



## SOLID PHASE EXTRACTION

Solid Phase Extraction (*DigiSEP* SPE) is a technique used to isolate or concentrate desired analytes from complex matrices. *DigiSEP* provides an effective and innovative solution to improve detection limits of elements through pre-concentration, or alternatively, to remove interfering matrices prior to ICP-OES or ICP-MS analysis.

- 122** Introduction to Solid Phase Extraction
- 123** *DigiSEP* Blue Label Metal Extraction Cartridges
- 124** *DigiSEP* Red Label Anion Extraction Cartridges
- 124** *DigiSEP* Green Label Cation Removal Cartridges
- 125** *DigiSEP* Orange Label Matrix Removal Cartridges
- 126** *DigiSEP* Molecular Recognition Technology (MRT) Gel
  - 126** Toxic Metals
  - 128** Precious Metals
  - 129** Alkali and Alkaline Earth Metals
  - 130** Radioactive Nuclides
  - 131** Anions and Halogens
  - 132** Transition Metals
- 133** *DigiSEP* Accessories and Reagents
- 135** *DigiSEP* Ion Chromatography Columns

## Solid Phase Extraction

SPE (Solid Phase Extraction) is a technique whereby a desired analyte, a cation or an anion, is concentrated and separated from a complex sample matrix onto a sorbent stationary phase. The interfering matrix, which is not retained, is effectively eliminated. As a result, the analyte can be analyzed at the best possible sensitivity range of the analytical technique, e.g. ICP-OES, without the risk of matrix interference.

In recent years, another technique, Matrix Component Retention, has become very popular. In this case, the sorbent is selected to retain unwanted components in the matrix and the analytes of

interest are not retained. Again, because the potentially interfering components have been removed, better sensitivity is obtained in sample analysis. This technique is seen most often in the food industry.

In both cases, the sorbent is placed in cartridges or liquid chromatography columns that can hold varying quantities of unprocessed samples.

In general, the SPE method should follow 4 steps:

Step One	Conditioning	The sorbent is prepared for the sample.
Step Two	Retention	Filter the desired analyte(s) or the unwanted matrix components.
Step Three	Rinsing	Any possible undesired component that may have been absorbed on the sorbent is washed away.
Step Four	Elution	The selective desorption and collection of the analyte of interest from the cartridge or column.



### TYPICAL APPLICATIONS

Sample preparation for the analysis of heavy metals in ground water

Removal of matrix from food and feed digests for improved transition metal elemental analysis

Removal of matrix from blood and serum digests for improved heavy metal elemental analysis

Concentration and desalination for the analysis of seawater samples

Enhancing the sensitivity of ICP Analysis for water samples through SPE pre concentration

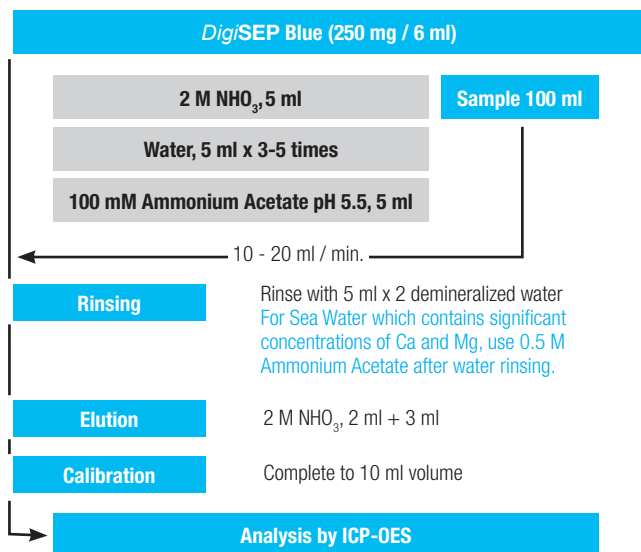
Weight reduction of water samples for transportation (carry only collected samples in cartridges)

### THE BED VOLUME AND THE RETENTION CAPACITY

To use the SPE method effectively, choose the cartridge or column volume and the appropriate sorbent type and mass for the analyte of interest. Normally, the total retention capacity (including interferences) of the cartridge or column is approximately 5% of the sorbent mass.

## DigiSEP | Blue Label METAL EXTRACTION CARTRIDGES

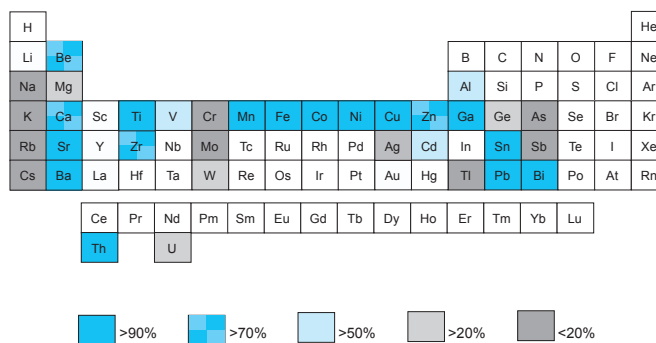
### Blue Application



A general purpose, single use, cation removal cartridge. This highly selective exchange cartridge is ideal for retaining transition metals in samples, such as sea water, that contain high concentrations of potassium and sodium.



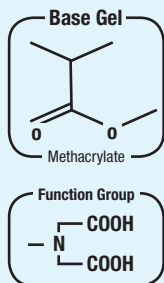
### Metal Retention on DigiSEP - Blue Label Cartridge



Base Material	Functional Group	Capture (g)
Methacrylate	Amino di acetate	Cu ion 0.29 - 0.34 mmol / g

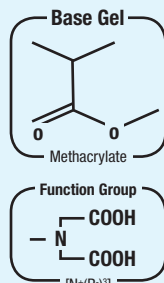
\* The retention of Ca, Mg, Ba on **Blue II** is less than 20%.

#### Blue Structure



Heavy Metal in Ground Water  
Heavy Metal in Silicone Rubber

#### Blue II Structure \*



Heavy Metal in Sea Water  
Heavy Metal in Food, Condiments

## ORDERING INFORMATION



Description	Particle ( $\mu\text{m}$ )	Surface ( $\text{m}^2/\text{g}$ )	Quantity	Catalog No.
DigiSEP - Blue Label 100 mg / 3 ml	70	80	50 per box	010-700-010
DigiSEP - Blue Label 250 mg / 6 ml	70	80	25 per box	010-700-012
DigiSEP - Blue Label 500 mg / 6 ml	70	80	25 per box	010-700-014
DigiSEP - Blue Label II 100 mg / 3 ml	70	80	50 per box	010-700-011
DigiSEP - Blue Label II 250 mg / 6 ml	70	80	30 per box	010-700-013
DigiSEP - Blue Label II 500 mg / 6 ml	70	80	30 per box	010-700-015

## DigiSEP | Red Label ANION EXTRACTION CARTRIDGES

**DigiSEP** Red is a strong anion exchanger, bearing a tetralkylammonium group. It can be used for the elimination of interferences or preconcentration of metal ions.



### SPECIFICATIONS

Base Material	Functional Group	Capture (g)
Methacrylate	Ammonium $\text{NH}_4^+$	Anion 0.55 - 0.66 meq / g



### ORDERING INFORMATION

Description	Particle ( $\mu\text{m}$ )	Surface ( $\text{m}^2 / \text{g}$ )	Quantity	Catalog No.
<b>DigiSEP</b> - Red Label 100 mg / 3 ml	60 - 75	220 - 270	50 per box	010-700-026
<b>DigiSEP</b> - Red Label 250 mg / 6 ml	60 - 75	220 - 270	25 per box	010-700-028
<b>DigiSEP</b> - Red Label 500 mg / 6 ml	60 - 75	220 - 270	25 per box	010-700-030

## DigiSEP | Green Label | CATION REMOVAL CARTRIDGES

A general purpose, single use, cation removal cartridge. This cartridge is best suited for samples that have low concentrations of alkali and alkaline earth metals.



### SPECIFICATIONS

Base Material	Functional Group	Capture (g)
Methacrylate	Sulfonate $\text{SO}_4^{2-}$	Cation 0.55 - 0.65 meq / g



### ORDERING INFORMATION

Description	Particle ( $\mu\text{m}$ )	Surface ( $\text{m}^2 / \text{g}$ )	Quantity	Catalog No.
<b>DigiSEP</b> - Green Label 100 mg / 3 ml	60 - 75	90 - 110	50 per box	010-700-032
<b>DigiSEP</b> - Green Label 250 mg / 6 ml	60 - 75	90 - 110	25 per box	010-700-034
<b>DigiSEP</b> - Green Label 500 mg / 6 ml	60 - 75	90 - 110	25 per box	010-700-036

## DigiSEP | Orange Label MATRIX REMOVAL CARTRIDGES

A general Purpose, single use, matrix clean-up.



### SPECIFICATIONS

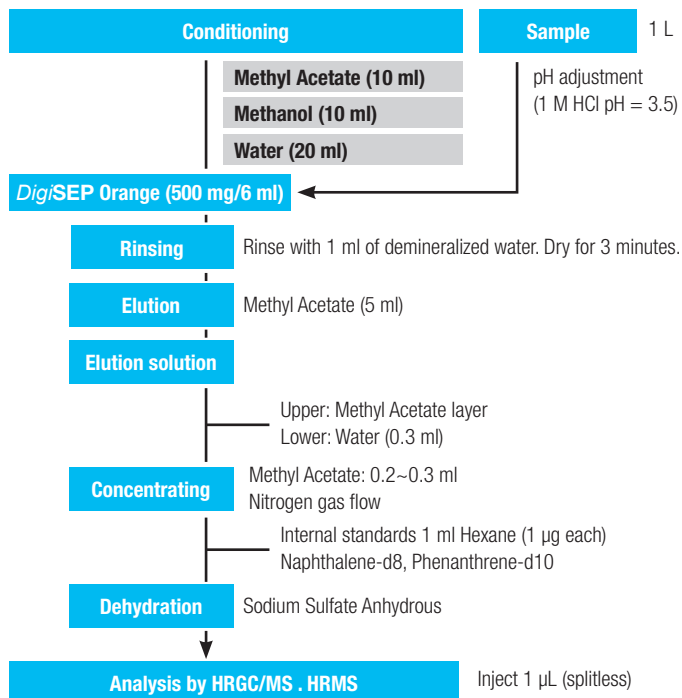
Base Material	Capture (g)
SDB/Methacrylate Co-Polymer	General Matrix Clean-up

### ORDERING INFORMATION

Description	Particle (µm)	Surface (m <sup>2</sup> / g)	Quantity	Catalog No.
<i>DigiSEP</i> - Orange Label 30 mg / 1 ml	60 - 75	620 - 660	100 per box	010-700-020
<i>DigiSEP</i> - Orange Label 60 mg / 3 ml	60 - 75	620 - 660	100 per box	010-700-022
<i>DigiSEP</i> - Orange Label 250 mg / 6 ml	60 - 75	620 - 660	25 per box	010-700-024
<i>DigiSEP</i> - Orange Label Mini 230 mg	46 - 52	620 - 660	50 per box	010-700-038

*DigiSEP* Orange is a polymer combining a styrene divinylbenzene (SDB) with a methylmethacrylate backbone providing both hydrophilic character and non-polar adsorption capability. It is mainly used to remove organic particles from aqueous matrices as a clean up preparation step before metal analysis. Metal ions pass through unretained.

#### Orange Application



## DigiSEP MOLECULAR RECOGNITION TECHNOLOGY GEL

Sample preparation and complex matrices represent two of the greatest challenges in Atomic Spectroscopy.

In the first case, if the samples are not prepared, i.e. digested and pre-treated prior to analysis, the data obtained can be meaningless. In the second case, if the matrices are composed of a complex mixture of salts, viscous acids and/or particulates, it may be next to impossible to detect very low levels of metals.

**SCP SCIENCE** can help the Atomic Spectroscopist with both of these problems. We have seen in the previous chapter by carefully monitoring and controlling sample temperature, the digested metal recoveries can be improved. However, the problem of complex matrices remains a real hurdle in the analysis of metals by Atomic Spectroscopy; independent of whether it is GFAA, ICP-OES or ICP-MS.

The solution to elemental analysis in complex matrices comes in the form of sample preparation using **DigiSEP** Cartridges. Highly selective Molecular Recognition Technology (MRT) gel is ideal for Alkali and Alkaline Earth Metals, Precious Metals, Cr (exclusively), and Hg (exclusively) retention. **DigiSEP** Cartridges can also be

used to remove  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ , and  $\text{Cl}^-$  ions from a sample matrix. In addition, newer MRTs are in development.

Some common applications of **DigiSEP** MRT Cartridges are:

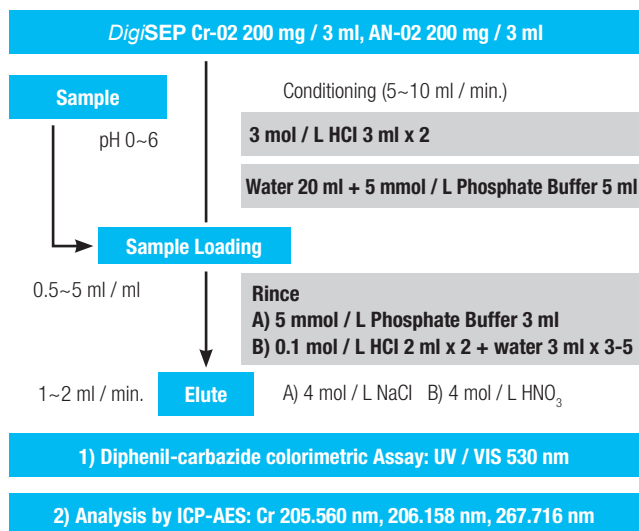
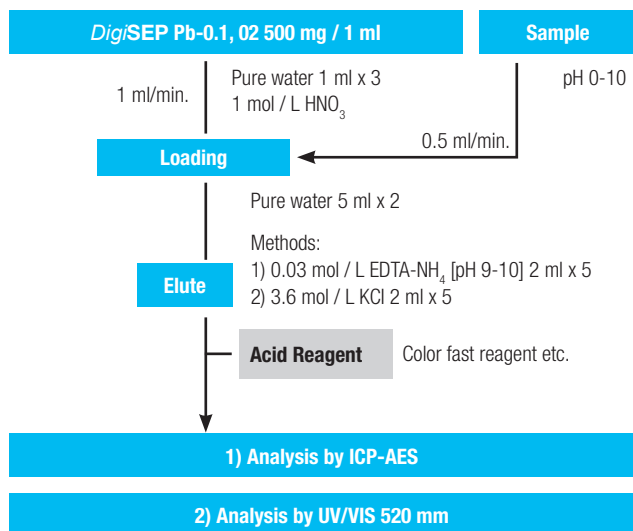
- Chelating Resins can separate difficult to analyze transition metals from high Alkali matrices
- Metal ions can be collected from acid digestion matrices
- Heavy metals can be separated from oil and other organic matrices
- Hg can be captured, collected and concentrated
- Precious metals can be collected and retained
- Pb can be collected and separated from other elements
- Radioactive elements can be collected for nuclear fuel industry

Binding resins are on a silica gel base and can be regenerated between uses. The products are available in cartridge form (3 ml / 500 mg), in 50 and 100 mm x 4.6 mm PEEK body liquid chromatography columns, or in powder form in bottles of 10 grams.

## TOXIC METALS



### SPECIFICATIONS



## DigiSEP

### MOLECULAR RECOGNITION TECHNOLOGY GEL

#### TOXIC METALS

#### SPECIFICATIONS



Product Type	Target Analyte	Matrix	Range (pH)	Optimal Flow Rate (ml / g / minute)	Remarks
<i>DigiSEP</i> Cd-01	Cd <sup>2+</sup>	Waste Water	2 - 9.5	0.5	Removal 1 ppb
<i>DigiSEP</i> Cr-01	CrO <sub>4</sub> <sup>2-</sup>	Waste Water	---	---	---
<i>DigiSEP</i> Cr-02	CrO <sub>4</sub> <sup>2-</sup>	Waste Water	2.0 - 8.0	---	---
<i>DigiSEP</i> Hg-01	Hg <sup>2+</sup>	Drinking Water	---	---	Thiourea or HBr elutable
<i>DigiSEP</i> Hg-02	Hg <sup>2+</sup>	Salt Water (Sea water)	---	0.5	< 20 ppt; thiourea elutable
<i>DigiSEP</i> Hg-03	Hg <sup>2+</sup>	Water	6.5 - 9.5	---	removal of 20 ppt
<i>DigiSEP</i> Pb-01	Pb <sup>2+</sup>	Water	1 - 9.5	0.5	removal of 5 ppb
<i>DigiSEP</i> Pb-02	Pb <sup>2+</sup> (>Pb-01)	Water	1 - 9.5	0.5	removal of 20 ppt
<i>DigiSEP</i> Pb-03	Pb <sup>2+</sup> (>Pb-02)	Water	6.5 - 9.5	0.5	Acid elutable, removal of 10 ppt
<i>DigiSEP</i> Pb-04	Pb <sup>2+</sup>	Water	7.0 - 9.5	---	Acid elutable, removal of 100 - 1000 ppt

#### ORDERING INFORMATION



Product Type	Cartridge (5 / pk) Catalog No.	Powder (10 g) Catalog No.
<i>DigiSEP</i> Cd-01	010-720-011	010-790-011
<i>DigiSEP</i> Cr-01	010-720-013	010-790-013
<i>DigiSEP</i> Cr-02	010-720-015	010-790-015
<i>DigiSEP</i> Hg-01	010-720-017	010-790-017
<i>DigiSEP</i> Hg-02	010-720-019	010-790-019
<i>DigiSEP</i> Hg-03	010-720-021	010-790-021
<i>DigiSEP</i> Pb-01	010-720-023	010-790-023
<i>DigiSEP</i> Pb-02	010-720-025	010-790-025
<i>DigiSEP</i> Pb-03	010-720-027	010-790-027
<i>DigiSEP</i> Pb-04	010-720-029	010-790-029

The most toxic form of Chromium is the Cr<sup>6+</sup> form. However, ICP-AES can only determine the total amount of Chromium. Now with the Cr series cartridges, the more toxic form can be effectively isolated and then analyzed.

The benefit of today's modern Hg analyzers is improved detection limits for this toxic and elusive metal. However, improved detection limits are hampered by base line stability problems. Through pre-concentration and matrix removal, improved sensitivities for Hg can be obtained. The Hg-01 to 03 cartridges provide this benefit.

## DigiSEP MOLECULAR RECOGNITION TECHNOLOGY GEL

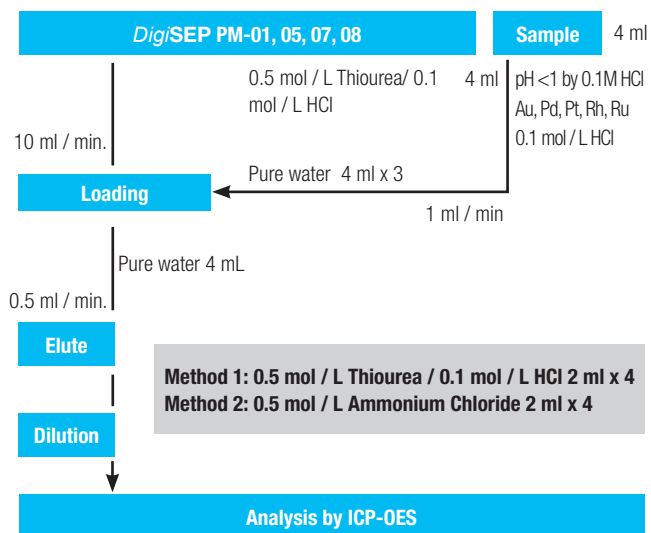
### PRECIOUS METALS

The mining industry is constantly in search of precious metals. Rock samples require grinding and then digestion by the appropriate Digestion System (See Method Development Guide). However, precious metals are found in limited quantities versus other metals in the same sample. Hence, their analysis may be more difficult. The PM series of **DigiSEP** Cartridges will retain and concentrate precious metals. The metals can then be eluted and analyzed at higher concentrations in the absence of interferences.



### ORDERING INFORMATION

Product Type	Target Analyte	Matrix	Range (pH)	Optimal Flow Rate (ml / g / minute)	Remarks
DigiSEP Pd-01	Pd <sup>2+</sup>	---	---	---	---
DigiSEP Pd-02	Pd <sup>2+</sup>	---	---	---	---
DigiSEP Pd-03	Pd <sup>2+</sup>	Minimum 6 M HCl	< 1 - 4.0	---	---
DigiSEP PM-01	Ir <sup>3+</sup> , Ru <sup>3+</sup> , and / or Rh <sup>3+</sup>	Minimum 6 M HCl	---	0.5	---
DigiSEP PM-02	Au <sup>3+</sup> , Ag <sup>1+</sup> , Pd <sup>2+</sup> , Pt <sup>2+</sup> , Pt <sup>4+</sup> , Ru <sup>3+</sup>	Minimum 6 M HCl	< 1 - 9.5	---	---
DigiSEP PM-03	Pd <sup>2+</sup> , Pd <sup>4+</sup> (>Pm-05)	Minimum 6 M HCl	< 1 - 4	---	Thiourea elutable
DigiSEP PM-05	Pd <sup>2+</sup> , Pd <sup>4+</sup>	Minimum 6 M HCl	< 1 - 4	0.5	NH <sub>3</sub> elutable
DigiSEP PM-06	Pd <sup>2+</sup> , Pt <sup>2+</sup>	---	< 1 - 9.5	0.5	---
DigiSEP PM-07	Au <sup>3+</sup> , Ag <sup>1+</sup> , Pd <sup>2+</sup> , Pt <sup>2+</sup> , Pt <sup>4+</sup> , Ru <sup>3+</sup> (>Pm-02)	Minimum 6 M HCl	---	---	---
DigiSEP PM-08	Ir <sup>3+</sup> , Rh <sup>3+</sup> , and Ru <sup>3+</sup>	Minimum 6 M HCl	1 - 9.5	0.5	Selectively elutable
DigiSEP PM-09	Au <sup>3+</sup> , Pt <sup>2+</sup> , Pt <sup>4+</sup> , Pd <sup>2+</sup>	Minimum 6 M HCl	1 - 9.5	0.5	Selectively elutable
DigiSEP PM-10	Ir <sup>3+</sup> , Ru, and / or Rh <sup>3+</sup>	Minimum 6 M HCl	< 1.0	---	---



Product Type	Cartridge (5 / pk) Catalog No.	Powder (10 g) Catalog No.
DigiSEP Pd-01	010-720-031	010-790-031
DigiSEP Pd-02	010-720-033	010-790-033
DigiSEP Pd-03	010-720-035	010-790-035
DigiSEP PM-01	010-720-037	010-790-037
DigiSEP PM-02	010-720-039	010-790-039
DigiSEP PM-03	010-720-041	010-790-041
DigiSEP PM-05	010-720-045	010-790-045
DigiSEP PM-06	010-720-047	010-790-047
DigiSEP PM-07	010-720-049	010-790-049
DigiSEP PM-08	010-720-051	010-790-051
DigiSEP PM-09	010-720-053	010-790-053
DigiSEP PM-10	010-720-055	010-790-055



## DigiSEP

### MOLECULAR RECOGNITION TECHNOLOGY GEL

#### ALKALI AND ALKALINE EARTH METALS

#### SPECIFICATIONS



Product Type	Target Analyte	Matrix	Range (pH)	Remarks
<i>DigiSEP</i> AM-01	Ca <sup>2+</sup> , Na <sup>+</sup>	Water	2.0 - 10.0	Water/EDTA, elutable
<i>DigiSEP</i> AM-02	Ca <sup>2+</sup> ,	Water	> 6.0	Acid elutable
<i>DigiSEP</i> AM-03	Na <sup>+</sup> , K <sup>+</sup> , Rb <sup>+</sup> , Ca <sup>2+</sup> , Br <sup>2+</sup> , Ba <sup>2+</sup> (Mg <sup>2+</sup> , Li <sup>+</sup> , weakly)	Water	2.0 - 10.0	Water/EDTA, elutable
<i>DigiSEP</i> AM-04	K <sup>+</sup> , Na <sup>+</sup> , Rb <sup>+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup>	Water	> 6.0	Acid elutable
<i>DigiSEP</i> AM-05	Li <sup>+</sup>	Water	> 6.0	Acid elutable
<i>DigiSEP</i> AM-06	Ba <sup>2+</sup> , Pb <sup>2+</sup> , Tl <sup>+</sup> , Sr <sup>2+</sup> , K <sup>+</sup>	Water	> 6.0	Acid elutable
<i>DigiSEP</i> AE-01	Ca <sup>2+</sup> , Mg <sup>2+</sup> , other +2 and +3 cations	Water	> 5.0	Acid elutable
<i>DigiSEP</i> AE-02	Ca <sup>2+</sup>	Water	> 6.0	Acid elutable
<i>DigiSEP</i> AE-03	All alkali and alkaline earths except Li <sup>+</sup> , Mg <sup>2+</sup> , Ba <sup>2+</sup>	Water	2.0 - 10.0	Water/EDTA, elutable
<i>DigiSEP</i> AE-04	Sr <sup>2+</sup> , Ca <sup>2+</sup> , Ba <sup>2+</sup> , Na <sup>+</sup> , K <sup>+</sup> , Cs <sup>+</sup>	Water	2.0 - 10.0	Water/EDTA, elutable

#### ORDERING INFORMATION



Product Type	Cartridge (5 / pk) Catalog No.	Powder (10 g) Catalog No.
<i>DigiSEP</i> AM-01	010-720-095	010-790-095
<i>DigiSEP</i> AM-02	010-720-097	010-790-097
<i>DigiSEP</i> AM-03	010-720-099	010-790-099
<i>DigiSEP</i> AM-04	010-720-101	010-790-101
<i>DigiSEP</i> AM-05	010-720-103	010-790-103
<i>DigiSEP</i> AM-06	010-720-105	010-790-105
<i>DigiSEP</i> AE-01	010-720-107	010-790-107
<i>DigiSEP</i> AE-02	010-720-109	010-790-109
<i>DigiSEP</i> AE-03	010-720-111	010-790-111
<i>DigiSEP</i> AE-04	010-720-113	010-790-113

The presence of large quantities (above 1%) of alkali and alkaline elements causes a matrix interference in the analysis of transition metals. The AM and AE series of cartridges allows selective removal of these interfering elements.

## DigiSEP

### MOLECULAR RECOGNITION TECHNOLOGY GEL

#### RADIOACTIVE NUCLIDES

Using teeth as a biological indicator of  $^{90}\text{Sr}^{2+}$  accumulation in the body has been pointed out since the early 1950's. The *DigiSEP* Sr-01 cartridges can be used to isolate  $\text{Sr}^{2+}$  from the digested tooth sample.



#### SPECIFICATIONS

Product Type	Target Analyte	Matrix	Range (pH)	Optimal Flow Rate (ml/g/minute)	Remarks
<i>DigiSEP</i> Pu-01	$\text{Pu}^{3+}$	> 2 M Acid	< 1 - 9.5	---	6 M HCl elutable
<i>DigiSEP</i> Pu-02	$\text{Pu}^{3+}$	2 M acid	1.0 - 9.5	---	> 6 M HCl elutable
<i>DigiSEP</i> Sr-01	$\text{Sr}^{2+}$	Waste Water	1 - 10.0	0.5	EDTA elutable
<i>DigiSEP</i> Cs-01	$\text{Cs}^{+}$	Water	< 0 - 9.5	---	Removal to 500 ppt
<i>DigiSEP</i> Tc-01	$\text{TcO}_4^{-}$	---	1 - 14	0.1	---
<i>DigiSEP</i> Tc-02	$\text{TcO}_4^{-}$	1 MH <sup>+</sup> or 0.1 M Na <sup>+</sup> or 0.01 MK <sup>+</sup>	1 - 14	0.1	---
<i>DigiSEP</i> Ra-01	$\text{Ra}^{2+}$	Water	< 0 - 9.5	< 0 - 9.5	EDTA elutable



#### ORDERING INFORMATION

Product Type	Cartridge (5/pk) Catalog No.	Powder (10 g) Catalog No.
<i>DigiSEP</i> Pu-01	010-720-057	010-790-057
<i>DigiSEP</i> Pu-02	010-720-059	010-790-059
<i>DigiSEP</i> Sr-01	010-720-061	010-790-061
<i>DigiSEP</i> Cs-01	010-720-063	010-790-063
<i>DigiSEP</i> Tc-01	010-720-065	010-790-065
<i>DigiSEP</i> Tc-02	010-720-067	010-790-067
<i>DigiSEP</i> Ra-01	010-720-069	010-790-069

*DigiSEP*  
MOLECULAR RECOGNITION TECHNOLOGY GEL

## ANIONS AND HALOGENS

## SPECIFICATIONS



Product Type	Target Analyte	Matrix	Range (pH)	Optimal Flow Rate (ml / g / minute)	Remarks
<i>DigiSEP</i> AN-01	SO <sub>4</sub> <sup>2-</sup> , SeO <sub>4</sub> <sup>2-</sup> , SeO <sub>3</sub> <sup>2-</sup> , Cr(VI)	μM (acid)	< 3.0	---	Base elutable
<i>DigiSEP</i> AN-02	SO <sub>4</sub> <sup>2-</sup> , SeO <sub>4</sub> <sup>2-</sup> , SeO <sub>3</sub> <sup>2-</sup> , Cr(VI)	Water	< 9.5	---	Base elutable
<i>DigiSEP</i> Ha-01	Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup>	HNO <sub>3</sub> , H <sub>2</sub> SO <sub>4</sub>	< 2.0	0.5	Removal of 100 ppb
<i>DigiSEP</i> F-01	F <sup>-</sup>	Water	< 4	---	Base elutable
<i>DigiSEP</i> F-02	F <sup>-</sup>	Water	< 1 - 8	0.5	Base elutable

## ORDERING INFORMATION



Product Type	Cartridge (5 / pk) Catalog No.	Powder (10 g) Catalog No.
<i>DigiSEP</i> AN-01	010-720-001	010-790-001
<i>DigiSEP</i> AN-02	010-720-003	010-790-003
<i>DigiSEP</i> Ha-01	010-720-005	010-790-005
<i>DigiSEP</i> F-01	010-720-007	010-790-007
<i>DigiSEP</i> F-02	010-720-009	010-790-009

Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) is a powerful oxidizing acid and using the appropriate *DigiPREP* Digestion System (See pg. XX), sulfuric acid can digest almost any organic matrix. However, it is extremely viscous, even at low concentrations, and requires long washout times through the ICP spray chamber. The AN-01 cartridge will avoid this problem.

At present, the only way to digest SiO<sub>2</sub> is to use an excess of HF (hydrofluoric acid) which creates problems with ICP spectroscopy. The resulting F<sup>-</sup> excess can precipitate elements of interest such as Mg and Al. In the past, Boric Acid has been added to the remaining F<sup>-</sup> ion complex. However, this solution results in a more complex matrix increasing the analytical difficulty. Now with the *DigiSEP* F-01 and F-02 cartridges, the excess F<sup>-</sup> ions can be removed.

## DigiSEP MOLECULAR RECOGNITION TECHNOLOGY GEL

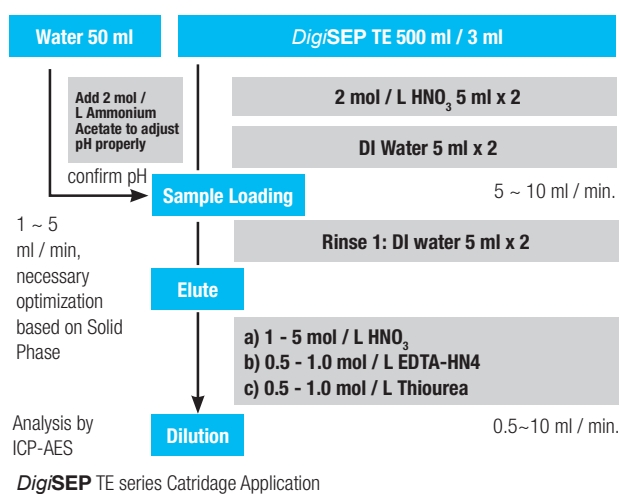
### TRANSITION METALS

Transition metals can represent a challenge in ICP analysis. These important metals can be retained on TE cartridges separating them from other interfering elements. The eluted transition metals can then be analyzed without the original matrix interferences.



### SPECIFICATIONS

Product Type	Target Analyte	Matrix	Range (pH)	Optimal Flow Rate (ml / g / minute)	Remarks
DigiSEP TE-01	Ag <sup>+</sup> , Au <sup>3+</sup> , Cd <sup>2+</sup> , Co <sup>2+</sup> , Cu <sup>2+</sup> , Fe <sup>2+</sup> , Hg <sup>2+</sup> , Ni <sup>2+</sup> , Pb <sup>2+</sup> , Pd <sup>2+</sup> , Zn <sup>2+</sup>	Water	4 - 9.5	0.5	Acid elutable, > 1 ppm
DigiSEP TE-02	Ag <sup>+</sup> , Au <sup>3+</sup> , Cd <sup>2+</sup> , Co <sup>2+</sup> , Cu <sup>2+</sup> , Fe <sup>2+</sup> , Hg <sup>2+</sup> , Ni <sup>2+</sup> , Pb <sup>2+</sup> , Pd <sup>2+</sup> , Zn <sup>2+</sup> , Fe <sup>3+</sup> , Mn <sup>2+</sup>	Water	4 - 9.5	0.5	6 M HCl elutable, > 0.1 ppm
DigiSEP TE-03	Au <sup>3+</sup> , Co <sup>2+</sup> , Cu <sup>2+</sup> , Hg <sup>2+</sup> , Fe <sup>3+</sup> , Pd <sup>2+</sup> , Zn <sup>2+</sup> (all pH range). Ag <sup>+</sup> , Cd <sup>2+</sup> , Pb <sup>2+</sup> , (pH>3), Cu <sup>2+</sup> (pH<3)	Water	1 - 9.5	0.5	EDTA, 6 M elutable; < 100 ppb
DigiSEP TE-04	Au <sup>3+</sup> , Co <sup>2+</sup> , Cu <sup>2+</sup> , Hg <sup>2+</sup> , Ni <sup>2+</sup> , Pd <sup>2+</sup> , Zn <sup>2+</sup> (all pH range). Ag <sup>+</sup> , Cd <sup>2+</sup> , Pb <sup>2+</sup> , (pH>3), Cu <sup>2+</sup> (pH<3)	Water	1 - 9.5	0.5	EDTA, 6 M elutable; < 100 ppb
DigiSEP TE-05	Fe <sup>3+</sup> , Co <sup>3+</sup> , Cu <sup>2+</sup> , Hg <sup>2+</sup> , Ni <sup>2+</sup> , In <sup>3+</sup> , Ga <sup>3+</sup> , Bi <sup>3+</sup> , Al <sup>3+</sup> (all pH range), Mn <sup>2+</sup> , Cd <sup>2+</sup> , Zn <sup>2+</sup> and Pb <sup>2+</sup> (pH>3)	Water	1 - 9.5	0.5	Acid elutable
DigiSEP TE-06	Cu <sup>2+</sup>	Water	2.0 - 9.5	0.5	Acid elutable
DigiSEP TE-07	Most +2, +3 and +4 metal ions as a group	Water	> 2.0	---	6 M HCl elutable
DigiSEP TE-09	Ni <sup>2+</sup> , Zn <sup>2+</sup> , Cd <sup>2+</sup> , Co <sup>2+</sup> , Cu <sup>2+</sup> , Fr <sup>2+</sup> , Au <sup>3+</sup> , Pb <sup>2+</sup> , Hg <sup>2+</sup> , Pd <sup>2+</sup> , Ag <sup>2+</sup>	Water	4.0 - 9.5	---	---
DigiSEP TE-10	Au <sup>3+</sup> , Hg <sup>2+</sup> , Pt <sup>2+</sup> , Cu <sup>2+</sup> , Ni <sup>2+</sup> , Co <sup>2+</sup> , Zn <sup>2+</sup>	Water	0 - 9.5	---	6 M HCl elutable
DigiSEP TE-11	Ni <sup>2+</sup> , Co <sup>2+</sup> , Cu <sup>2+</sup> , Zn <sup>2+</sup>	Water	0.5 - 2.0	---	6 M HCl elutable
DigiSEP TE-12	Ni <sup>2+</sup> , Co <sup>2+</sup> , Cu <sup>2+</sup> , Zn <sup>2+</sup>	Water	0.5 - 2.0	---	6 M HCl elutable
DigiSEP TE-13	Ge <sup>2+</sup> , Sn <sup>4+</sup> , MoO <sub>4</sub> <sup>2-</sup> , borate as a group	Multiple	1 - 12	---	HCl elutable



Product Type	Cartridge (5 / pk) Catalog No.	Powder (10 g) Catalog No.
DigiSEP TE-01	010-720-071	010-790-071
DigiSEP TE-02	010-720-073	010-790-073
DigiSEP TE-03	010-720-075	010-790-075
DigiSEP TE-04	010-720-077	010-790-077
DigiSEP TE-05	010-720-079	010-790-079
DigiSEP TE-06	010-720-081	010-790-081
DigiSEP TE-07	010-720-083	010-790-083
DigiSEP TE-09	010-720-085	010-790-085
DigiSEP TE-10	010-720-087	010-790-087
DigiSEP TE-11	010-720-089	010-790-089
DigiSEP TE-12	010-720-091	010-790-091
DigiSEP TE-13	010-720-093	010-790-093

## DigiSEP ACCESSORIES AND REAGENTS

The **DigiSEP** and Molecular Recognition Technology Gel cartridges concentrate and separate complex sample matrixes. Several accessories are required to optimize results.

### SPE Vacuum Manifold Set

SPE Vacuum Manifold Set is used to concentrate or separate up to 12 **DigiSEP** cartridge analytes simultaneously. Each cartridge tip is placed into the luer stopcock hole located at the top of the SPE vacuum manifold. Once the cartridge is conditioned, the vacuum pump is turned-on and each luer lock valve is opened. Analytes are then filtered and the unwanted matrix is drained into the waste station located in the base of the Manifold. Each cartridge is then rinsed to remove any undesired component(s) that may have been absorbed on the sorbent; which are again drained into the Waste Station.

The base of the **DigiSEP** manifold is split into two compartments: a Waste Station and Elution Station. After rinsing the analytes, the top of the SPE vacuum manifold with cartridges is picked-up, rotated 180 degrees and placed back on the base of the manifold. The cartridges are now at the Elution Station where a rack with 50 ml **DigiTUBE**s collects the analytes of interest from each cartridge. Samples are then available for ICP/ICP MS analysis. Vacuum pump sold separately.



Description	Qty	Catalog No.
SPE Vacuum Manifold Set	each	010-790-501

### Vacuum Pump

The Vacuum Pump is recommended for use with the SPE Vacuum Manifold to provide a vacuum for effective solid phase extractions. Each pump is equipped with a regulator and a moisture trap for particle and moisture removal. Pumps are quiet with low vibration.

Description	Specifications	Qty	Catalog No.
Vacuum Pump, 1/8 hp motor	230 V (17 L / min.)	1	010-790-509
	115 V (20 L / min.)	1	010-500-235



### SPE Cartridge Adapter

SPE Cartridge Adapter connects two **DigiSEP** cartridges in a "top to bottom" format. The connected cartridges are placed on top of the SPE Vacuum Manifold to filter or concentrate specific elements. For example, using the SPE Cartridge Adapter to connect a **DigiSEP** Red and **DigiSEP** Green cartridge to separate Cr(III) and Cr(VI) from an analyte (Application Note available upon request).

Description	Qty	Catalog No.
SPE Cartridge Adaptor	5/pk	010-790-507



## DigiSEP ACCESSORIES AND REAGENTS



### DigiSEP Sample Vacuum Kit

**DigiSEP** Sample Vacuum Kit is used to filter or concentrate analytes in the field or outside the laboratory setting. The Kit is composed of two syringes (3 ml and 20 ml) to provide a vacuum to filter the sample; a SPE vacuum adapter to hold the cartridge and **DigiTUBE** in the proper orientation; and a 12-position autosampler rack with fifteen **DigiTUBE**s (50 ml).

Description	Qty	Catalog No.
<b>DigiSEP</b> Sample Vacuum Kit	1	010-720-150



## ORDERING INFORMATION

Description	Qty	Catalog No.
Excess Liquid Collection Vessel with Pump Tubing	2/pk	010-790-503
Teflon® Luer Stop Cocks	6/pk	010-790-505
Borosilicate Tube with screw caps at both ends for making your own cartridges	1	010-790-511
Polypropylene Frit 10 µm pore size	2	010-790-513
12 Place Rack (12 position)	1	010-510-050

## REAGENTS

Reagent	Description	Concentration	Catalog No.		
			500 ml	1 L	5 L
Ammonium Acetate	CH <sub>3</sub> COONH <sub>4</sub>	2 M	250-220-145	250-220-146	250-220-147
Nitric Acid	HNO <sub>3</sub>	2 N	250-035-250	250-035-251	250-035-252
Water, Deionized, ASTM Type I	H <sub>2</sub> O	18 Megohm/cm	---	---	250-310-820

## DigiSEP ION CHROMATOGRAPHY COLUMNS

### SPECIFICATIONS



Product Type	Application	Capacity ( $\mu\text{eq} / \text{g}$ )	Particle Diameter ( $\mu\text{m}$ )	Size
<i>DigiSEP</i> IC-1	Br, I, Cr	70	6	4.6 x 100 mm
<i>DigiSEP</i> IC-2	As	50	6	4.6 x 150 mm
<i>DigiSEP</i> IC-3	Se	70	6	4.6 x 150 mm
<i>DigiSEP</i> IC-4	Normal Ion Chromatography	30	10	4.6 x 100 mm
<i>DigiSEP</i> IC-G	Guard Column	50	6	4.6 x 10 mm

### ORDERING INFORMATION



Description	Catalog No.	Cross Referencing		
		Dionex®	Metrohm®	Agilent®
<i>DigiSEP</i> IC-1	010-700-044	Ion Pac AS14A / IC-Pac A25S	IC 1H-424 / IC SI-90	---
<i>DigiSEP</i> IC-2	010-700-046	---	---	G3154-65001
<i>DigiSEP</i> IC-3	010-700-048	Ion Pac AS14S / IC-Pac A25S	IC 1H-424 / IC SI-90	---
<i>DigiSEP</i> IC-4	010-700-050	---	IC NI-424	---
<i>DigiSEP</i> IC-G	010-700-052	---	---	---

