Reducing Reagent Waste in Multi-Channel Reservoirs

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Abstract

Reagent reservoirs are commonly used to contain fluid that will be aspirated by multichannel pipettes. Considering the high cost of many reagents, it is highly desirable to employ a reservoir design that minimizes the residual or "dead" volume of reagent that cannot be aspirated from the reservoir. Seven commercially available reagent reservoirs were tested to determine the residual volume when aspirating with an eight channel pipette. Distilled water as well as fluids of varying viscosity were tested. The reagent reservoirs manufactured by VistaLab Technologies were shown to have residual volumes up to 67% less than the other reagent reservoirs with distilled water and 54% less with other tested fluids.

Test Method

Each test was started with a clean, unused reservoir. An analytic balance was zeroed and the empty reservoir weighed. The reservoir was then removed from the balance and filled with 2.0ml of distilled water. An eight-channel mechanical pipette was positioned with the tips at the bottom of the reservoir, and the liquid was slowly and carefully aspirated. Aspiration continued until one of the tips began to aspirate air. Aspiration was then immediately stopped and the fluid remaining in the reservoir was weighed. This procedure was repeated three times on three different reservoirs of each type for a total of nine measurements on each reservoir type. The reservoirs tested are shown in Table 2.

A second shorter study was done with two additional fluids. The first fluid was a dilute solution of the green dye used to demonstrate low retention tips. The second fluid was 3% BSA solution. The procedure for measuring residual volume was identical to that above however only reservoir VL8/4 and VF8 were tested. (Figure 2 on reverse side)

Results

The residual volumes for all the tested reservoirs with distilled water are shown in Table 1 and the mean and standard deviation is shown in the Figure 1. The lowest residual volume was 0.12mL for the 8 channel side of the VL8/12. The second lowest residual volume was 0.17ml for the twelve-channel VL12 reservoir. The VL12 reservoir had residual volume 67% below the next lowest 12 channel reservoir, TF12. The VL8 had residual volume 52% lower than the next lowest 8-channel reservoir, AX8.

Residual volumes for the other fluids are shown in Figure 2. Note that the residual volumes for dye and BSA were considerably smaller than for distilled water. However VL8 reservoir continued to have substantially lower residual volumes than the other tested reservoir, VF8.

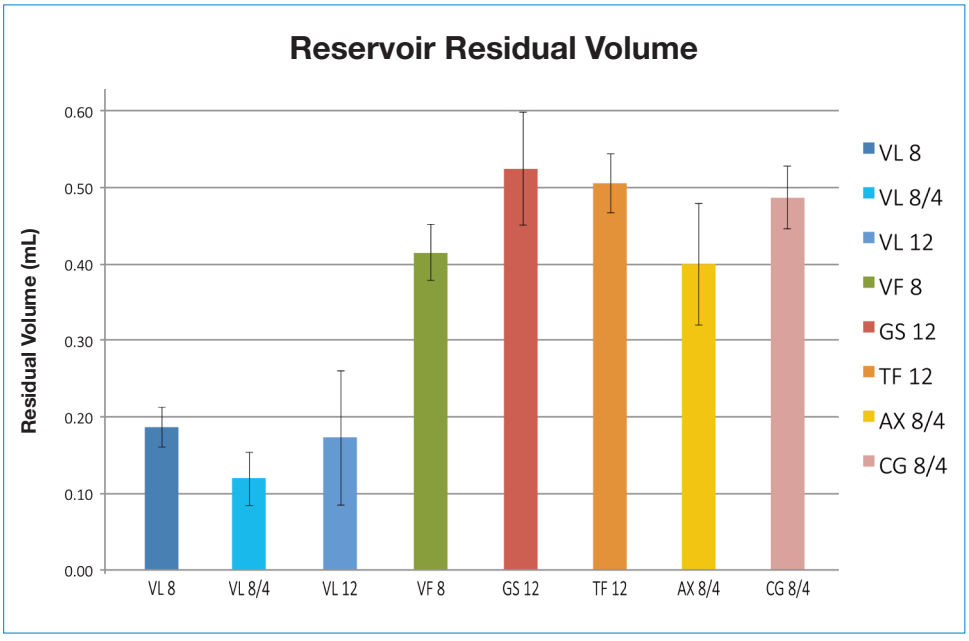

Figure 1

	Reservoir 1			Reservoir 2			Reservoir 3				
Reservoir type	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Average	STDEV
VL 8	0.18	0.14	0.21	0.20	0.21	0.18	0.22	0.17	0.17	**0.19**	**0.03**
VL 8/4	0.15	0.06	0.15	0.14	0.13	0.15	0.07	0.13	0.10	**0.12**	**0.04**
VL 12	0.11	0.11	0.13	0.11	0.14	0.10	0.24	0.32	0.30	**0.17**	**0.09**
VF 8	0.38	0.39	0.42	0.45	0.47	0.45	0.40	0.36	0.41	**0.41**	**0.04**
GS 12	0.45	0.48	0.48	0.55	0.61	0.65	0.43	0.51	0.56	**0.52**	**0.07**
TF 12	0.52	0.48	0.51	0.55	0.51	0.46	0.57	0.45	0.50	**0.51**	**0.04**
AX 8/4	0.42	0.47	0.43	0.39	0.38	0.28	0.54	0.30	0.39	**0.40**	**0.08**
CG 8/4	0.48	0.50	0.43	0.43	0.46	0.53	0.54	0.52	0.49	**0.49**	**0.04**

Table 1 (Reservoir Residual Volume mL)

Discussion

As the fluid volume in a reagent reservoir is reduced, at some point the remaining fluid beads up into droplets such that the fluid cannot be aspirated by each tip in a multichannel pipette. This determines the residual or "dead" volume of the reservoir. In order to achieve low residual volumes the VL8, VL8/4 and VL12 reservoirs employ a number of techniques:

1. Trough within a trough reservoir shape.
2. High wettability (hydrophilic) surface of proprietary laminated polystyrene.
3. Automated, dust-free production environment to eliminate contamination of the reservoir surface.

These techniques enable the VL8, VL8/4 and VL12 reservoirs to achieve a reduction in residual volume of up to 67% over comparable reagent reservoirs. This reduction occurs for both water as well as fluids with different wetting characteristics such as dye and BSA.

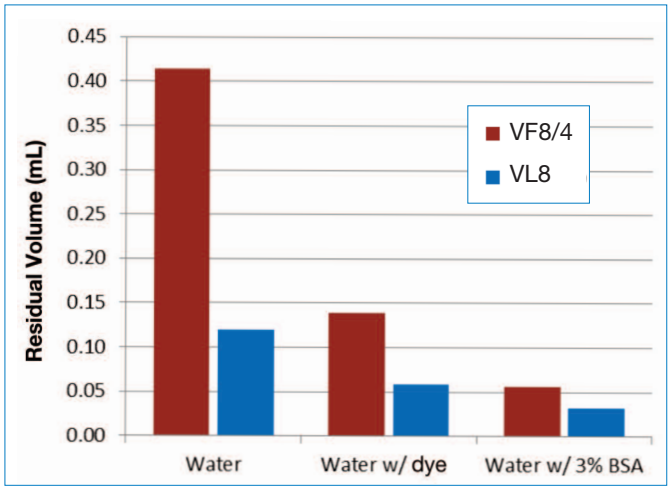

Figure 2

Item	Channels	Size	Brand	Part #
VL 8	8	10ml	Vistalab Technologies™	3054-1013
VL 8/4	8/4	25ml	Vistalab Technologies™	3054-1005
VL 12	12	25ml	Vistalab Technologies™	3054-1003
VF 8	8	10ml	Integra Biosciences™	4331
GS 12	12	25ml	Gilson™	F267660
TF 12	12	25ml	Thermo Scientific™	95128093
AX 8/4	8/4	25ml	Axygen®	RES-2CV-25
CG 8/4	8/4	25ml	Chemglass™	CLS-3798-015

Table 2

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