USD 3482

Liquid-Liquid Mixing at 500 L Scale

Mixing system: Pall Magnetic Mixer system
Mixing biocontainer: 500 L Round mixing biocontainer (off-center impeller)
Application mixing type: Liquid-liquid

The Pall Magnetic Mixer platform is a scalable single-use mixing system. The heart of this system is a mixing biocontainer incorporating an innovative bottom-mounted, magnetically-driven impeller capable of providing efficient, high speed, high-torque mixing in powder-liquid and liquid-liquid applications.

Figure 1
500 L tank and drive

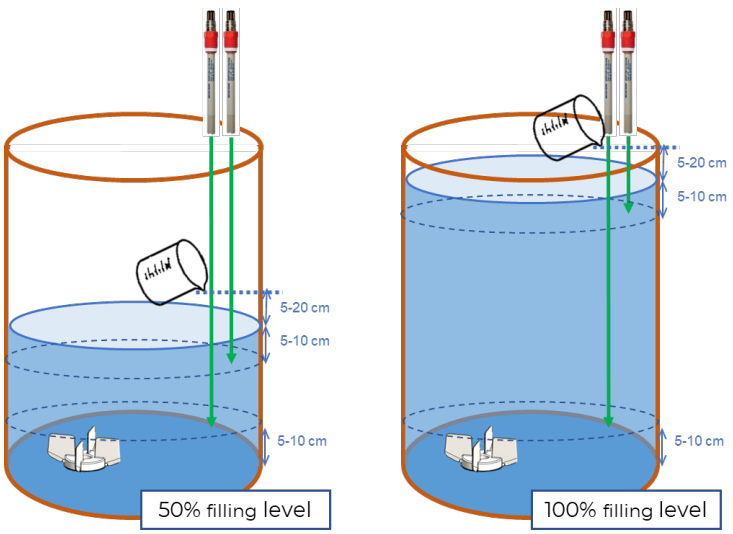
Introduction

Liquid-liquid mixing is a common requirement in biopharmaceutical processing. Biotech applications involving stress-sensitive materials (e.g. some proteins) often require the use of reduced impeller mixing speeds to minimize risk of yield loss. In this experiment, mixing performance was evaluated at a power input of approximately 1 W/m³ which is apparently very soft as it presents no significant visible movement of the liquid surface; sodium chloride (NaCl) aqueous solution was added to water at the 250 L and 500 L scales, with the time to reach homogeneity determined by conductivity measurement.

Experimental

A Magnetic Mixer 500 L biocontainer was installed in a 500 L round mixing tank and then filled with 250 L of room-temperature water via a top-mounted liquid inlet port. Mixing was then initiated with an impeller speed of 45 rpm (equivalent to ~1 W/m³ power input) and then 500 mL of 20% (w/w) NaCl solution was added to the top of the biocontainer over a duration of ~ 1 second on the opposite side from the impeller just above the liquid surface. The test was repeated five times. Solution homogeneity was monitored using two conductivity sensors located at the top and bottom of the biocontainer; homogenization was deemed complete when both sensors had reached a stable reading within ± 5 % of the conductivity signal shift. Figure 2 shows the test set up. The test was repeated at the 500 L scale with an impeller speed of 60 rpm.

Figure 2
Test setup



Results

The homogenization times are reported in Table 1. As an example, the conductivity vs time chart for the 250 L tests is shown in Figure 3. With the impeller speeds tested, at the 250 L scale (50% of tank capacity) it took in average 116 seconds to reach homogeneity, and at the 500 L scale (100% of tank capacity) it took in average 198 seconds to reach homogeneity. The longest homogenization time (at the 500 L scale) was 238 seconds.

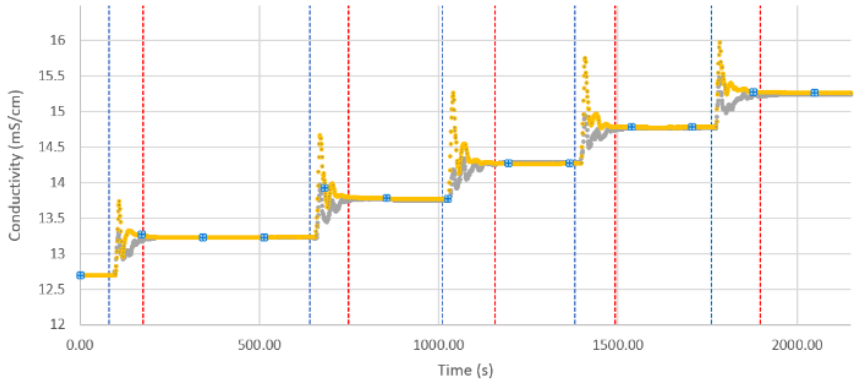
Table 1

Homogenization time in seconds (s) in a 500 L round tank. Each test was repeated 5 times

Filling Level	Speed (rpm)	Test 1 (s)	Test 2 (s)	Test 3 (s)	Test 4 (s)	Test 5 (s)
50%	45	100	136	113	113	118
100%	60	222	174	170	187	238

Figure 3

Conductivity evolution during the 250 L test. The blue lines indicate the addition times and the red lines indicate the calculated mixing times



Conclusion

The mixing capabilities of the Magnetic Mixer system facilitate rapid liquid-liquid mixing of water-like solutions at the 250 L and 500 L scales, even when low impeller speeds are required due to product stress-sensitivity concerns. Under the conditions evaluated, homogenization was typically completed within 2 and 4 minutes respectively.

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