



AMT TN-07

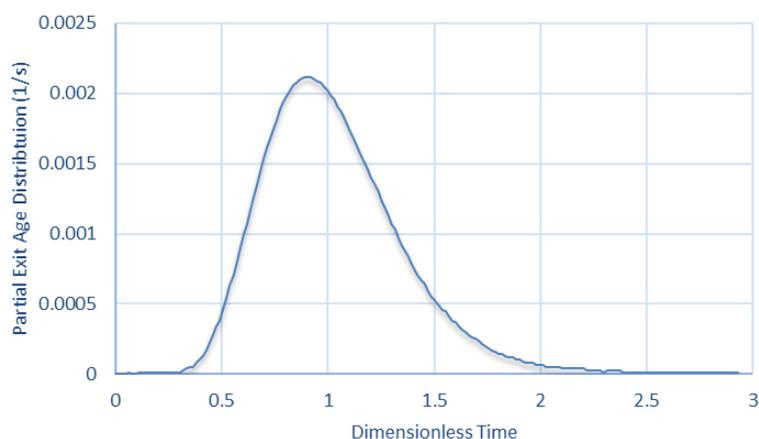
Residence Time Distribution in the Coflore[®] RTR

Overview

This technical note looks at the residence time distribution (RTD) in the Coflore RTR continuous flow reactor. The RTR reactor (Figure 1) has a 100 L internal volume and houses a free-moving agitator that separates the reactor tube into 10 distinct stages via baffles located along the agitator (Figure 2). As reaction media is pumped through the system, the RTR reactor tube rotates by 140° in reciprocating cycles, resulting in radial mixing that gives high mixing performance without the need for rotating drive shafts, mechanical seals, or wall-mounted baffles. Maximum turbulence and shear conditions exist at the very outer region of the tube to optimise multi-phase handling characteristics. This delivers short mixing times, excellent mass-transfer conditions, and optimum heat-transfer capability, whilst eliminating back-mixing to maintain plug flow performance.

RTD Test Procedure

For this test, the agitation speed of the RTR was set at 25 cycles per minute. Water was continuously fed to the RTR at a flowrate of 9.5 Litres per minute. This equates to a residence time of 10.5 minutes in the RTR. 60 mL of saturated brine solution was injected into the water feed line using a polypropylene syringe and data was recorded for at least 2 residence times using a conductivity sensor at the outlet. Through monitoring the change in conductivity vs time, the RTD can be calculated as summarised in Graph 1.



Graph 1: Residence Time Distribution Curve for the Coflore RTR; 10.5 Minute Residence Time, 25 cycles/min Agitation Rate.



Figure 1: The Coflore RTR Continuous Flow Reactor.



Figure 2: Coflore RTR Reactor Tube (cut away) showing internal agitator.

Results

The Coflore[®] RTR was determined to have consistent orderly flow behaviour. At the tested agitation speed of 25 cycles per minute, 11 ± 1 CSTRs in series were observed. Experimental results were fit to the Tanks-In-Series model. All model fit results are accurate with a coefficient of determination exceeding 99%.