Technical Note

BRAND Ultra Low Retention tips: Determining residual liquids using gravimetric measurement

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Summary

The moistening of untreated standard tips while pipetting detergent-containing or viscous media is a general problem in the laboratory. A film forms on the surface of the polypropylene that, when delivering liquid at normal speed without adhering to long waiting periods, leads to residual liquid in the tip. Expensive samples, some of which are difficult to obtain, can be lost, and the residual liquids in the tip lead to erroneous results. Gravimetric measurements can be used to compare the residual quantity of liquid remaining in the tip when using BRAND Ultra Low Retention tips, untreated pipette tips from BRAND, and Low Retention pipette tips from other manufacturers. The results show that BRAND Ultra Low Retention tips have the least residue and therefore obtain the most accurate results – often significantly more accurate.

Introduction

After certain media is dispensed, close examination often still reveals additional droplets of liquid or a thin film in or on the tip of the pipette. Several factors can lead to the formation of such residues such as, the different surface energy components of the pipette tips, the samples being pipetted, as well as their molecular composition.

In biological applications such as in PCR, PAGE, or many other areas of protein chemistry, the sample must often be treated with detergent. An exact determination of the behavior on pipette surfaces for complex media is very difficult or even impossible. Detergents significantly decrease the surface tension of liquids, which hinders the optimal expulsion of the liquid from the pipette tip and diminishes pipette performance.

BRAND offers ultra-hydrophobic Ultra Low Retention tips and filter tips that solve this problem. A special physicochemical process is used to greatly reduce the surface energy, making the polypropylene of the tip extremely liquid repellent. The surface energy is three times lower than for PTFE. That reduces expensive sample losses during pipetting to a minimum, while significantly increasing reproducibility even for critical media. Since the tips are not coated in this treatment, any associated sample contamination can be ruled out.

Materials and methods:

To test the tips, five liquids frequently used in the laboratory were selected whose delivery behavior during pipetting could be tested with surface-treated Low Retention tips:

- SDS (1 %)
- BSA (1 %) + SDS (0,1 %)
- Glycerin 60 %
- DMSO
- Gel electrophoresis buffer

Composition of gel electrophoresis buffer

1 M Tris-HCl pH 6,8	3,20 ml
20 % SDS	1 ml
ß-mercaptoethanol	0,02 ml
Glycerin	1 ml
0,2 % bromphenol blue	0,05 ml

BSA 20 µg/20 µl
+ 8 µl of the sample buffer.

Boil buffer for 5 minutes.

To carry out the measurements, the electronic multi-channel Transferpette®-12 electronic 30-300 µl was used in pipetting mode. Aspiration and dispensing speeds were set to Stage 3, since the objective was to work as realistically as possible during testing. 200 µl standard pipette tips and 200 µl Ultra Low Retention pipette tips were tested, as well as 200 µl and 250 µl tips labeled „Low Retention“ from three additional manufacturers. Depending on the availability, either the 200 µl or the 250 µl tips from these manufacturers were tested. A uniform volume of 200 µl was pipetted in each case. The residual liquids in the tips were determined using gravimetric measurement with a Sartorius analytical balance at room temperature. A pipetting procedure was carried out with 12 tips. To increase the statistical validity of the results, this procedure was repeated three times. The overall average was used to obtain the percent residue in the pipetted volume.

Results and discussion:

The percentage of residual volume in the tips was compared in two diagrams. Figure 1 shows the residual volume in BRAND Ultra Low Retention tips in comparison with the residual liquids in the Low Retention tips of other manufacturers. It can clearly be seen that the liquids were delivered very well by the BRAND Ultra Low Retention tips, and that the lowest residual volume remained in the tips. For 1% SDS, 60% glycerin, and the gel electrophoresis buffer, the liquid could even be delivered completely with no residual liquid at all. In the Low Retention tips of competitor C, very poor delivery behavior could be observed. With these tips, the measured values for all liquids were notably higher than those of BRAND Ultra Low Retention tips and of the Low Retention tips of both of the other manufacturers.

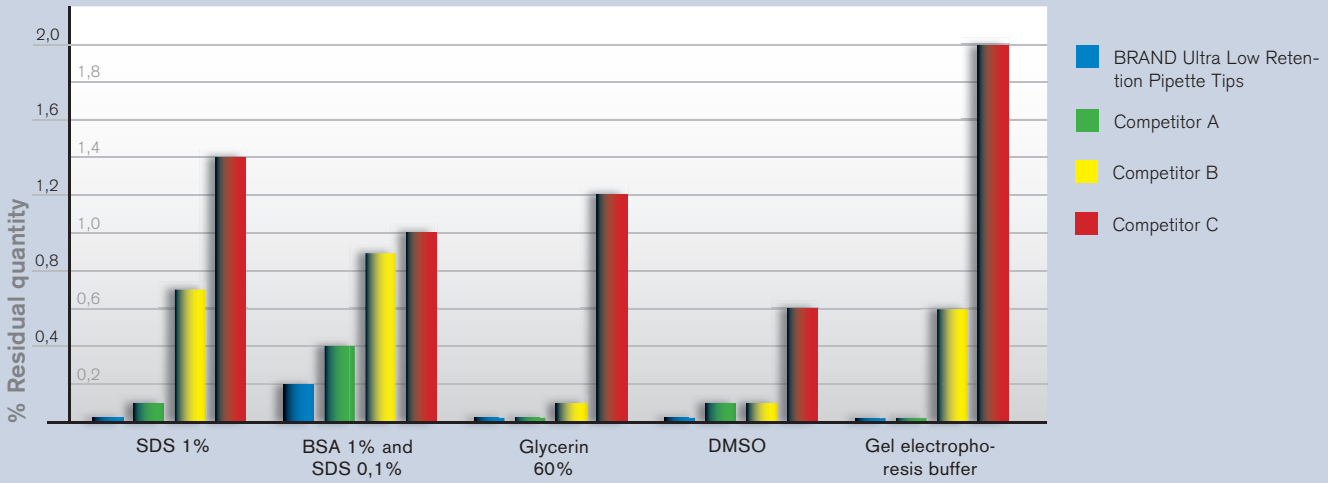

Figure 1: Residual volume in BRAND Ultra Low Retention tips, and Low Retention tips from other manufacturers in comparison with different liquids

The comparison of BRAND Ultra Low Retention tips with BRAND standard pipette tips in Figure 2 shows that enormous differences in delivery behavior were observed between the liquids selected. The standard tips that contained the 1% SDS and gel electrophoresis buffer contained a large amount of residual liquid in the tip after pipetting. However, there were also liquids such as 60% glycerin that were without leaving a large residual volume well even by untreated tips. Despite different delivery behavior, the comparison clearly shows that the residual quantity of liquid in the Ultra Low Retention tips was dramatically lower than in the standard pipette tips.

In Figure 1, the different delivery properties of the Low Retention tips on the market are already clearly visible. But if we compare the two diagrams with one another, it is even easier to see the great differences in quality between the Low Retention tips of different manufacturers. Some tips labeled “Low Retention” on the market have a residual volumes after pipetting that are nearly comparable with those using BRAND standard tips.

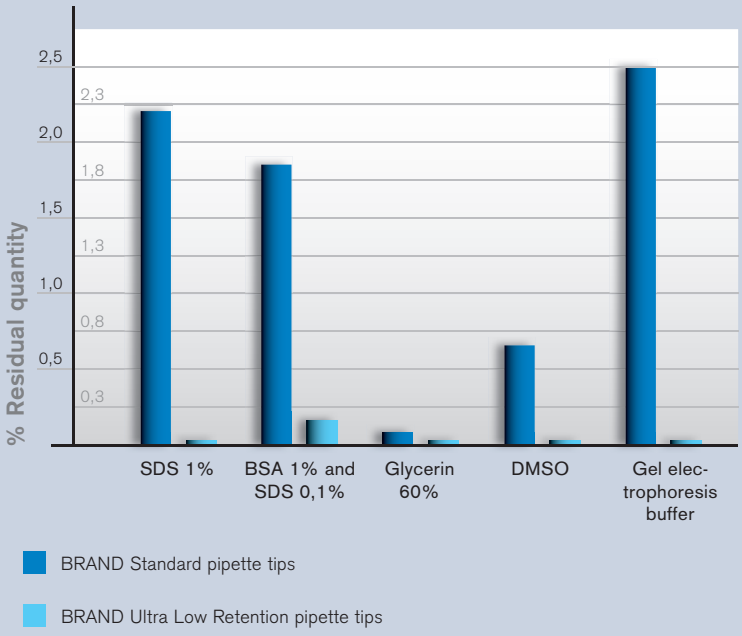

Figure 2: Residual volume in 200 µl BRAND standard tips, BRAND Ultra Low Retention tips in comparison with different liquids

In summary:

The measurements show that there are enormous differences in quality between Low Retention tips of different manufacturers. The data within demonstrates that the best values were obtained when pipetting the test liquids with BRAND Ultra Low Retention tips. Depending on the liquids, there were large variations, but previous experience shows that using the surface-treated tips from BRAND is not a disadvantage for any liquid. Residual liquids can generally be significantly reduced by using Ultra Low Retention tips. A simple photometric test is shown in the product video at www.brand.de. We still recommend that the user test the delivery behavior of the liquids used in their specific applications with Low Retention tips and standard tips. They can then make their own assessment of whether media loss and inaccurate pipetting results can be prevented.

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