Technical Note: 07009

Using the Thermo Scientific Matrix® PlateMate® 2x3 Stainless Steel Positive Displacement Pipetting Head for Low Volume Dispensing of Dimethyl Sulfoxide (DMSO)

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Key Words

- Thermo Scientific Matrix PlateMate 2x3
- Dimethyl Sulfoxide (DMSO)

Introduction

Dimethyl Sulfoxide (DMSO) can be difficult to pipette accurately because of its low viscosity. The following experiment was conducted to minimize reagent waste and measure the precision (CV) for a 0.1 µl incremental, wet dispense of DMSO. Dispenses were performed with the 0.1-50 µl stainless steel, positive displacement pipetting head for the Thermo Scientific Matrix PlateMate 2x3 automated liquid handling workstation.

Materials:

1. 1xPBS
2. 100% Dimethyl Sulfoxide (DMSO)
3. 1 nM Fluorescein Dye
4. 70% Ethanol (EtOH)
5. Distilled Water
6. Thermo Scientific Matrix PlateMate 2x3 (Item no. 801-10001)
7. Thermo Scientific Matrix PlateMate 2x3 Pipetting Head, Positive Displacement, 96-Channel, 0.1-50.0 µl, Stainless Steel/PTFE Coated (Item no. 501-102810)
8. ControlMate 2xY Software Pre-Release Version 1.1.2
9. Thermo Scientific Matrix 96-Well Polystyrene Microplate, Clear, Flat Bottom (Item no. 4915)
10. Thermo Scientific Matrix Disposable Automation Reservoir, 96-Channel (Item no. 1064-05-8)
11. Nunc 384-Well Low Volume Microplates
12. Corning 384-Well Microplates, Black, Flat Bottom
13. Multichannel Thermo Scientific Matrix Pipette
14. Microplate Reader

Methods:

1. 200 µl of 1xPBS was added to a 96-well microplate with a calibrated multichannel pipette and the plate was placed onto the stage of the Matrix PlateMate 2x3
2. 20 µl of 100% DMSO and 100 nM Fluorescein dye was added to a 384-well microplate with a calibrated multi-channel pipette and the plate was placed onto the stage of the Matrix PlateMate 2x3
   (Please note: Rows A and B were left empty as a control)
3. Using the Matrix PlateMate 2x3 with a stainless steel, positive displacement pipetting head, 20 µl with a 5 µl overstroke of 1xPBS was aspirated from the 96-well microplate
4. 10 µl of 1xPBS was dispensed incrementally into the dry wells A1 and A2 of a 384-well low volume microplate
5. The pipetting head needles were then washed with 25 µl of 100% DMSO in a 125 ml reservoir for 3 cycles
6. Following the wash with DMSO, the needles were then washed with 25 µl of 70% EtOH in a 125 ml reservoir for 3 cycles
7. 1 µl with a 5 µl overstroke of 100 nM Fluorescein dye/100% DMSO was aspirated from well A1 of the 384-well microplate (from Step 2). Trail dispenses of 0.5 µl, 0.1 µl and 0.1 µl were dispensed back into the 384-well microplate
8. 0.1 µl of 100 nM Fluorescein dye/100% DMSO was dispensed incrementally to wells A1 and A2 of the 384-well low volume microplate (from Step 4)
9. The pipetting head needles were washed with 25 µl of distilled water in a 125 ml reservoir for 3 cycles, followed by a second wash with 25 µl of 100% DMSO in a 125 ml reservoir for 3 cycles, as well as a third wash of 25 µl of 70% EtOH in a 125 ml reservoir for 3 cycles
10. The 384-well low volume plate (from Step 8) was labeled Plate 1 and placed in a microplate reader where it was shaken at a speed of 900 rpm for 1 second before it was read
11. Steps #3-10 were repeated a second time with a modification to Step 7: 2 µl of 100 nM Fluorescein dye/100% DMSO was aspirated from A1 of the 384-well microplate, the piston speed was slowed down and set to 1255 rpm and a trail dispense of 1.3 µl was dispensed back into the microplate (This plate was labeled Plate 2)
12. Steps #3-10 were repeated a third time with a modification to Step 7: 2 µl of 100 nM Fluorescein dye/100% DMSO was aspirated from A1 of the 384-well microplate, the piston speed was slowed down and set to 1255 rpm and trail dispenses of 1.2 µl and 0.1 µl were dispensed back into the microplate (This plate was labeled Plate 3)

Results

Table 1: Plate 1 – 0.1 µl incremental, wet dispense of 100% DMSO.

Column	Mean	Standard Deviation	% CV
1	22476.86	2931.85	13.04
2	16014.67	2432.94	15.19
3	23768.86	2749.87	11.57
4	17351.71	2416.71	13.93
5	22431.71	4002.11	17.84
6	15363.86	2230.19	14.52
7	23414.14	1567.56	6.69
8	17133.00	2011.22	11.74
9	21238.86	2891.07	13.61
10	17522.00	2619.26	14.95
11	24226.57	1705.93	7.04
12	16920.86	1688.49	9.98
13	23894.14	1734.81	7.26
14	16077.71	1924.61	11.97
15	24028.43	1085.16	4.52
16	16492.00	961.07	5.83
17	23375.14	2364.12	10.11
18	16255.71	1027.27	6.32
19	24002.14	1895.71	7.90
20	16466.71	1111.95	6.75
21	23436.57	1233.25	5.26
22	17145.00	2327.87	13.58
23	23623.43	1596.47	6.76
24	17293.29	1100.37	6.36
Average	19998.06	1983.74	10.11

Table 2: Plate 2 – 0.1 µl incremental, wet dispense of 100% DMSO.

Column	Mean	Standard Deviation	% CV
1	26572.14	4511.33	16.98
2	18621.14	1301.17	6.99
3	29093.71	2705.23	9.30
4	19730.00	2144.19	10.87
5	29814.71	2444.71	8.20
6	18984.00	1322.06	6.96
7	28874.71	1856.41	6.43
8	19089.57	1060.93	5.56
9	27796.57	1425.76	7.36
10	19602.86	1425.76	7.27
11	30600.14	1657.51	5.42
12	18595.00	1128.29	6.07
13	27708.29	1239.16	4.47
14	18340.86	1296.98	7.07
15	27796.43	3630.84	13.06
16	17308.43	2620.79	15.14
17	29284.57	2647.97	9.04
18	18581.86	1455.11	7.83
19	27573.57	3354.87	12.17
20	18616.57	1781.82	9.57
21	27804.29	3329.84	11.98
22	18202.86	2014.09	11.06
23	29441.57	4361.47	14.81
24	17820.71	3303.28	18.54
Average	23577.27	2250.81	9.67

Table 3: Plate 3 – 0.1 µl incremental, wet dispense of 100% DMSO.

Column	Mean	Standard Deviation	% CV
1	27948.57	2585.17	9.25
2	21393.14	1301.60	6.08
3	29907.71	1514.30	5.06
4	22329.43	1087.96	4.87
5	29821.14	1406.98	4.72
6	22591.57	1343.01	5.94
7	28784.57	1547.97	5.38
8	22591.57	1193.74	5.28
9	28914.43	1955.05	6.76
10	23100.57	1116.58	4.83
11	29378.86	1925.89	6.56
12	22763.14	1180.07	5.18
13	26853.57	1147.76	4.27

Column	Mean	Standard Deviation	% CV
14	22650.14	1181.32	5.22
15	28202.00	976.96	3.46
16	22500.43	1454.58	6.46
17	28068.43	1180.84	4.21
18	23624.71	1479.42	5.84
19	28425.71	2014.29	7.09
20	23933.43	826.09	3.45
21	25448.43	3802.93	14.94
22	22434.57	1524.56	6.80
23	28245.43	2473.12	8.76
24	22478.43	1293.99	5.76
Average	25516.25	1563.09	6.09

Conclusion

The reported precision specifications for the 0.1-50 µl stainless steel, positive displacement pipetting head of the Matrix PlateMate 2x3 is 2.5% or 0.02 µl. For a 0.1 µl dispense the accepted %CV is 20%. Based on the results listed above, all three of the plates run, each with different optimization steps, produced %CV between 6-10% which are within the published specifications for precision.

The optimization steps for each of the three plates tested varied. All three plates had at least two trail dispenses with the final one being 0.1 µl. However, the other optimization steps such as the addition of an overstroke, slowing the dispense speed and the amount of reagent waste differed. Plate 3 produced the best %CV of all three plates tested, averaging 6.09%. The optimization steps which produced these results for two incremental, wet dispenses of 0.1 µl of DMSO were a 2 µl aspirate with an overstroke of 5 µl, slowing down the dispense speed to a setting of 1255 rpm, and performing two trail dispenses of 1.2 µl and 0.1 µl prior to dispensing into the destination plate. The approximate amount of reagent wasted was 5-6 µl.

Based on these results, the 0.1-50 µl stainless steel, positive displacement pipetting head of the Matrix PlateMate 2x3 produces low %CV for low volume, incremental, wet dispenses of DMSO. Also, the %CV can be optimized with the addition of an overstroke command, slowing down the dispense speed, trail dispenses and having residual reagent in the needles after the final dispense.

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In addition to these offices, Thermo Fisher Scientific maintains a network of representative organizations throughout the world.

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