Tuning of Particle Size in a Helical Coil Reactor

S. K. Pal, P. Dhasmana, K. D. P. Nigam, and V.Singh*

Department of Chemical Engineering, IIT Delhi, Hauz Khas, Delhi-110016, India

E-mail: vs225@chemical.iitd.ac.in

Supplementary Information

XRD analysis for phase identification

The XRD peaks of precipitated $BaSO_4$ powder are matched with the standard inorganic reference database to check the purity of the precipitate. The diffraction pattern matched with the entry number 00-101-0542[?] of the COD (crystallographic open database) reference database which suggests an orthorhombic crystal system with cell dimensions of a= 8.8500 Å, b=5.4300 Å and c= 7.1300 Å. Fig. SS.1 shows the XRD pattern for the precipitated particle samples obtained at different Dean numbers.

Zeta potential of barium sulfate in different solution conditions

Table S.1: Zeta potential values obtained from the zetasizer ZS-90 for barium sulfate particles dispersed in different solutions.

Sample No.	Dispersant	Zeta Potential(mV)
SW	DI water	-3.25
SE	Pure Ethanol	-11.3
SC1	0.1% NaHMP in DI water	-12.8
SC2	0.5 % NaHMP in DI water	-68.2

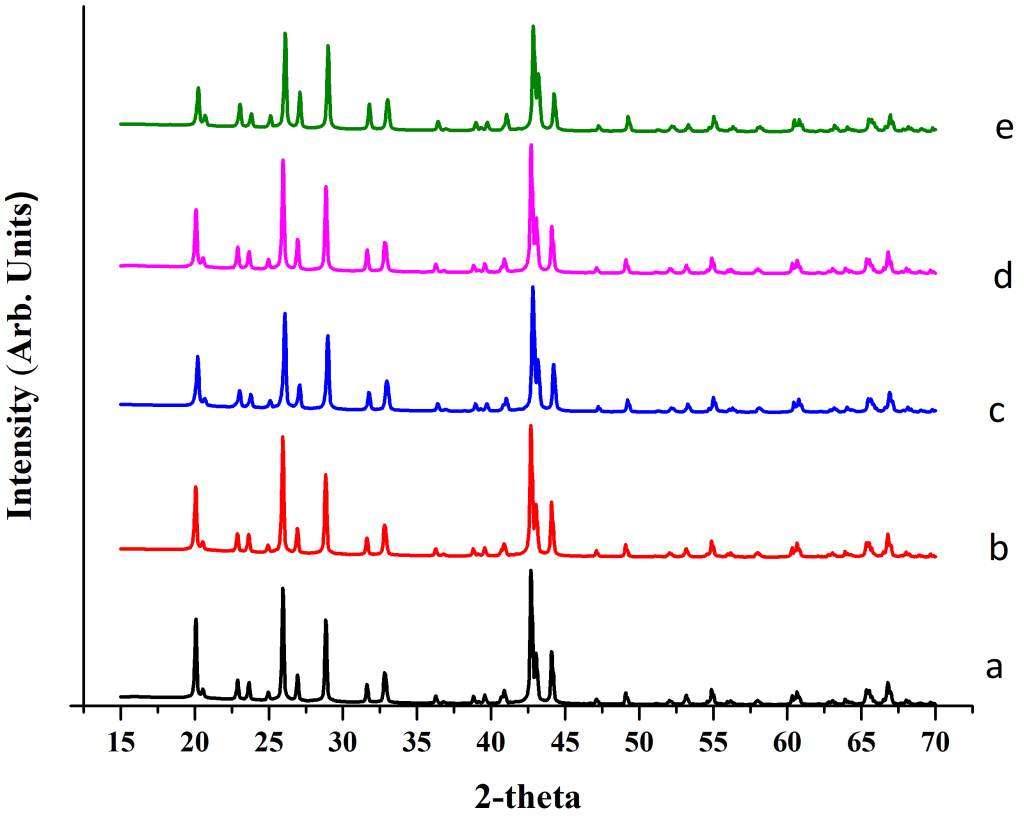


Figure SS.1: XRD patten of samples at different Dean numbers, (a) De=63.92, (b) De=133.66, (c) De=191.77, (d) De=290.56 and (e) De=370.5 respectively.

Effect of concentration on polydispersity index and size in straight tube reactor

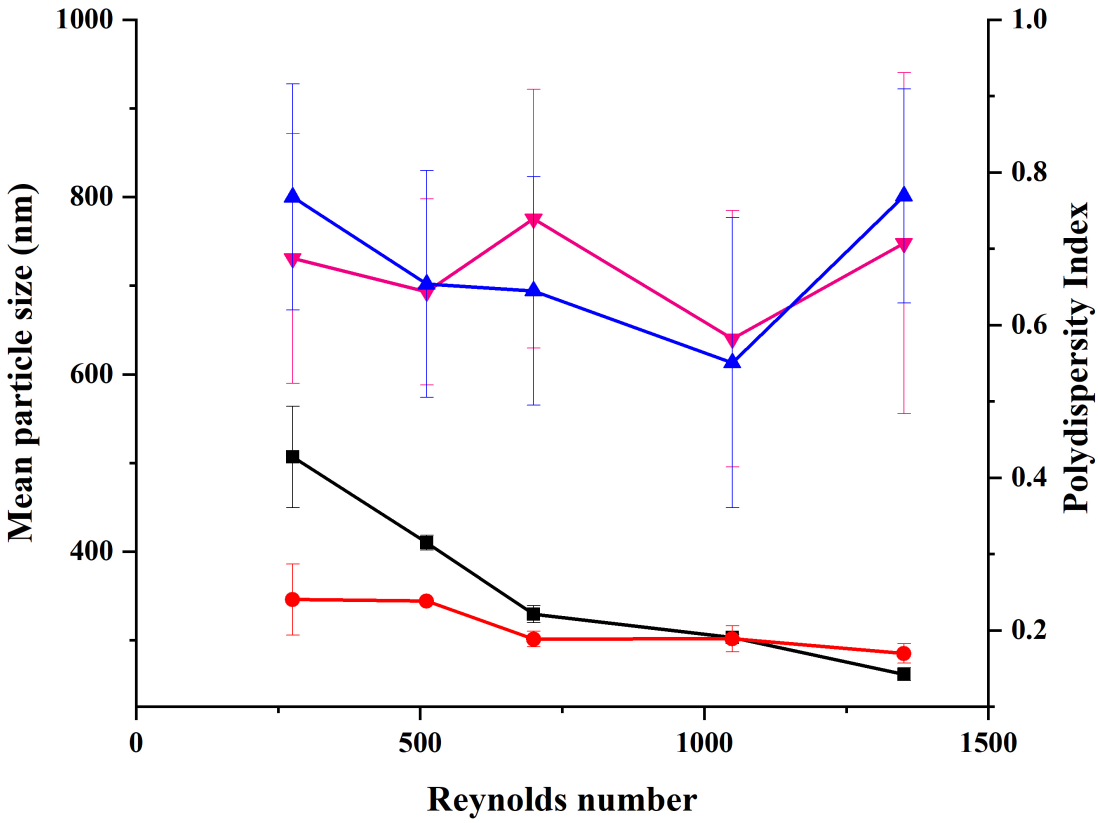
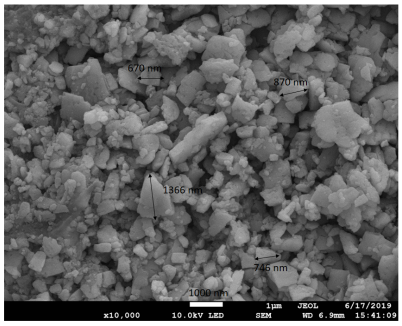
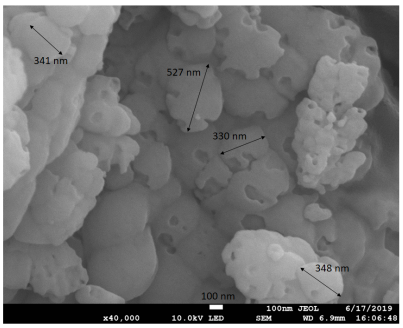


Figure SS.2: Effect of concentration on particle size and polydispersity index in a straight tube reactor where symbols represent (▽) mean particle size at 0.1 M, (■) mean particle size at 0.5 M, (▲) polydispersity index at 0.1 M and (●) Polydispersity index at 0.5 M respectively. The difference in the particle size between a straight channel and a helical coil with the same Y-mixer further suggests that even at large concentrations the growth process is long compared to the time spent in the Y-mixer.

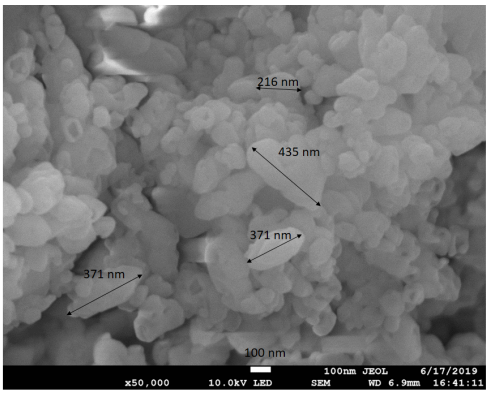
FESEM of particles with different flowrates and initial concentrations



(a) FESEM image at De=63.93 and C=0.1 M



(b) FESEM image at De=370.5 and C=0.1 M



(c) FESEM image at De=370.5 and C=0.5 M

Figure SS.3: FESEM images comparing particle size at different flowrates and initial reactant concentration conditions.