UNCERTAINTY ESTIMATION USING THE SPREADSHEET APPROACH FOR DETERMINATION OF ^{210}Po IN ENVIRONMENTAL SAMPLES BY ALPHA SPECTROMETRY

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METHODS

- Reference Certified Material (IAEA – 447)
- Po-210 deposition onto a silver disc
- Alpha Spectrometry System

THE SPREADSHEET APPROACH

$$A_A = c_T \times V_T \left(\frac{R_{GA} - R_{BA}}{R_{GT} - R_{BT}} - q_I \right) \times \left(\frac{P\alpha T}{P\alpha A} \right)$$

$$a_A = \frac{A_A}{m_a \times q} \times f_1 \times f_2 \times f_3 \times f_4$$

Parameters	Value	Uncertainty
$m_{a\ (kg)}$	0,0009951	±0,0000001
$v_{T\ (ml)}$	9,9963	±0,0001
R_{GA}	0,06061470	±0,00055046
R_{BA}	6,9986-05	±1,8704E-05
R_{GT}	0,0351	±0,0004
R_{BT}	0,0072035	±0,0001898
q_1	0	0
PaT	1	0
PaA	1	0
$c_{T\ (Bq\ .\ ml^{-1})}$	0,02204	±0,00012
q	1	0
$\lambda_{Po-210}\ (s^{-1})$	5,7976234E-08	±7,1225780E-09
$\lambda_{Po-209}\ (s^{-1})$	1,91E-10	±2,16E-11
$t_s - t_{e(s)}$	172800	±1
$t_{g(s)}$	200042,4	±1
$t_s - t_{c(s)}$	5710176000	±1
f_1	1,01007	±0,00124
f_2	1,005810	±0,000715
f_3	0,897	±0,013
f_4	1,000019	±0,000002

Table I: Summary of parameters, values and uncertainties

	1E-07	0,0001	0,00055	1,87E-05
0,0009951	0,000995	0,000995	0,000995	0,000995
9,9963	9,9963	9,9964	9,9963	9,9963
0,0606147	0,060615	0,060615	0,061165	0,060615
6,99858E-05	7E-05	7E-05	7E-05	8,87E-05
⋮	⋮	⋮	⋮	⋮

VariedResult	437,39	437,44	441,41	437,30
Residuals	-0,04	0,00	3,98	-0,14
Residuals²	0,00	0,00	15,82	0,02
Sum	101,83			
Uncertainty	10,10			

Table II: Partial example of calculations

^{210}Po Activity Concentration $(423 \pm 10)\,Bq \cdot kg^{-1}$

- Activity concentration was found as expected;

- Percentual contribution of each parameter to final uncertainty;
    - Main contributor: gross counting rate of tracer;

- Optimization of future analysis;
    - To increase the counting time;

C O N C L U S I O N

Uncertainty estimation using the spreadsheet approach offers effective quality assessment and helps to increase the quality of the processes.