

## **Novel method for preparing vesicles from a monodisperse emulsion aimed at controlling the size and improving the entrapment yield**

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Vesicle is a compartment composed of lipid bilayer of amphiphilic molecules. Vesicles are applied to carriers of drugs, cosmetics and functional food ingredients in industries. They are also applied as model for artificial cell membrane and expected as microreactor. Vesicles are generally prepared by the hydration of dry lipid film, but there is no method to prepare vesicles with controlled size and high entrapment yield of hydrophilic materials inside vesicles. In this study, microchannel (MC) emulsification method was applied to prepare vesicles aimed at controlling the size and improving the entrapment yield. Firstly, monodisperse water-in-oil (W/O) emulsions were prepared by the MC emulsification method using an emulsifier dissolved in the oil phase. With keeping water droplets frozen, the emulsifier was replaced to a bilayer-forming lipid mixture, and then oil phase was evaporated. After hydration of lipid layers surrounding water droplets, spherical vesicles were formed. The final sizes of the prepared vesicles were comparable to the original emulsion droplet sizes. This means that size of vesicles can be controlled by controlling of the size of original water droplets of the W/O emulsions. Furthermore, calcein as a hydrophilic fluorescent marker was entrapped into the internal water phases of vesicles. The operating parameters in this preparation method were examined in order to improve the entrapment yield of hydrophilic material inside vesicles. The method proposed in this study enables the formation of vesicles with a controlled size and high entrapment yields, potentially useful for expanding the application fields of vesicles as biocompatible carriers and microreactors for biochemical reactions.