Effect of initial conditions on foam formation from supersaturated food liquid systems

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Introduction

Foam formation upon depressurization is a technique used mainly in the food industry to introduce bubbles in products in order to improve their appearance and taste. Through this technique, the pressure is released from a supersaturated liquid and the gas no longer soluble will escape from the liquid phase and accumulate at the interface in a bubble form (see Figure 1) [1].

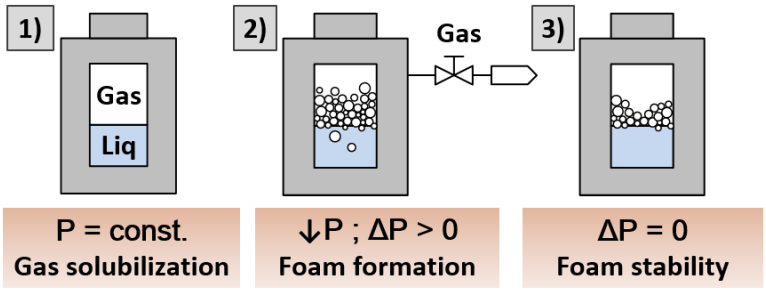


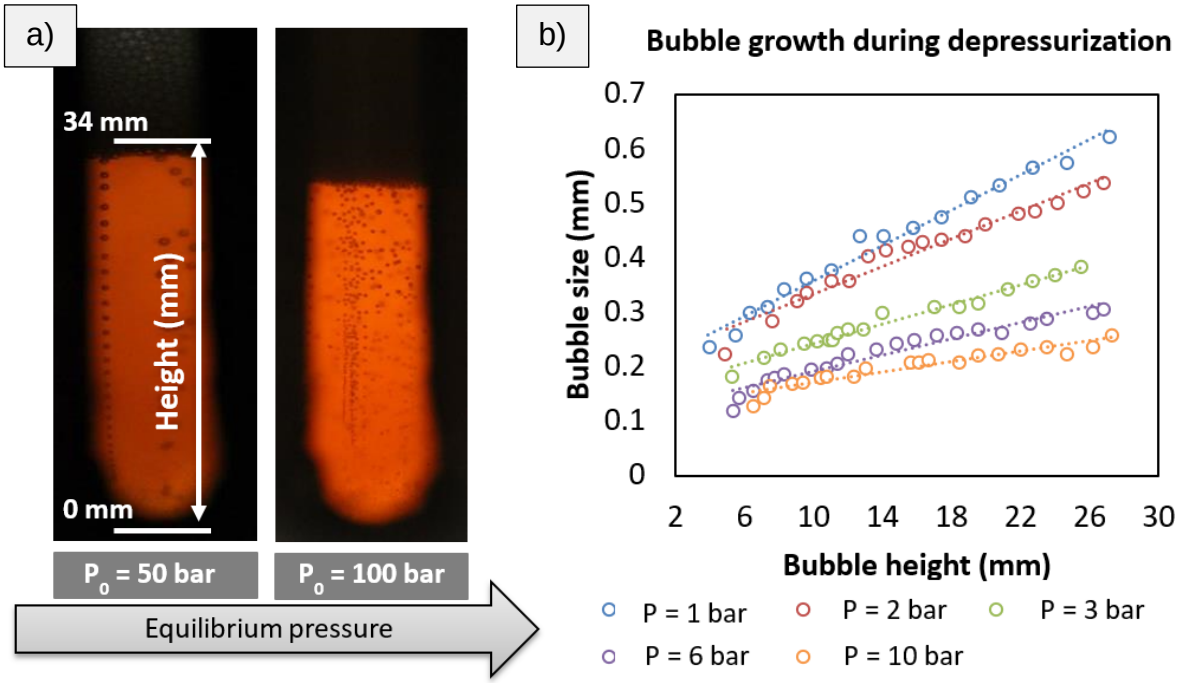
Figure 1 Process of foam formation upon depressurization

Parameters such as the equilibrium pressure and temperature, solubility of the gas in the liquid phase, interfacial tension, surface-active components and depressurization rate play an important role on the bubble nucleation. All of these parameters are interconnected and they strongly affect the formation, structure and stability of the foam. Therefore, the goal of the work is to systematically examine the influence of each parameter in model systems, aiming at a better understanding of the factors controlling the quality of foamed food products [2].

Results

During depressurization, bubbles grow while they rise from the nucleated point towards the surface due to CO_2 diffusion. Our experimental approach is to study how the bubble nucleation is affected by the equilibrium and the remaining pressure in the system. In Figure 2a, we demonstrate an influence of starting pressure on

homogeneous nucleation as well as on bubble growth when the system is depressurized from 100 and 50 bar to 1 bar. The ability of the gas to escape from the system could be explained by the state of the carbon dioxide (at 50 bar, it is in gas state; while at 100 bar, supercritical state), surface tension, oversaturation and



Laplace pressure [2].

Figure 2 a) Bubble nucleation and growth at 40 °C at a remaining pressure of 1 bar. Depressurization from 50 and 100 bar; b) Bubble size at different heights and at different remaining pressures. Equilibrium pressure: 50 bar. Temperature: 40 °C

Our focus here is to consider also the remaining pressure in the autoclave (Figure 2b). The bubble growth is more significant when the system is close to atmospheric pressure, probably due to a higher density difference at lower pressure ranges.

Conclusions and future work

In this contribution, we discuss the strong effect of the equilibrium pressure in the nucleation and bubble growth, which will predetermine the structure and the stability of the final foam. On the other hand, we suggest studying deeply the oversaturation in terms of the depressurization rate in order to fully understand this process.

References

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