

## Coaxial Ultrasonic Atomizer System to Prepare Reservoir-Type Microcapsules Bearing Protein Drugs

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The microparticulate system has attracted significant interest as the carrier of protein drugs that are susceptible to the harsh biological environments such as hydrolytic enzymes and the low pH. In an attempt to encapsulate protein drugs in the mild condition, a new technique has been developed based on the solvent exchange method, implemented by the ultrasonic atomizer system. The reservoir-type microcapsules were prepared to encapsulate lysozyme as a model protein by inducing collision of the aqueous droplets containing lysozyme and the organic droplets bearing poly(lactic acid-co-glycolic acid). The resulting microcapsules released native lysozyme in a sustained manner, in which the release rate was dependent on the formulation conditions such as the polymer concentration and the molecular weight of the polymer used. It was demonstrated that the solvent exchange method does not induce lysozyme aggregation as well as loss of its biological activity. Overall, the solvent exchange method, implemented by the ultrasonic atomizer system, was considered to be an effective tool capable of preparing reservoir-type microcapsules for delivering the protein drugs in their native forms.