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Encapsulation of magnesium in W/O/W emulsions: characterization and stability evaluation

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Due to their structure, W/O/W emulsions, i.e. O/W emulsions of oil globules, in which water droplets are included, are good candidates for ion encapsulation. The ions are initially entrapped in the internal water droplets to protect them from chemical degradation and/or to mask their eventual unpleasant taste. Encapsulated ions are generally released to the external aqueous phase following two different mechanisms: permeation through the oil phase and coalescence between the internal droplets and the globule surface. Magnesium supplementation of food may be indicated for preventing and managing disorders such as hypertension or cardiovascular diseases. In this study, we have investigated the potentiality of W/O/W double emulsions stabilized by Polyglycerol Polyricinoleate (PGPR) and sodium caseinate to encapsulate magnesium ions. Different vegetable oils (rapeseed oil, olive, miglyol) were probed. Ion release was quantified in the outer-phase solution after centrifugation by flam atomic absorption spectroscopy. The effects of the oil nature, of the fat globule concentration, and of the temperature (4 and 25°C) on the rate of magnesium release were investigated. A progressive release occurred at the time scale of several months. Observations under the microscope showed that the W/O/W structure was preserved over a one-month storage period at 4 or 25°C, i.e., no coalescence between the fat droplets or between the aqueous internal globules took place. This finding revealed that the release occurred mainly by permeation of the ions through the oil phase. The oil nature influenced magnesium leakage: best encapsulation stability was obtained with rapeseed oil. Depending on the oil type, emulsion dilution and/or storage at room temperature favoured magnesium release. When placed in simulated gastrointestinal conditions, the triglycerides were hydrolyzed by pancreatic lipase leading to magnesium release. On the whole, our results showed that, due to their quite good stability, W/O/W emulsions loaded with magnesium ions are potential active ingredients for food supplementation, and that the encapsulated magnesium should be available for in vivo conditions.