

Carryover Contamination Protection from Vapor Phase Volatile Organics

ABSTRACT

SOLVENT SAFE™ carbon filter pipet tips manufactured by Molecular BioProducts, Inc., were tested for their ability to protect against the carryover of vapors from volatile organic solvents. Strongly acidic and basic reagents were used in two experiments to test the carbon filter's effectiveness in protecting against carryover contamination as well protecting against corrosion of Molecular BioProducts, Inc.

INTRODUCTION

Carryover of vapors caused by the action of pipetting volatile organic solvents will contaminate subsequent samples and lead to inaccurate results. These volatile aerosols will also cause damage to critical internal pipettor parts and negatively affect accuracy.

To prevent carryover contamination and protect the precise inner workings of expensive pipettors, Molecular BioProducts, Inc., makers of ART® (Aerosol Resistant Tips™) pipet tips, developed a specialized carbon filter that effectively blocks the passage of volatile vapors and aerosols to the pipettor. SOLVENT SAFE carbon filter pipet tips are available in popular sizes to fit major pipettors and are specifically designed for pipetting corrosive or volatile organic solvents.

OBJECTIVE

ART filter tips, with patented hydrophilic filter barriers, have been proven to provide the only effective filter protection against aqueous based reagents, but are not designed for use with reagents composed of organic solvents. The

following experiments were performed to evaluate the true effectiveness of SOLVENT SAFE carbon filter pipet tips in preventing carryover contamination and pipettor damage.

MATERIALS AND METHODS

Two series of experiments were conducted to demonstrate the effectiveness of the carbon filter and are described below in detail.

Experiment #1

The first protocol was qualitative and examined the ability of the carbon filters to block organic vapors associated with strongly acidic and basic reagents. The relevant section of a pH 0-14 indicator strip (Color pHast; EM Science, Gibbstown, NJ) was moistened with distilled water and positioned in the proximal end of a SOLVENT SAFE 1000 pipet tip. A control experiment was conducted with another SOLVENT SAFE tip with the carbon filter removed.

One ml of the test reagents (trifluoroacetic acid and triethylamine) was drawn into and expelled from each tip four times to generate vapors that would travel to the pipettor. The tips were then removed and the pH paper examined for any color change.

Experiment #2

A second protocol was conducted using gas chromatographic mass spectrometry (GCMS) analysis to determine the efficacy of SOLVENT SAFE carbon filters with a variety of polar and non-polar organic liquids (see table 2). For this experiment, SOLVENT SAFE 200 and SOLVENT SAFE 1000E tips, with 200µl and 1000µl capacities respectively, were used with a gas phase volatile standard consisting of 27 organic compounds. Control experiments were again performed with unfiltered pipet tips.

The standard was passed through each pipet tip and into the gas chromatograph injector. For each pipet tip, the volume of

volatile organics tested was 1x and 5x the maximum specified volume (i.e., 200µl and 1000µl for the SOLVENT SAFE 200; 1000µl and 5000µl for the SOLVENT SAFE 1000E).

RESULTS

Experiment #1

As shown in table 1, vapors were readily detected by the indicator paper in the unfiltered tips, while none was detected in the tips with the protective, carbon filters.

Experiment #2

The concentration of the standard mixture, after passage through the respective tips, and the limits of detection of the respective compounds are shown in table 2. The mixture of compounds was found to pass unimpeded through the pipet tips without the barrier. However, the physical barrier provided by the activated carbon filters was effective in stopping the gas phase components.

To demonstrate the capacity of the filters to limit contamination, the SOLVENT SAFE pipet tips were tested with a 500% volume and the organics were reduced to below-detectable levels.

DISCUSSION

These results demonstrate that SOLVENT SAFE pipet tips, manufactured by Molecular BioProducts, Inc., are completely effective in preventing vapor contamination by a wide variety of organic compounds. Thus, problems of reagent contamination and pipettor corrosion associated with the use of organic solvents are eliminated.

I would like to thank Carl Hoeger, Ph.D., of the Salk Institute of La Jolla, California, for his valuable suggestions and advice.

Edward G. Fox, Ph.D.

TABLE 1

Comparison of Standard and SOLVENT SAFE™ Carbon Filter Pipet Tips to Passage of Vapors of Organic Acids and Bases as Measured by pH Indicator Strips		
	Standard Tips	SOLVENT SAFE Tips
Trifluoroacetic Acid (100%)	<2 ¹	7
Triethylamine (100%)	>13	7

Legend Table 1: 1 - visual pH reading

TABLE 2

Measurement of Gas Phase Volatile Organics by GCMS After Passage Through Standard and SOLVENT SAFE™ Carbon Filter Pipet Tips					
Pipet Tip Tested	Standard Tip	SOLVENT SAFE Tips			
	200µl	200µl	1000µl	1000µl	5000µl
Volume tested	200µl and 1000µl	200µl	1000µl	1000µl	5000µl
COMPOUND:					
Acetone	51 ¹	<4.0 ²	<1.0	0.7	<2.0
Benzene	96	<3.0	<0.9	<0.7	<1.0
Carbon Disulfide	100	<0.7	<0.2	<0.2	<0.2
Carbon Tetrachloride	103	<2.0	<0.5	<0.5	<0.6
Chlorobenzene	38	<1.0	<0.3	<0.2	<0.3
Chloroethane	104	<3.0	<0.8	<0.9	<1.0
Chloroform	98	<1.0	<0.3	<0.8	<0.4
O-Dichlorobenzene	35	<2.0	<2.0	<1.0	<3.0
Dichlorodifluoromethane	46	<0.9	<0.2	<0.3	<0.3
1,1-Dichloroethane	102	<4.0	<1.0	<0.3	<1.0
1,2-Dichloroethane	99	<2.0	<0.6	<0.4	<1.0
1,1-Dichloroethylene	97	<2.0	<0.5	<0.5	<0.5
Trans-1,2-Dichloroethylene	100	<1.0	<0.4	<0.6	<0.4
Ethylbenzene	34	<2.0	<0.6	<0.2	<0.9
Freon-113	96	<1.0	<0.3	<0.3	<0.3
Isopropanol	83	<0.6	<0.3	<0.4	<0.4
Methyl Ethyl Ketone	47	<0.6	<0.2	<0.2	<2.0
Methyl Isobutyl Ketone	13	<1.0	<0.5	<0.2	<0.8
Methylene Chloride	98	<2.0	<0.6	<0.6	<0.8
Styrene	22	<2.0	<0.6	<0.3	<1.0
Tetrachloroethylene	67	<2.0	<0.5	<0.4	<0.5
Tetrahydrofuran	47	<0.95	<0.3	<0.2	<0.5
Toluene	91	<1.0	<0.3	<0.2	<0.4
1,1,1-Trichloroethane	99	<2.0	<0.5	<0.4	<0.6
Trichloroethylene	105	<2.0	<0.5	<0.4	<0.5
Vinyl chloride	104	<2.0	<0.5	<0.6	<1.0
M-Xylene	19	<0.8	<0.3	<0.2	<0.4

Legend Table 2: 1 - Parts Per Million 2 - Below Detection Level

Additional tests by GCMS and HPLC have found SOLVENT SAFE™ carbon filter pipet tips to be effective at preventing pipettor contamination by the following compounds: Acetonitrile, Ethanol, Hexane, and Phenol.