



AMT TN-03

Calcium Carbonate Slurry Recycling in the Coflore® ACR

Introduction

The Coflore® Agitated Cell Reactor (ACR) is a multipurpose flow reactor designed for laboratory and small scale manufacturing duties. A key feature of the ACR is its suitability for multiphase reactions such as solid-liquid reactions.

When assessing the suitability of solid-liquid reactions in flow, the characteristics of the solid have a large impact on the reaction set up required. In particular, the settling characteristics of a solid has a significant impact, with fast-settling solids behaving very differently to slow-settling solids in flow.

Internal testing at AM Technology investigated the ability of an ACR to handle a >60%w/v suspension of a slow-settling solid, calcium carbonate, over extended run times.



Figure 1: The Coflore® ACR



Figure 2: calcium carbonate accumulation on the feed vessel lid

Experimental Work

A vigorously stirred 60.8%w/v suspension of calcium carbonate in water (5 L) was prepared in a 10 L feed vessel. The Coflore® ACR system was assembled so that the outlet of the ACR fed back into the feed vessel. The slurry was then recycled through a Coflore® ACR containing 10x high-shear agitators at an initial flow rate of 90 mL/min to give a Residence Time (RT) within the reactor cell block of 1 minute. After 24 h, the peristaltic pump rpm was adjusted to give a 2 minute RT. After a further 72 h, the rpm was adjusted to give a 5 minute RT. Samples were regularly taken from both the feed vessel and the ACR outlet to allow monitoring of the slurry concentration at the various residence times.

ACR Residence Time (min)	Run Time (h)	Total Residence Times	Average Slurry Concentration (%w/v)
1	24	1,440	60.5
2	72	2,160	60.8
5	24	288	60.7

Table 1: Summary of results from the slurry handling testing.

Results & Conclusion

Initially, a 63.2%w/v suspension of calcium carbonate was prepared however, due to vigorous agitation of the suspension in the feed vessel, deposits of calcium carbonate accumulated on the feed vessel walls and lid as pictured in figure 2. Therefore, the actual slurry concentration was found to be 60.8%w/v. The ACR successfully handled this slurry without any blocking for a total run time of 120 h. Three residence times were investigated as summarised in table 1 above. At all three residence times, no accumulation of solids within the ACR was observed after extended run times.