PRODUCT SHEET

TK-SrScint Resin

Main Applications

- Separation and LSC measurement of strontium ($^{89/90}Sr$)

Packing

Order N°.	Form	Particle size
SRSC-R10-P	10 2mL TK-SrScint Resin cartridges	60 µm

Also available as bulk resin, please contact us for more information.

Physical and chemical properties

Density: 0.59 g/mL TK-SrScint Resin

Conditions of utilization

Recommended T of utilization : 20-25°C
Storage: Dry and dark, T<25°C

TK-SrScint Resin

The TK-SrScint Resin is a resin based on “Impregnated Plastic Scintillation microspheres” developed by Tarancón, and Bagán at the University of Barcelona[1-5].
These new materials consist of plastic scintillation microspheres (PSm), supplied by the group at the University of Barcelona, which are impregnated with selective extractants.
The TK-**Sr**Scint Resin is designed for use in similar separation methods to those employing SR or TK102 Resins. The selective extractant used in the production of this PS resin is a crown ether (also used in SR Resin) dissolved in a fluorinated alcohol (used in TK102 Resin). Consequently, its selectivity will generally be very similar to that of the aforementioned resins, which are primarily used for Sr or Pb separations.

Figure 1 shows SEM pictures of the impregnated microspheres (TK-SrScint).

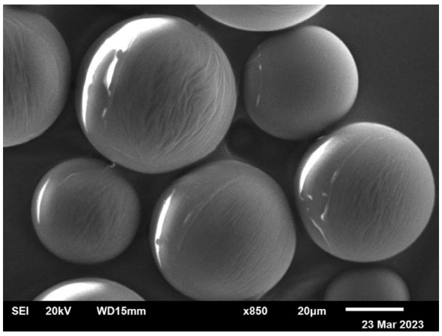

Figure 1: impregnated PSm (TK-SrScint). Taken from [4]

The TK-SrScint is available as pre-packed 2 mL cartridges for use with vacuum box systems or systems that can be easily automated using pump systems[1, 5].

As with the also available TK-TcScint Resin, the PSm support acts as a scintillating medium, allowing for direct measurement of the isotope retained on the cartridge.

Thus, there is no need to elute the target radionuclide and mix the eluate (i.e. radioactive solution) with a liquid scintillation cocktail (i.e. organic product). Incorporating this PS resin thus helps to reduce the amount of mixed (radioactive + organic) waste generated during the determination procedure.

This has a number of advantages:

- Less hands-on time consumed which is particularly interesting in emergency situations
- No mixed liquid radioactive waste
- No Sr, Pb or Ba elution required and no evaporation / sample preparation of the eluate
- No cutting of columns or cartridges to push the resin into LSC vials

Especially the latter two points are interesting in terms of radiation protection when samples of elevated activity are being analyzed.

Ideally the chemical yield is determined via ICP-MS or ICP-OES using Sr as internal standard (comparison between the initial amount added and the strontium not retained on the PS Resin).

Figure 2 compares this new approach based on impregnated PSm Resins such as the TK-TcScint with classical methods.

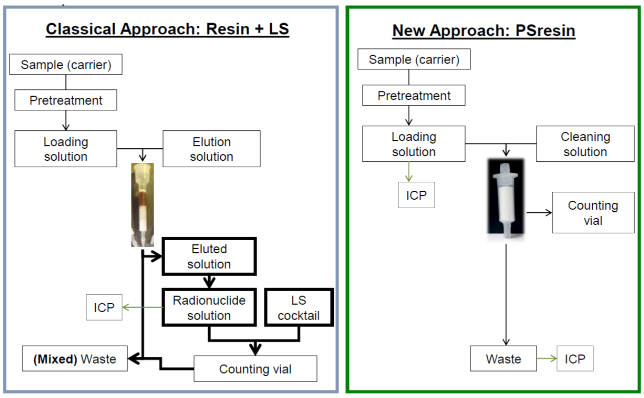

Figure 2 : Overview classical radioanalytical method and PS Resin approach. Taken from [5]

In order to easily handle and avoid contaminating the LSC counter the cartridges should be placed in a standard 20 mL LSC vial for its measurement.

The TK-SrScint Resin has been tested in various water samples, including river, MAPEP, and CSN interlaboratory samples. Results were compared with the two most common methods for Sr-90 determination: extraction chromatography using SR Resin combined with LSC, and successive precipitations combined with LSC. Sr-90 activity evaluated using the different methods ranged from 0.49-4.9 Bq/L in spiked river water samples, to 5.65-10.48 Bq/L in MAPEP interlaboratory samples, and 4.1 Bq/L in CSN interlaboratory samples. Moreover, in CSN samples, interferences such as Co-57, Co-60, Cs-134, Pu-238, Ra-226, Pb-210, and Ra-228 were evaluated.

Prior to applying the PS method using TK-SrScint Resin, various precipitation methods to remove Pb from the sample were investigated. Iodate precipitation was selected as the most suitable method for Pb removal, and further optimization was performed to increase Sr recovery while decreasing Pb presence (~3% remaining). The final procedure included precipitating Pb by adding iodate and calcium as coprecipitating agents and boiling of the sample. Once Pb was removed, Sr was precipitated using hydrogen phosphate in a basic medium, and the resulting precipitate was dissolved with 8 M HNO_3 for loading the sample onto the TK-SrScint Resin.

After analyzing water samples spiked with CSN, Sr chemical yields of approximately 87% were achieved. The analysis considered a background signal of 0.18 CPM, and no other radionuclides, including Pb-210, were detected in the samples. For larger samples, such as 1 L spiked river water samples, a carbonate precipitation step was added to reduce sample volume. In these cases reported chemical recoveries ranged between 63% and 81%[6].

Figure 3 shows the LS spectra of the target radionuclide (Sr-90) and the potential interference (Pb-210) at different times to account for Y-90 ingrowth.

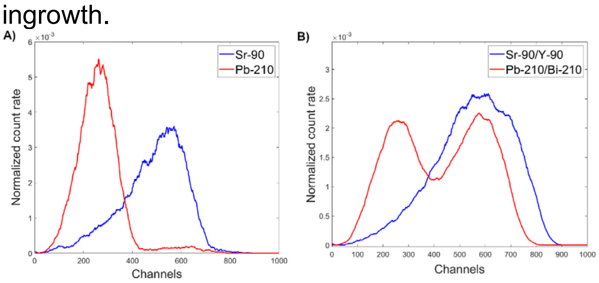

Figure 3: Liquid Scintillation normalized Spectra of Sr-90/Y-90 (blue) and Pb-210/Bi-210 (red) on TK-SrScint at time 0 (A) and with ingrowth daughters at time >21 days (B). Taken from [6]

The detection efficiency of Sr-90, evaluated at time 0, was found to range between 86% and 51% for complete and optimal window settings, respectively. The optimal window was selected to minimize the possible contribution of Pb-210 to the LS spectrum. A lower background signal of 0.3 CPM, compared to standard methods, was achieved with TK-SrScint resin, resulting in a lower detection limit of 27 mBq/L (1 h counting time). As mentioned earlier, the inclusion of PS Resin in the Sr-90 determination method reduced the procedural turnaround time to 5-6 hours.

Determination of Sr-90 in milk samples has also been investigated by Tarancón et al. Their tests resulted in the detection of approximately 65% of the total Sr-90.

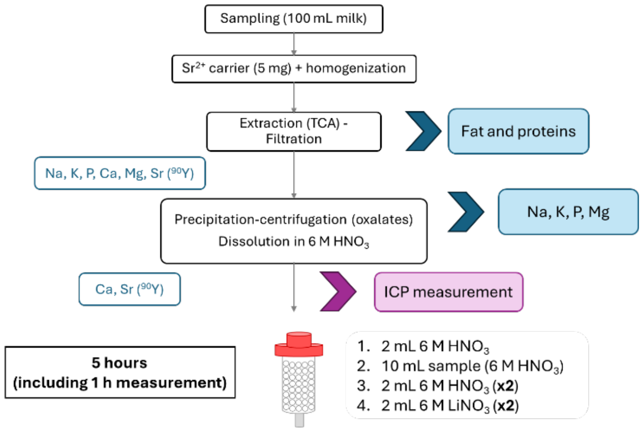

Figure 4: Sr-90 determination procedure in milk samples. Taken from [7]

According to the results obtained by Tarancón et al. (2024) [7] when testing IAEA milk powder samples, the Sr-90 activity quantified using the TK-SrScint Resin was in agreement with the reference activity. Moreover, interferences such as Ca, Na, and K were shown to be removed by observing a clear Sr-90/Y-90 spectrum and through measurements taken with ICP.

Bibliography

(1) Coma et al. "Automated separation of 99Tc using plastic scintillation resin PSresin and openview automated modular separation system (OPENVIEW-AMSS)", Journal of Radioanalytical and Nuclear Chemistry (2019) 321:1057–1065. https://doi.org/10.1007/s10967-019-06659-7
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(3) Tarancón et al. "A new plastic scintillation resin for single-step separation, concentration and measurement of 99Tc", presented at the NRC9 (29/08/16 – 2/09/16, Helsinki, Finland)
(4) Hidex eBook "Liquid Scintillation Measuring Procedures: New Developments" https://hidex.com/ebooks/liquid-scintillation-measuring-procedures/measuring-procedures/radionuclides-from-nuclear-fission-activities/2-3-14-tc-by-rad-disk-and-psresins/
(5) J. Garcia & A. Tarancon, "Radionuclide determinations with PS Resin MASS

WaterRadd", presented at the European Users Group Meeting in Cambridge (UK) - 21/09/2018, https://www.triskem-international.com/scripts/files/5bae2550c30ed4.50583030/11_j-garcia_a-tarancon_radionuclide-determinations-with-ps-resin_mass_waterradd.pdf

(6) Giménez et al. "A new method based on selective fluorescent polymers (PSresin) for the analysis of ^{90}Sr in presence of ^{210}Pb in environmental samples" Applied Radiation and Isotopes, 199, 2023, https://doi.org/10.1016/j.apradiso.2023.110879

(7) Tarancón et al. "Recent applications of Plastic Scintillation Resins », presented at Raddec-Triskem Workshop 2024, (18/04/24, Portsmouth, UK)