

Experimental Report

CellVessel: Motor Sizing

The object of this report is to determine the motor power required to drive different impeller setups in liquids with varying viscosity. The CerCell magnetic stirring table (MST) has been used to drive the impeller system with magnetic power transfer. The impellers was mounted in a $\text{\O}130\text{mm}$ 3L CellVessel equipped with four OD12 mm PC tubes simulating; temperature well, in-out system and two sensor. These tubes will prevent some of the formation of a large vortex (act as stators), which improves agitation.

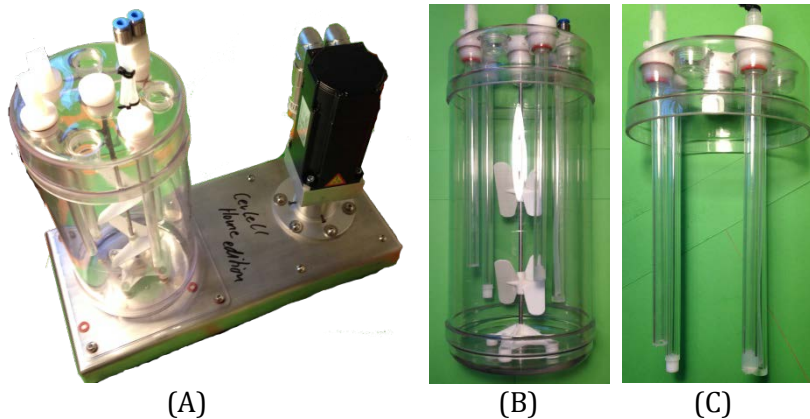


FIGURE 1: (A) EXPERIMENTAL SETUP; CELLVESSEL, MST, MOTOR. (B) CELLVESSEL SIDE VIEW. (C) TEMPERATURE WELL, IN-OUT SYSTEM AND SENSOR IMITATION.

1. Magnetic stirring table (MST)

The MST-table was equipped with an electro servo motor and spun through its operating rang (0 to 2000 RPM). The power used by the motor through the operating rang was collected. The results were then plotted in a graph as power usage Vs. RPM, see Figure 1 below. It is important to emphasize that this power usage is just for the MST-table without driving any vessel.

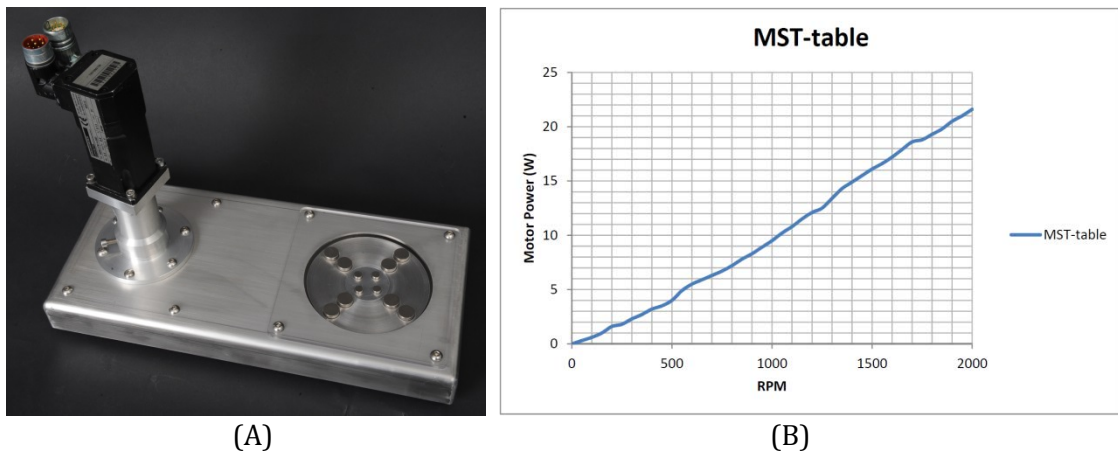


FIGURE 2- (A) PICTURE OF MST-TABLE MOUNTED WITH SERVO MOTOR. (B) POWER USAGE VS RPM FOR MST-TABLE.

2. Impeller Setups

Three different setups for agitation have been utilized for the experiment. Two setups consisted of two pitch blade impellers OD45, angle 45° (see 3 (A, B)) and another of two Rushton turbine's OD 45 mm (see 3 (C)) mounted on a four magnet engine.

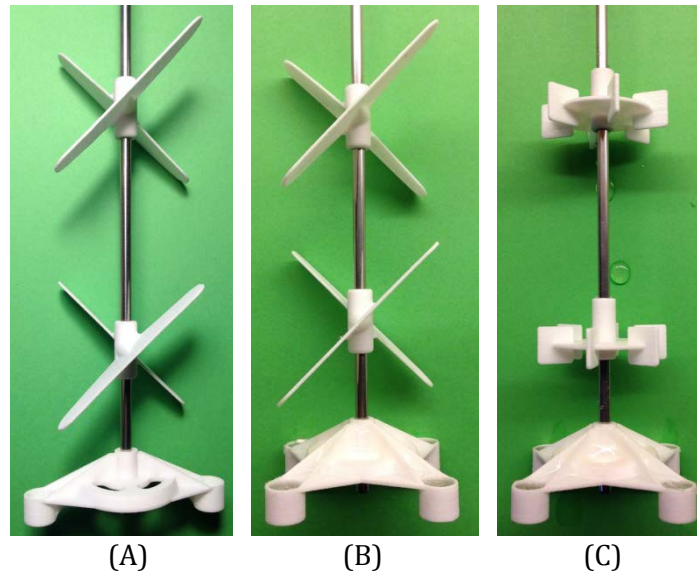


FIGURE 3- (A) DUAL PITCH BLADE OD45 45° WITH TWO MAGNET ENGINE. (B) DUAL PITCH BLADE OD45 45° WITH FOUR MAGNET ENGINE. (C) DUAL RUSHTON TURBINE OD45 WITH FOUR MAGNET ENGINE.

3. Experiments

Each of the three impeller setups in 3 was driven in two liquids with different viscosity. The two liquids were water (1 cP) and glycerin (1000 cP). The collected data is presented in the graph below.

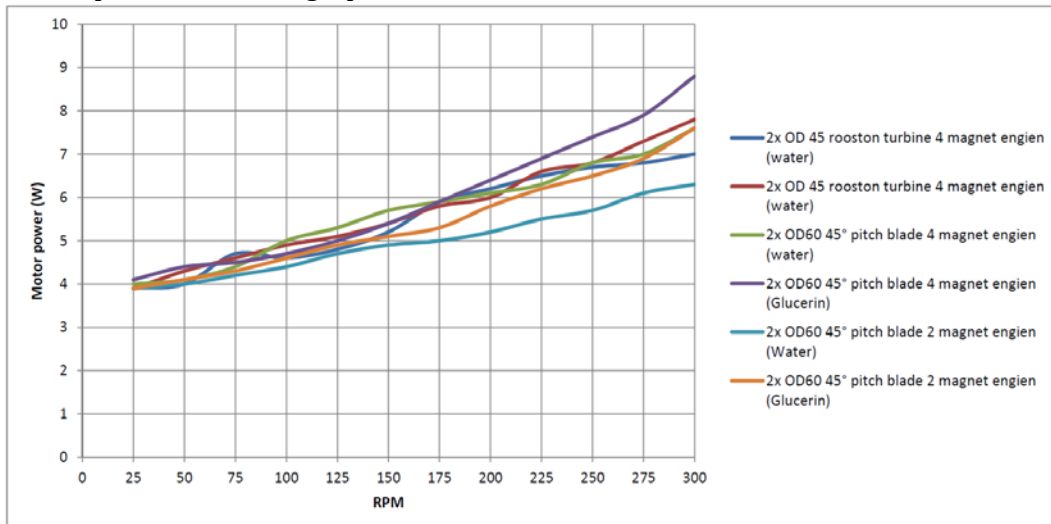


FIGURE 4 GRAPH SHOWING MOTOR POWER USAGE VS RPM FOR THE DIFFERENT EXPERIMENTS.

It can from Figure 4 be concluded that all that all the tested setups required less than 10 watt of motor power and that there was relatively small difference between the different two liquids at the tested RPM.

Conclusion

The minimum amount of power needed to drive the different impeller setups is displayed in the table below. With the three different setups showed in Figure 3 it and should be safe to say that they can be driven in by a 10W motor even in a 1000 cP liquid (centiPoise). However the smallest motors which are often used supply around 30W which is more than enough to drive all the different CellVessel impeller configurations in 1000 cP liquid.

RPM	MST [W]	To liquid [W]	Total [W]
50	0,3	4,2	4,5
100	0,6	4,4	5
150	1	4,6	5,6
200	1,6	4,8	6,4
250	1,8	5,7	7,5
300	2,3	6,5	8,8

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