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# Effect of carnauba wax and glyceryl monostearate ratio on foaming ability and rheological properties of whipped oleogel

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## Abstract

Oleofoms represent a useful strategy for replace solid fats in food product containing aerated structure, such as sponge cakes, mousse and whipped creams. Their inclusion allows to design food with a lower energy density and less sensitive to microbial spoilage. The study aimed to assess the feasibility of oleofoms based on carnauba wax and glyceryl monostearate, investigating the effect of their ratio on the resulting oleofom properties. To this aim a total of nine oleogels were prepared by changing the carnauba wax (CW) and glyceryl monostearate (GMS) ratios from 10:0 to 0:10 (10:0, 8:2, 7:3, 6:4, 5:5, 4:6, 3:7, 2:8; 0:10). The samples were stored at 8 °C for 12 h before the whipping with a hand-held electric mixer for the optimal whipping time. Dynamic rheological analysis (strain sweep and angular frequency sweep) was performed to explore mechanical properties of both oleogels and oleofoms. The overrun was measured to provide information on the gas hold-up in oleofoms, which were also characterized in terms of texture, colour and physical stability. Both oleogels and oleofoms exhibited a solid like behaviour, with the elastic component ( $G'$ ) dominating the viscous component ( $G''$ ), confirming the formation of a fat crystal network during the cooling and whipping process. The  $G'$  of oil foams ranged from  $2 \cdot 10^3$  Pa to  $1 \cdot 10^4$  Pa, which was lower than that of the oleogel that reached values around  $2 \cdot 10^5$  Pa. Rheological moduli of oleofoms were slightly affected by oscillation frequency, as well as for viscoelastic solids. The overrun values ranged from 25% to 50% as a function of CW:GMS ratio and showed a very low resistance to penetration ( $\approx 1-2$  N). Although air incorporation was difficult in higher strong oleogels, once entrapping air bubbles will be more stable. All the samples showed high physical stability during storage, improving waste management and preserving overall quality, which are of utmost importance for food industries, but also cosmetic and pharmaceutical application.