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## The formation of double emulsions in skim milk using minimal food-grade emulsifiers – A comparison between ultrasonic and high pressure homogenisation efficiencies

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### Abstract

Double emulsions of W1/O/W2-type were formed in skim milk. Skim milk (W1) was emulsified within sunflower oil (O) using ultrasonication that was in turn emulsified within an external skim milk phase (W2) using ultrasonication or high pressure homogenisation (HPH). The internalised aqueous phase was stabilised within the oil phase using food-grade surfactants: polyglycerol polyricinoleate (PGPR) and/or lecithin. Encapsulation yields of the W1/O emulsion into the double emulsion were between 30-100%, with increased yields achieved with reduced sonication time or HPH pressure, or increased PGPR or lecithin concentration. Ultrasonication was found to form relatively better monodisperse emulsions that showed greater stability to coalescence than those produced by HPH. Ultrasonication and HPH were found to be translatable in the sense that at a similar specific energy density (~ 20 J/g) emulsion droplet sizes with a similar size distribution between 1-10 µm and encapsulation yield (*ca* 37 wt%) could be achieved.

### Keywords

Double emulsion; skim milk; ultrasonication; high pressure homogenisation; lecithin; PGPR

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