

parently, the larger the particle size of the codried product is, the smaller the angle of repose for the same amount of added β -CD will be. Increasing the amount of β -CD added improved the flowability of the codried particles as evidenced by a smaller value of the angle of repose. However, both size fractions of all

codried products showed better flowability compared to those for the 2 grades of Avicel with 2 different DP values. Carr index demonstrated the same tendency as that supported by the angle of repose except for the 4L sample. As reported previously,^{3,4} the rounded shape of codried particles (Fig. 1) is responsible for the better flowability compared to those of both grades of Avicel with 2 different mean sizes.

The mechanical performance of the codried products was examined by evaluating Heckel plots using compression at 4 different forces. Values for Avicel PH101, 102, 301, and 302 were included for comparison. Results are listed in Table 2. Linearity of these plots was acceptable with all R^2 values greater than 0.8. Yield pressure was calculated from the slope of the linear plot of $\ln(1/(1 - D_{\text{bulk}}/D_{\text{true}}))$ versus compaction pressure. D_0 refers to the relative density at 0 compression pressure, which is defined as $D_{\text{tapped}}/D_{\text{true}}$ in this study. D_a is obtained from the intercept of the linear plot, indicating the relative density before an appreciable bonding was formed between particles. D_b is the difference between D_0 and D_a , indicating the relative density change due to the movement and rearrangement of particles.

As indicated in Table 2, both D_0 and D_a values for the 2 series of formulations of L and S increased with increasing amount of β -CD except the D_a value for the 1S formulation. Comparable values of D_0 and D_a were shown for Avicel products of the same DP value (PH101 and PH102 vs. PH301 and PH302), whereas these 2 values were larger for Avicel products with a lower DP value (PH301 and PH302) than for those with a higher DP value (PH101 and PH102). The D_0 values of pure MCC of the 1S and 1L formulations were comparable, but in a range between those for Avicel PH101 and PH301. However, the D_a value of the 1S formulation was larger than that of the 1L formulation, but both were smaller than that for the respective Avicel sample of a similar size range. Both the D_0 and D_a values for β -CD were the largest among all products.

Correspondingly, D_b values of formulations 1L and 1S were larger than those of 2L-4L and 2S-4S, respectively. But no significant differences in D_b values among the S or L series were seen, and that of the latter

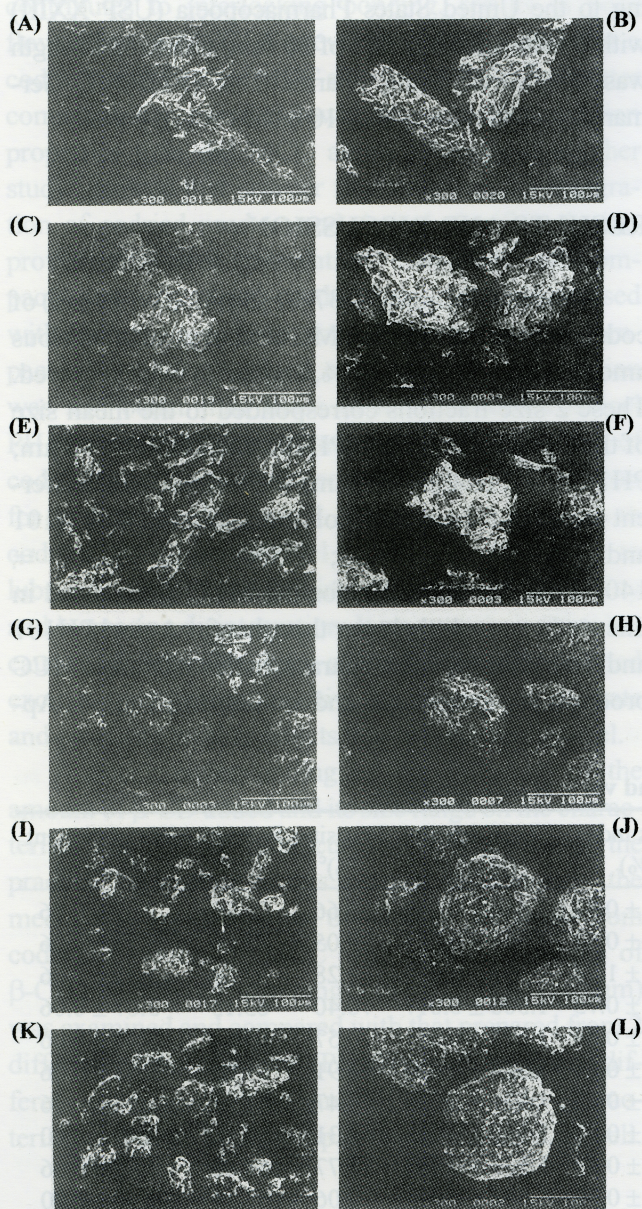


Fig. 1. SEM photographs of granules of individual and codried MCC samples. (A) Avicel PH101; (B) Avicel PH301; (C) Avicel PH102; (D) Avicel PH302; (E) 1S; (F) 1L; (G) 2S; (H) 2L; (I) 3S; (J) 3L; (K) 4S; (L) 4L.