# Chemical stability of the Varispenser® and the Top Buret

## Introduction

Bottle-top dispensers are used in the lab for dispensing a wide range of different solvents from glass or stainless steel containers. These dispensers have to meet various requirements. For example, they must not give off any substances which may disturb trace analysis, have cytotoxic properties, distort optical tests or influence chromatographic methods and residue analysis.

## Materials

Even after prolonged contact with the solvent, the materials of the dispenser must not be affected nor bind the solvent non-specifically. This means that there are very high demands on the chemical resistance of bottle-top dispensers.

The bottle-top dispensers Varispenser® and Varispenser® plus from Eppendorf are made of material which is particularly resistant to chemicals. Only parts made of PFA (perfluor alkoxy), PTFE (polytetrafluor ethylene), boron silicate glass 3.3 and platinum/iridium come into contact with the solvents. The adapter rings for the screw connection are made of PP (polypropylene).

The following pages include an example on the use of a Varispenser for residue analysis in the lab of a food manufacturer as well as a list of the materials of which the Varispenser is made and their chemical resistence.

**Dispensing ultrapure solvents for residue analysis at the Hipp plant in Pfaffenhofen, Germany**

The residue analysis of foodstuffs places high demands on the solvents and the inertness of the lab equipment used to detect, for example, detect, for example, even the smallest traces of pesticides.

Therefore, contamination caused by lab equipment has to be avoided under all circumstances.

A series of experiments were performed to test the suitability of the Varispenser for food analysis.
Aim: to determine wether the Varispenser is inert to the solvents commonly used in this field.

## Two examples

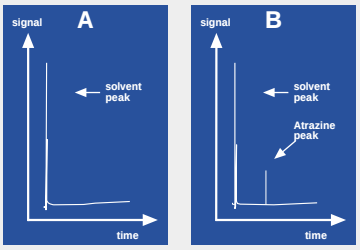
**Test A**
100 ml of the solvent acetonitrile ($CH_3CN$) were drawn from a larger supply with a Varispenser, evaporated in a rotation evaporator and then dissolved in 1 ml of the solvent i-octane. This sample was examined using gas Chromatography.

**Result**
No other peak could be found in addition to the solvent peak. Therefore, no substances had been released from the Varispenser.

**Test B**
A specific amount of the herbicide atrazine (50 pg/ml)1) was added to a sample treated as in test A as a comparative standard for pesticides. In order to detect minute amounts of pesticide, the background in the chromatogram must consistently be as low as possible.

**Result**
The atrazine peak can be clearly seen in the chromatogram without any ghost bands. This shows that minute amounts of pesticides can be detected with this system.

**Quotation from Mr. Lembacher, main lab residual analysis of the Hipp plant**:
“The chromatograms recorded show that the dispenser is extremly inert. Fears about interference by plasticizers – even during long-term use – were totally unfounded.”




1)(EG drinking water limit: 100 pg/ml)

**Test A:**
**100 ml acetonitrile evaporated, dissolved in 1 ml i-octan, 0.5 µl injected.**

**Test B:**
**Like test A, except 50 pg/ml atrazine added as pesticide reference.**

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For each chemical, 2 figures are stated. The figure on the left is stability at a test temperature of +20 °C, the figure on the right is the stability at +50 °C. Salts were tested as almost saturated solutions. All data are recommondations without guarantee. **1** = resistant **2** = sensitive (raw material is affected after longer contact) **3** = incompatible

| Materials | PP Adapter rings* Top Buret/Varispenser can be used | | | | |
|---|---|---|---|---|---|
| | Boron silicateglass 3.3 | | | | |
| | PTFE | | | | |
| | PFA | | | | |
| **Chemicals** | | | | | |
| **A** | | | | | |
| Acetaldehyde | 1 1 | 1 1 | 1 1 | **1 1** | 1 3 *1 |
| Acetic acid 50% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Acetone *5 | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Acetonitrile *5 | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Acrylonitrile | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Adipic acid | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Allyl alcohol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Aluminum chloride | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Aluminum hydroxide | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Amino acids | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Ammonia | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Ammonium chloride | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Ammonium hydroxide 30% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| n-Amyl acetate | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Amyl alcohol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Amyl chloride | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Aniline | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Aqua regia *2 | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| **B** | | | | | |
| Barium chloride ($BaCl_2$) | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Benzaldehyde | 1 2 | 1 1 | 1 1 | **1 2** | 1 1 |
| Benzene | 1 1 | 1 1 | 1 1 | **1 1** | 1 2 *1 |
| Benzine | 1 1 | 1 1 | 1 1 | **1 1** | 2 2 *1 |
| Benzyl alcohol | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Biuret reagent | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Boric acid | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Bromine | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Bromoform (Tri Methanbromid) | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| n-Butanol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| n-Butyl acetate | 1 1 | 1 1 | 1 1 | **1 1** | 2 2 *1 |

| Materials | PP Adapter rings* Top Buret/Varispenser can be used | | | | |
|---|---|---|---|---|---|
| | Boron silicateglass 3.3 | | | | |
| | PTFE | | | | |
| | PFA | | | | |
| **Chemicals** | | | | | |
| **C** | | | | | |
| Calcium chloride | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Carbon disulphide | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Carbon tetrachloride | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Chloroacetic acid | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Chromic acid 10% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Chromic acid 50% *2 | 1 1 | 1 1 | 1 1 | **1 1** | 2 2 *1 |
| Chromic sulfuric acid, concentrated *2 | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Cresol | 1 1 | 1 1 | 1 1 | **1 1** | 1 2 *1 |
| Cupric sulphate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 *1 |
| **D/E** | | | | | |
| Decahydronaphtalene | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Dibutyl phthalate | 1 1 | 1 1 | 1 1 | **1 1** | 1 2 *1 |
| Dichlorobenzene | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Dichlorethane (Ethyl dichloride)*5 | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Dichlormethane (Methylene chloride) *5 | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Diethylene glycol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Diethyl ether | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Dimethylformamide | 1 1 | 1 1 | 1 1 | **1 1** | 1 3 *1 |
| 1.4-Dioxan | 1 1 | 1 1 | 1 1 | **1 1** | 2 2 *1 |
| Ethanol 100% (Ethyl alcohol) | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Ethyl acetate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Ethylene oxide | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| **F/G** | | | | | |
| Formaldehyde 40% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Formic acid 98–100% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Fuel oil | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Glycerol *4 | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Glycol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |

| Materials | PP Adapter rings* Top Buret/Varispenser can be used | | | | |
|---|---|---|---|---|---|
| | PFA | PTFE | Boron silicateglass 3.3 | | |
| **Chemicals** | | | | | |
| **H/I/J** | | | | | |
| n-Hexane | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Hydrochloric acid 35% *5 | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Hydrochloric acid 37% *5 | 1 1 | 1 1 | 1 1 | **1 1** | 1 3 *1 |
| Hydrofluoric acid 40% | 1 1 | 1 1 | 3 3 | **3 3** | 1 1 |
| Hydrogen peroxide 30% *3 | 1 1 | 1 1 | 1 1 | **3 3** | 1 1 |
| Iodine-potassium iodide sol. | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Isobutanol (Isobutyl alcohol) | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Isopropanol (Isopropyl alcohol) | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Isopropyl benzene | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| **L/M/N** | | | | | |
| Lactic acid/Lactate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Magnesium chloride (MgCl) | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Mercury | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Mercury (I) chloride | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Methanol (Methyl alcohol) *5 | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Methyl propyl ketone | 1 1 | 1 1 | 1 1 | **1 1** | 1 2 *1 |
| Nitric acid 10% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Nitric acid 50% | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Nitric acid 70% | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Nitrobenzene | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| **O/P** | | | | | |
| Octane/Iso octane | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Oil of turpentine | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Oxalic acid | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Pentane (n-/Iso-) *5 | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Perchlorethylene | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Perchloric acid 10% | 1 2 | 1 1 | 1 1 | **1 1** | 1 3 *1 |
| Phenol 100% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Phosphoric acid 85% | 1 1 | 1 1 | 2 3 | **2 3** | 1 1 |
| Potassium chloride | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Potassium hydroxide 50% | 1 1 | 1 1 | 1 2 | **1 2** | 1 1 |
| Potassium permanganate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Propanol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Propylene glycol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |

| Materials | PP Adapter rings* Top Buret/Varispenser can be used | | | | |
|---|---|---|---|---|---|
| | PFA | PTFE | Boron silicateglass 3.3 | | |
| **Chemicals** | | | | | |
| Propylene oxide | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Pyridine | 1 1 | 1 1 | 1 1 | **1 1** | 2 2 *1 |
| **S** | | | | | |
| Salicylaldehyde | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Salicylic acid | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Scintillation cocktail | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Silver acetate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Silver nitrate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Sodium acetate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Sodium dichromate | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Sodium hydroxide 50% | 1 1 | 1 1 | 1 2 | **1 2** | 1 1 |
| Sulphuric acid 60% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Sulphuric acid 98% | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| **T/U** | | | | | |
| Tartaric acid | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Tenside (Tween-, Trition X-, Brij-dilutions) | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Tetrachloroethylene | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Tetrahydrofuran | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Toluene | 1 1 | 1 1 | 1 1 | **1 1** | 2 3 *1 |
| Trichloroacetic acid 10% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Trichlorethane | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Trichlorethene | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Trichlorofluorethane *5 | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Trichloromethane (Chloroform) *5 | 1 1 | 1 1 | 1 1 | **1 2** | 2 2 *1 |
| Triethylene glycol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Trifluoroacetic acid (fuming; strongest of halogenized acids) *5 | 3 3 | 1 1 | 3 3 | **3 3** | 3 3 |
| Tripropylenglycol | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Urea | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| **V/X** | | | | | |
| Vinylidene chloride | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| Xylene | 1 1 | 1 1 | 1 1 | **1 1** | 3 3 *1 |
| **Z** | | | | | |
| Zinc chloride 10% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |
| Zinc sulphate 10% | 1 1 | 1 1 | 1 1 | **1 1** | 1 1 |

*1 PTFE adapter available
*2 Pt-Ir can be easily loosened from the spring
*3 Catalytic reaction with Pt-Ir spring
*4 Liquid with high viscosity
*5 Liquid with high vapor pressure; gases leak (observe safety regulations)

## Material Varispenser/Top Buret

| Part | Manual no. | Varispenser | Varispenser plus | Manual no. | Top Buret Bottletop Buret |
|---|---|---|---|---|---|
| | | 4960 | 4961 | | 4965 |
| **Direct contact to dipensing fluid** | | | | | |
| Valve block | 15 | PFA | PFA | 9 | PFA |
| Valve cock | 11 | – | PTFE | 8 | PTFE/PFA |
| Filling valve | 17 | ETFE | ETFE | 10 | ETFE |
| Discharge valve | 11;12 | ETFE | ETFE/PFA | – | ETFE/PFA |
| Discharge valve | 10 | PFA | PFA | 7 | PFA |
| Spring for valve | | – | Pt-Ir | Pt-Ir | – Pt-Ir |
| Valve ball | 16 | Borosilicate (DURAN) | Borosilicate (DURAN) | – | Borosilicate (DURAN) |
| Cylinder | 6 | Borosilicate (DURAN) | Borosilicate (DURAN) | – | Borosilicate (DURAN) |
| Telescopic filling tube | – | FEP | FEP | 12 | FEP |
| **Indirect contact to dipensing fluid** | | | | | |
| Piston (2.5–10 ml) | 5 | PFA | PFA | – | PTFE/PFA |
| Piston (25–100 ml) | 5 | ETFE | ETFE | – | – |
| Piston holder | 2 | PP | PP | – | PTFE |
| Cylinder casing | 3 | PP | PP | – | PTFE/PFA |
| Protective cylinder sleeve | 7 | PTFE | PTFE | – | – |
| Valve block housing | 14 | PP | PP | 2;10 | PP |
| Discharge tube sleeve | 9 | PP | PP | 5 | PP |
| Discharge tube cap | 13 | PVDF | – | – | – |
| Air vent cup | 18 | PP | PP | 11 | PP |
| Volume adjustment knob | 1 | PP | PP | – | – |
| O-ring for valve cock protection | – | Viton | Viton | – | Viton |
| Volume setting knob | 4 | PP | PP | – | – |
| Discharge valve toggle | 8 | PP | PP | 4 | PP |
| Drying tube | – | PP | PP | – | PP |
| Wheel | – | – | – | 3 | PP |
| Display foil | – | – | – | 1 | PE |

**DURAN** Borosilicate 3.3
**ETFE** Tefzel ETFE (Ethylene tetrafluorethylene)
**FEP** Teflon FEP (Tetrafluoroethylene perfluoropropylene)
**PFA** Teflon PFA (Perfluoro-alkoxy-PTFE-Copolymer)
**PP** Polypropylene
**PE** Polyethylene
**PTFE** Polytetrafluoroethene
**PVDF** Polyvinylidene fluoride
**Pt-Ir** Platinum-Iridium

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