453d Microencapsulation of Hydrophilic Additives into Colloidal Polymers with the Aid of Compressed Carbon Dioxide

Matt Yates, X Chen, Z Dong, N Finn, and W Yin

The swelling of aqueous latexes with compressed carbon dioxide can be exploited to impregnate colloidal particles with additives, such as dyes, fragrances, or pharmaceutical compounds without the use of harmful organic solvents. We have previously demonstrated that this carbon dioxide-based microencapsulation process can facilitate the spontaneous diffusion of lipophilic additives into colloidal polymer particles. Hydrophilic additives, on the other hand, interact more favorably with the water surrounding the polymer particles and as a result have a low encapsulation efficiency. In the present study, we report the results of two approaches to enhance the encapsulation efficiency of hydrophilic additives. Hydrophobic ion pairing is used to enhance the interaction of ionic compounds with the polymer and the double emulsion technique is used to kinetically trap hydrophilic additives into polymer particles. Our results demonstrate that a variety of compounds may be encapsulated including ionic dyes, small molecule ionic drugs, and proteins. The use of carbon dioxide allows for microencapsulation with a large reduction in the use of organic or halogenated solvents.