Supporting Information

Detection of Polonium-210 in Environmental, Biological and Food Samples: A Review

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Chemical Purification	Reagents	Advantage	Disadvantage
Solvent extraction	● Isopropyl ether; ● Methyl isobutyl ketone; ● Diisopropyl ketone; ● Tributyl phosphate; ● DDTC; ● TOPO.	● Easy operation; ● Large selection of reagents; ● Suitable for a wide range of hydrochloric acid concentrations.	● Generates mixed radioactive waste; ● Third phase formation.
Ion exchange chromatography	● Dowex-1; ● Dowex-2; ● Bio-rad AG1-X4; ● Bio-Rad AG50Wx8.	● Low interference by other nuclides; ● Large selection of reagents; ● High selectivity for polonium.	● Complexity of operational steps; ● Labour-intensive.
Extraction chromatography	● Sr resin; ● DGA resin; ● HRA resin.	● High selectivity for polonium; ● Faster exchange kinetics than anion exchange; ● Simple operation steps; ● Reducing the volume of highly radioactive waste.	● Complexity of operational steps; ● Labour-intensive; ● Longer experimentation time.

Figure S1. The advantages and disadvantages of the different chemical purification for ^{210}Po.

Source preparation		Advantage	Disadvantage
Spontaneous deposition		● Better selectivity for polonium; ● Higher choice of deposition materials; ● Does not require power for use.	● Need to remove interfering ions; ● Longer deposition times.
Electrodeposition		● Large selection of materials; ● Better selectivity for polonium; ● Shorter depositiont time.	● Requires power for use; ● Complicated procedure.
Micro-precipitation	CuS micro-precipitation	● Faster source preparation; ● No heating required; ● Suitable for bulk sample processing.	● Poor recovery stability; ● Low acid resistance.
	Te micro-precipitation	● No heating required; ● Suitable for large number of samples; ● Higher acid resistance; ● Good selectivity for polonium.	● Incomplete reduction of Te(IV) to Te under acidic conditions; ● Not widely used.
	$BiPO_4$ micro-precipitation	● Reduced source production time; ● No heating required; ● Suitable for large volume urine samples.	● Interference by other alpha nuclides; ● Requires purification steps.

Figure S2. The advantages and disadvantages of the different source preparation for ^{210}Po.

Measurements		Advantage	Disadvantage
Alpha spectrometry	Alpha spectroscopy with tracer	• Simple operation; • Low detection limits; • High energy resolution; • Effective separation from other alpha nuclides.	• Complex pretreatment steps are required; • Tracers are difficult to obtain; • Tracers contamination.
	Total alpha counting	• No tracer is used; • Matrix elements are not separated; • Suitable for near-field measurements.	• Accurate recovery of samples cannot be determined.
Liquid scintillation counting (LSC)	Unoptimized LSC	• No contamination of the detector chamber; • High detection efficiency.	• Poor energy resolution; • High detection limits.
	Photon electron rejecting liquid alpha spectroscopy	• Low detection limits; • Smaller sample volume; • Simple operation without complex pretreatment.	• High-purity phosphoric acid is more difficult to obtain; • Separation of other nuclides.
Large area screen grid spectrometry		• Low detection limits; • Simple sample preparation process; • Simultaneous determination of multiple nuclides.	• High requirements for sample particles; • Large area source stability is not good; • Not widely used.

Figure S3. The advantages and disadvantages of the different radioactivity measurements for ^{210}Po.