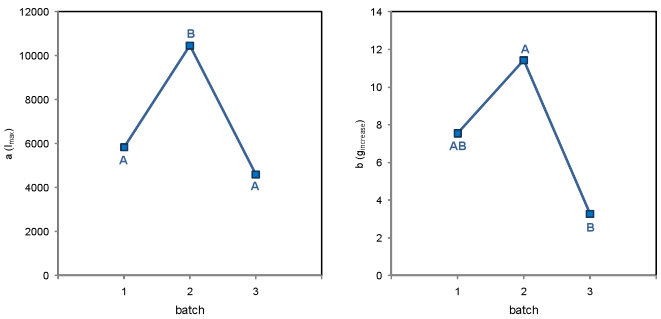


Figure 4: Limonene concentration in breath in time.



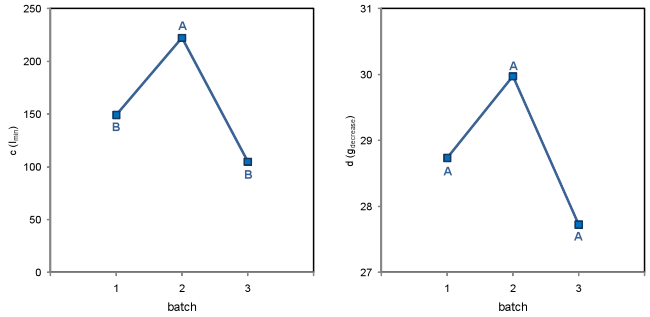


Figure 5: Model parameters of each batch. Significant differences exist when letters are different between the batches.

DISCUSSION

Using different encapsulation methods to apply flavoured oil to a biscuit's dough does have an effect on the aroma loss during processing and storage of the biscuit. This can be explained by differences in interfacial properties between the oil and the water matrix, and the interaction with the other ingredients of the samples. Furthermore, the aroma release during eating is influenced by the type of encapsulation. This observation can be explained by the fact that oral processing induces structural changes in the product; oil can coat the oral mucosa, emulsion droplets can coalesce or aggregate. The full formulation of biscuits needs to be taken into account to explain differences in aroma release in combination with the temporal and spatial differences in oral break down.

CONCLUSIONS

Emulsification with sodium caseinate was found to reduce the loss in aroma during processing of flavoured oil in a biscuit's dough. In addition, the release of aroma during eating the biscuit was affected by the type of encapsulation method.

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