Impact of pulsed electric field (PEF) intensity on cream yield, overrun, stability, and protein components

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New applications from altering structural components in dairy food could be enabled by the use of pulsed electric fields (PEF), ideally, retaining the native character of the dairy product. The effect of PEF intensity on the fat separation from bovine raw milk following centrifugation was studied regarding yield, overrun, stability and protein components in the resulting cream.

PEF treatment was conducted with refrigerated raw milk, using a continuous-flow co-current treatment chamber with electric field strengths ranging from 9 to 27 kV/cm for a treatment time of 33 µs. Prior to skimming PEF-treated milk was heated to 40°C. Cream was analysed regarding yield and fat content (Milkoscan), overrun (high-shear mixer) and stability (centrifugation) after 20 and 60 s, and protein components (gel electrophoresis).

Cream yield increased ($P<0.05$) for milk PEF-treated at 21 kV/cm and below considering the total amount of fat removed from the skimmed milk. However, no significant differences were observed for the fat content when comparing cream from untreated and PEF-treated milk fat globules (P?0.05). PEF treatments also influenced the overrun of the produced cream, with the most intense treatment at 27 kV/cm decreasing the overrun capacity, whereas the mildest treatment at 9 kV/cm increased it by 30% compared to cream that was not treated with PEF ($P<0.05$) at 20 s. At 60 s an increased overrun was observed from 9 to 21 kV/cm, achieving an overrun up to 65% greater for the least intense PEF treatment conditions than for untreated cream ($P<0.05$). Moreover, the stability analyses of the cream showed a stronger cohesion induced by the most intense exposure to PEF. Milk protein banding on non-reduced and reduced gels remained unchanged after PEF, but for PEF-treated cream the quantity of protein bands decreased slightly.

Processing raw milk with PEF at different intensities followed by milk separation for cream production produced a higher yield in cream without affecting the fat content. Different PEF intensities enabled tailored cream overrun and stability for industrial applications. Milk protein components subjected to PEF did not change regardless of the applied intensity, but subsequent heating and separation induced changes in protein structure of cream.