

Centrifugal ultrafiltration for the determination of antioxidant partitioning in emulsions – pitfalls and considerations

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The partitioning of substances between (pseudo-)phases in emulsions and emulsion-based delivery systems is part of many studies considering e.g. antioxidant activity or stabilisation of bioactive compounds. Ultrafiltration (UF) has been commonly used in such studies. However, when the partitioning / distribution of a compound is governed by a dynamic equilibrium, and that is most often the case, the separation of the phases has to be avoided, since disturbing the equilibrium will cause distorted results. Furthermore, interactions between the analyte and the UF membrane must be kept to a minimum. Nevertheless, these prerequisites are often neglected or at least not reported in the current literature.

The aim of the present study was to experimentally demonstrate in which cases and under which circumstances UF can nevertheless yield reliable results. Therefore, the partitioning of ferulic acid (FA) in Tween 20 stabilized o/w emulsions of different compositions was studied by ultrafiltration using centrifugal filtration devices. The filtration conditions were varied in a way that different filtrate volumes were obtained. The impact of the filtration conditions and especially the impact of the filtrate volume on the apparent partitioning of FA in o/w emulsions was experimentally shown and could be integrated in an existing theoretical framework^{1,2}. The proportion of FA could easily be overestimated. However, the data show that UF can yield reliable results with low centrifugal speed, short centrifugation times and proper choice of membrane, depending on emulsion composition.

While these findings are not surprising, their importance becomes most apparent when experimental conditions have to be chosen to study and compare the partitioning of a substance in different emulsions.

¹Bravo-Díaz, C., et al. (2017) Eur. J. Lipid Sci. Technol., 119: 1600277.

²Stöckmann, H. & Schwarz, K. (1999) Langmuir, 15, 6142-6149.