# Novel design of osmotic chitosan capsules characterized by asymmetric membrane structure for in situ formation of delivery orifice

許明照
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## Abstract

In this study, chitosan capsules with asymmetric membrane to induce osmotic effects and in situ formation of the delivery orifice were optimally prepared and characterized. Chitosan capsules were formed on stainless steel mold pins by dipping the pins into a chitosan solution followed by forming asymmetric structure by dipping into a quenching solution containing tripolyphosphate (TPP) to cause an ionic cross-linking reaction between the outer layer of chitosan and TPP. Factors influencing the properties of the capsule membrane, such as the molecular weight of chitosan, the dipping solution and dipping time, and the quenching solution and time, were optimized to successfully produce osmotic chitosan capsules with asymmetric membrane using chitosans that possessed different viscosities. In situ formation of a delivery orifice on the asymmetric membrane of the chitosan capsule was proven by the observation of a jet stream of chlorophyll being released from the capsule. Drugs with different solubility were selected, and a linear correlation between drug solubility and the initial drug release rate calculated from the slope of the drug release profile was used to verify that the delivery orifices that were in situ formed on the asymmetric membrane of the chitosan capsules induced by osmotic effect was responsible for the drug release. Water permeability across the optimally produced asymmetric membrane of the capsule from chitosan of 500 cps (300-700 cps) quenched with TPP for 30 min (C500/TPP30) was determined to be 1.40 x 10(-6)cm(2)h(-1)atm(-1) at 37.0+/-0.5 degrees C. The encapsulation of poorly water-soluble drugs, felodipine (FE) and nifedipine (NF), in such an asymmetric chitosan capsule was capable of creating a sufficient osmotic effect to activate the release of the drug with the addition of SLS and HPMC. The multiple regression equations of maximal release percent at 24h for FE and NF confirmed that both sodium lauryl sulfate (SLS) and hydroxypropyl methylcellulose (HPMC) positively influenced this response factor, and the effect of SLS was greater than that of HPMC.