PRODUCT SHEET

TRITIUM columns

Main applications

- Determination of tritiated water

Packing

Order N°.	Form	Particle size
H3-C20-A, H3-C50-A, H3-C200-A	20, 50 and 100 Tritium resin columns	75-150 µm

Physical and chemical properties

Capacity :	Cations (Diphonix):	0,8 mEq per column
	Anions (Anion exchange resin):	0,8 mEq per column
	Organical impurities (Prefilter resin)	50 mg. per column

Conditions of utilization

Recommended T of utilization : /

Flow rate : For A grade: 0,6 – 0,8 mL/min

Storage : Dry and dark, T<30°C

For additional information see enclosed literature study

Methods*

Reference	Description	Matrix	Analytes	Support
OTW02	Tritium in water	water	H-3	columns

*developped by Eichrom Technologies Inc.

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LITERATURE STUDY

TRITIUM COLUMNS

Tritium columns (H3 columns) are used for the separation and determination of free Tritium and are an alternative to direct measurement or measurement after distillation. Since the columns are not concentrating Tritium, they can only be used when the required detection limit can be obtained by measurement of a sample volume of 5 – 10 mL.
The free Tritium is eluted from the column while other elements of the matrix are retained on the three components of the Tritium column (fig. 1).

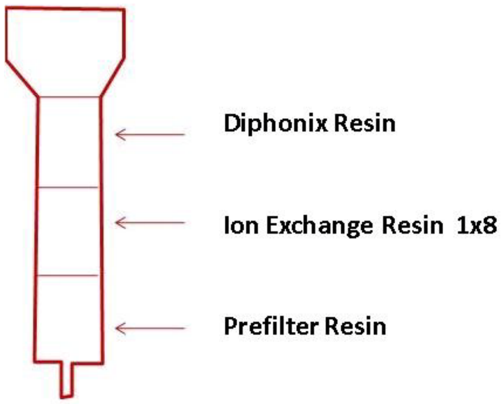

Fig. 1 *: Tritium column*

Tables 1 and 2 show exemplary the decontamination that can be obtained using Tritium columns by comparing the activity concentration of various radionuclides in samples from boiling and pressurized water reactors before and after passing them through a column (2).°

Isotope	A before column [Bq/L]	A after column [Bq/L]
Cr-51	2900	< LD
Mn-54	518	< LD
Co-58	4740	< LD
Fe-59	109	< LD
Co-60	392	< LD
Sn-113	230	< LD
Nb-95	4220	< LD
Zr-95	2210	< LD
I-131	14200	< LD
Cs-134	1120	< LD
Cs-137	1320	< LD

Tab.1 *: Radionuclide removal by Tritium columns in smples from a pressurized water reactor (2)*

Isotope	A before column [Bq/L]	A after column [Bq/L]
Cr-51	1990	< LD
Mn-54	5590	< LD
Co-58	4960	< LD
Co-60	5990	< LD
Nb-95	116	< LD
La-140	1550	< LD
Ce-144	203	< LD

Tab.2 *: Radionuclide removal by Tritium columns in smples from a boiling water reactor (2)*

The Diphonix resin retains cations in exchange of protons; its theoretical capacity is 0.8 mEq per column.
The 1X8 anion exchange resin (Cl- form) retains anions that might interfere with the Tritium measurements. Its theoretical capacity is 0.8 mEq per column. It is recommended to work at sample-pH values greater than 1.
The Prefilter resin is used to bind traces of organic impurities. Its theoretical capacity is 50 mg per column.

Procorad (l'Association pour la **Pro**motion du **Co**ntrôle de Qualité des Analyses de Biologie Médicale en **Rad**iotoxicologie) organises a variety of intercomparisons on urine and fecal samples, including the determination of Tritium in urine samples. Table 1 compares results obtained for the 2005 intercomparison samples; a good agreement between the results obtained using the Tritium column, distillation and the reference values was observed.

Samples	Reference Procorad $A(^3H)/Bq.L^{-1}$	Distillation		Tritium column	
		$A(^3H)/Bq.L^{-1}$	$LD/Bq.L^{-1}$	$A(^3H)/Bq.L^{-1}$	$LD/Bq.L^{-1}$
A	Blank	(1,22±0,46)E+01	8,27	(1,22±0,51)E+01	9,56
B	(1,54±0,05)E+03	(1,49±0,05)E+03	7,86	(1,46±0,05)E+03	9,51
C	(7,69±0,27)E+03	(7,30±0,21)E+03	8,60	(7,05±0,20)E+03	9,42
D	(3,06±0,00)E+04	(2,95±0,08)E+04	8,12	(2,64±0,07)E+04	9,78
E	(10,3±0,4)E+03	(9,81±0,28)E+03	7,71	(9,41±0,26)E+03	8,94

Tab.3: *Comparison of results obtained by distillation and by tritium column clean up, Procorad intercomparison tritium in urine*

Similar studies were performed for samples from nuclear power stations and from nuclear fuel reprocessing plants. For these samples it could equally be shown that results obtained by distillation methods and by column separation methods are very similar.

Sample Type	A(H-3) distillation [Bq/L]	A(H-3) column [Bq/L]	Bias / %
Surface water-40	1,66 (±0,24) x 10^{2}	1,92 (±0,25) x 10^{2}	-13,5
Surface water-26	2,86 (±0,26) x 10^{2}	2,99 (±0,27) x 10^{2}	-4,3
Groundwater-16	1,25 (±0,041) x 10^{3}	1,26 (±0,041) x 10^{3}	-0,8
Groundwater-2C	1,73 (±0,044) x 10^{3}	1,66 (±0,044) x 10^{3}	4,2
BWR-RCS	1,02 (±0,004) x 10^{5}	1,01 (±0,004) x 10^{5}	1,0
PWR-RCS	1,62 (±0,0) x 10^{7}	1,52 (±0,0) x 10^{7}	6,6

***Tab.4** : Comparison of results obtained for real samples of a nuclear power station after distillation and after column separation (2)*

Sample	A(H-3) distillation [Bq/L]	A(H-3) column [Bq/L]	Bias / %
1	2,05 x 10^{7}	2,04 x 10^{7}	0,5
2	4,7 x 10^{4}	4,4 x 10^{4}	5,9
3	1,8 x 10^{6}	2,1 x 10^{6}	-14,3
4	9,2 x 10^{3}	9,6 x 10^{3}	-4,2
5	6,4 x 10^{3}	6,5 x 10^{3}	-1,5

***Tab.5** : Comparison of results obtained for real samples of a fuel reprocessing plant after distillation and after column separation (2)*

Bibliography

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