

Filter Tip Effectiveness Against Radioactive Carryover

Liquid Handling Consumables, Thermo Fisher Scientific

Abstract

Thermo Scientific™ ART™ self-sealing barrier tips were compared with filter tips from Continental Lab Products, Inc. (CLP), Oxford, LabCon and USA Scientific in a test designed to measure the degree of protection each tip provides against radioactive label (^{32}P dCTP). Three randomly chosen, 20 μl pipette tips from each manufacturer were used to intentionally overdraw radioactive label and any liquid that passed beyond the aerosol-blocking insert was tested on a scintillation counter. Only ART barrier tips completely blocked the passage of liquids and radioactive label. Of the five tips tested, only ART barrier tips provided complete and consistent protection against pipette contamination.

Introduction

Pipette tips with aerosol-blocking filters were specifically designed to prevent carryover contamination from liquids and aerosols that come in contact with the pipette. For example, if liquid samples are accidentally overdrawn, contamination will spread to subsequent reactions through direct contact with the pipette barrel. Likewise, samples can be corrupted through the transmission of aerosols generated by the action of pipetting. The resulting contamination can lead to inaccurate results and illustrates the importance of an effective aerosol barrier.

Objective

Various aerosol-blocking technologies have been developed, each claiming to prevent carryover contamination. The subtle and seemingly insignificant differences between these technologies can mean the difference between success and failure in experiments that depend on the use of uncorrupted samples. Therefore, this study was designed to test the true effectiveness of filter tips from CLP, USA Scientific, Oxford, LabCon, and ART self-sealing barrier tips from Thermo Scientific.

Materials and Methods

In an independent lab, 20 μl samples of radioactive label (^{32}P dCTP) were carefully drawn as test aliquots for pipette tips randomly chosen from each of the five manufacturers. All samples were counted on a scintillation counter to determine initial counts per minute (cpm). Each tip was used on a 200 μl pipette intentionally set at 200 μl to overdraw radioactive label through the inserts. Any liquid that passed beyond the filters was collected with a 20 μl pipette set at 20 μl . The exact volume retrieved was then determined by backing down the pipette volume adjustment until the fluid in the tip reached the point. After the exact volume was recorded, the fluid was expelled and counted on a scintillation counter to determine counts per minute. This was compared to the initial cpm's recorded at the beginning of the test to determine the percent penetration of radioactive label. The results for each tip were recorded and are summarized in the table on page 2.

Results

As shown in the tables, only the ART self-sealing barrier tips from Thermo Scientific, prevented radioactive label from passing to the pipette. In every other case, sample with significant cpm levels passed through the filters freely, creating the opportunity for pipette contamination. The inconsistent densities of the filters become evident when using the viscous radioactive label. The USA and Oxford tips allowed a range of 4.59% to 79.38% penetration and 30.71% to 79.94% penetration respectively. LabCon tips showed approximately 75% penetration in every tip tested. Although two of the three CLP tips were able to block the viscous liquid, the 33% failure rate is no guarantee of consistent protection from carryover contamination.

Thermo Scientific ART	1	2	3
Initial CPM	1,584,350	1,584,350	1,584,350
Filtered CPM	0	0	0
% Penetration	0.00%	0.00%	0.00%
Volume Penetrated (µl)	0	0	0

USA	1	2	3
Initial CPM	1,523,360	1,523,360	1,523,360
Filtered CPM	1,209,310	115,120	69,913
% Penetration	79.38%	7.56%	4.59%
Volume Penetrated (µl)	18.59	1.92	1.42

Oxford	1	2	3
Initial CPM	393,870	393,870	393,870
Filtered CPM	314,850	120,950	162,570
% Penetration	79.94%	30.71%	41.28%
Volume Penetrated (µl)	16.5	12.04	0

LabCon	1	2	3
Initial CPM	405,500	405,500	405,500
Filtered CPM	304,750	300,700	303,910
% Penetration	75.51%	74.16%	74.95%
Volume Penetrated (µl)	16.52	16.3	15.6

CLP	1	2	3
Initial CPM	1,537,180	1,537,180	1,537,180
Filtered CPM	152,190	0	0
% Penetration	9.90%	0.00%	0.00%
Volume Penetrated (µl)	2.34	0	0

Discussion

Preserving sample integrity is paramount to achieving accurate results in bio-research, and aerosol-blocking pipette tips have been specifically designed for this purpose. Regardless of the source of potential contamination, choosing the right pipette tips is essential in guaranteeing protection against carryover contamination. It is clear from this study that filter technology is not as effective as the ART self-sealing barrier technology from Thermo Scientific.

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