Surface interaction control and characterization of microcapsule and biological molecules for pharmaceutical application

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For the development of drug delivery systems using particulate matters and microcapsules, the surface interaction between such materials and biological molecule was controlled by surface molecular and nanometer scaled structure design. The interactions between pharmaceutical particulate material and biological molecules such as mucin layers were successfully measured by using colloid probe atomic force microscopy (AFM) under various conditions. Based on the measurement result, our group and co-workers designed surface molecular and nanometer scaled structure to control surface interaction. In this research, we will introduce the results of surface interaction control for various kinds of pharmaceutical particles, microcapsules and biological molecule. One example is novel thermo- and pH-sensitive nanogel particle, which is a core-shell structured particle as a vehicle for the controlled release of peptide drugs. The pH depended change of surface interaction between p(MMA-g-EG) shell and mucin layer of the small intestine were measured by colloid probe AFM. The interaction between nanogel and mucin layer in each pH condition was able to be controlled by molecular level shell structure design. Next, chitosan-coated liposomes have been designed for same purposes. Carbon nano-tube (CNT) attached probe was immersed in PEI solution (3mg/ml) over night and then adsorbed mucin layer on CNT probe. Micro adhesion behavior of chitosan-coated liposomes was quantitatively assessed by using CNT probe with coated mucin layer.