

Analysis of Hydrogen Isotopes in Consumer Goods Using High Precision Gas Mass Spectrometry

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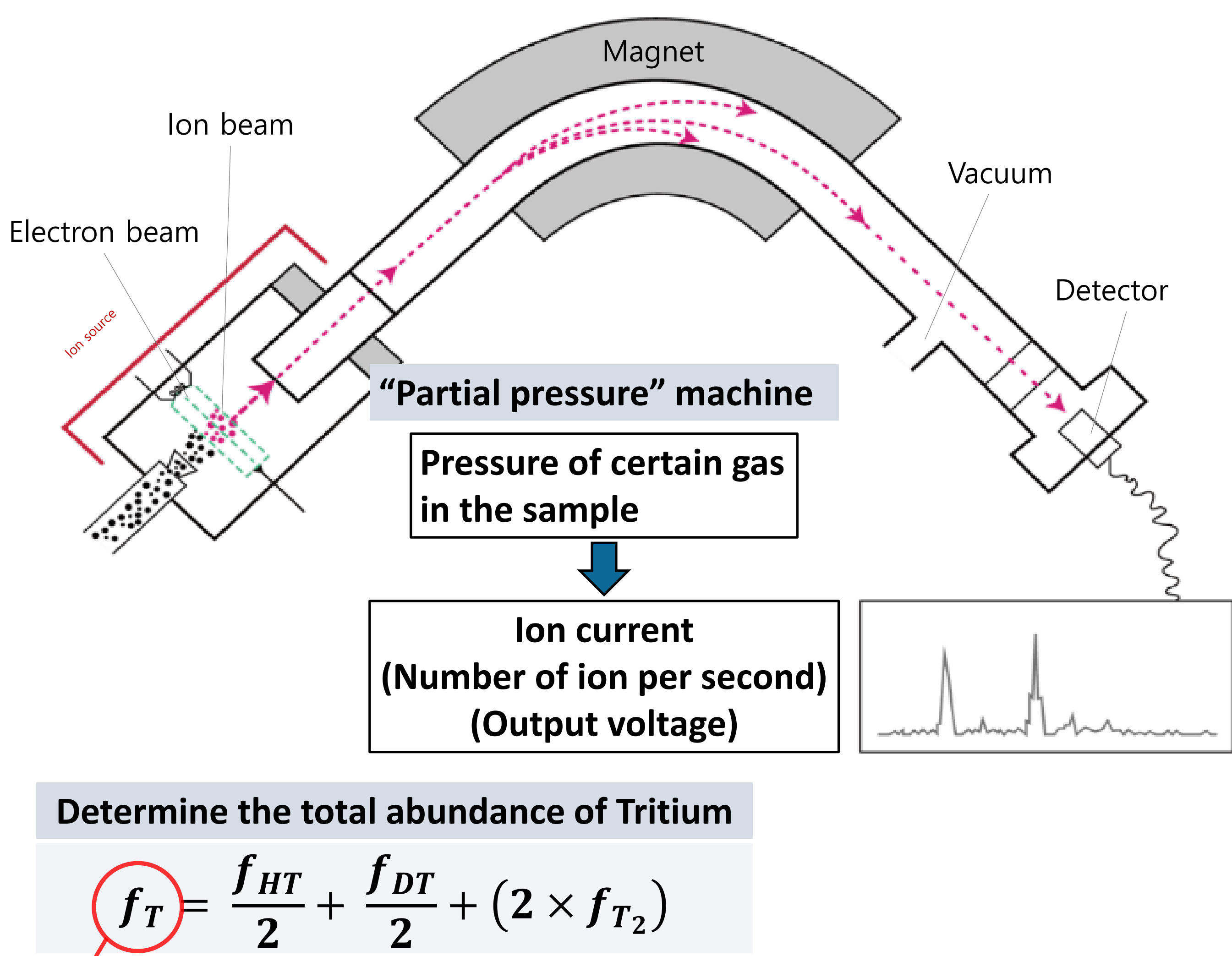
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Introduction

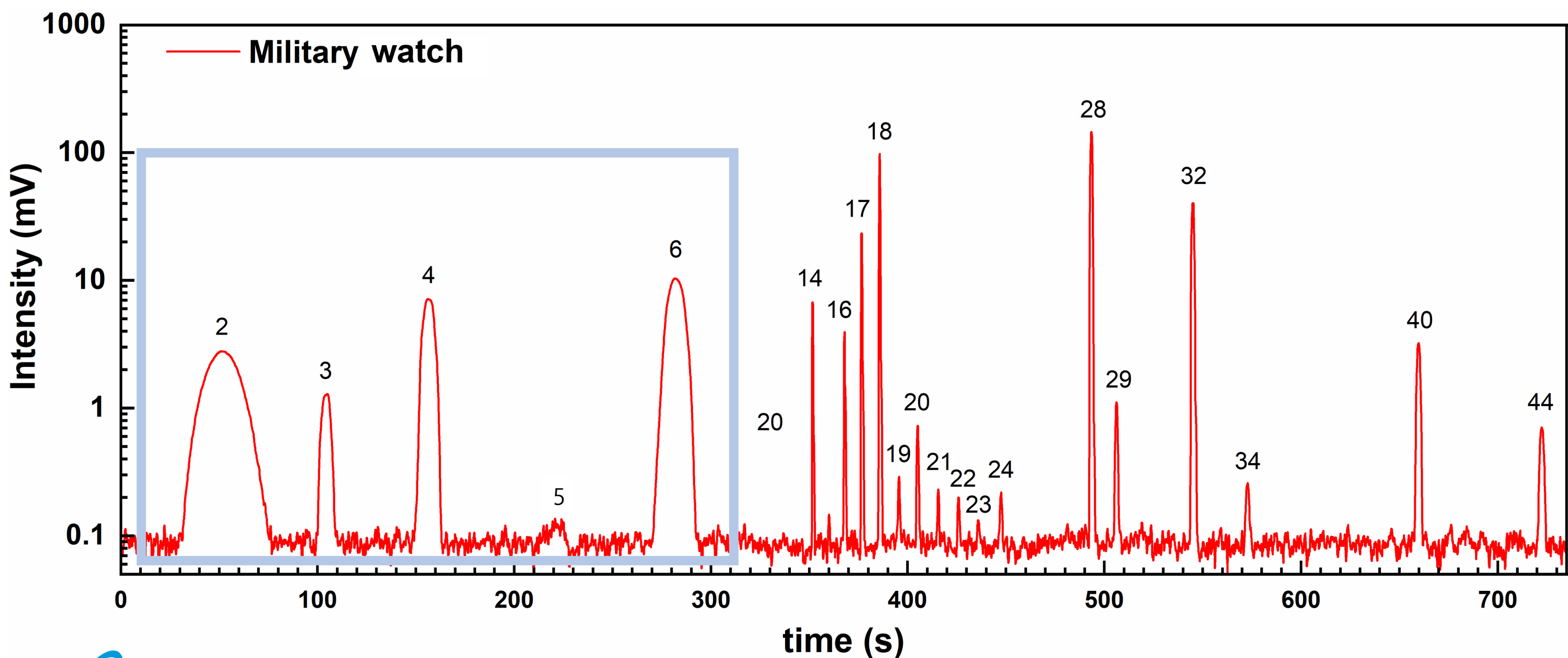
Some consumer goods containing radioactive substances are in circulation and used in everyday life. Among these consumer goods, a gaseous tritium light source (GTLS) contains gaseous tritium. The light of GTLS is based on the principle that beta rays emitted by tritium excite fluorescent materials to emit light. Tritium light is similar to that of fluorescent lamps, but it has a much longer lifespan. Therefore, tritium lights are being used as a consumer product in industry and daily life because they can be operated without electricity. Since tritium has radioactive, it is regulated with a certain radioactive concentration and total radioactivity in accordance with the Nuclear Safety Act. However, since most consumer goods distributed in Korea have no information that can confirm the amount of radiation, it is necessary to analyze the radiation for safety regulation. In this study, hydrogen isotopes included in several consumer products were analyzed using a high precision gas mass spectrometer.

Experiment



Results

Products		Amount of gases (μg)			Total amount of T (μg)	Radiation of T (GBq)	Exceeding the reference value or not
		HT	DT	T ₂			
Fishig lure	A	0.619	0.00164	6.010	6.48	2.31	Excess
	B	0.214	0.00168	1.960	2.12	0.76	-
	C	0.264	0.00478	3.570	3.77	1.34	Excess
Necklace Large (Freestone)		2.54	-	32.20	34.11	12.14	Excess
Necklace Small (Freestone)		0.523	-	3.73	4.12	1.47	Excess
Tritium tube Small (Mixglo)		0.0866	-	1.06	1.12	0.40	-
Tritium tube medium (Mixglo)		0.138	-	1.37	1.47	0.52	-
Tritium tube Large (Mixglo)		0.0053	0.0053	4.92	4.93	1.75	Excess
Compass (CARMENGA)		0.99	0.00144	4.7	5.46	1.94	Excess
Watch (ADDIES)		0	0	0	0.00	0.00	Not included
Watch (Luminox)		0.125	0.00017	0.409	0.50	0.18	-
Watch (Deepblue)		0.668	0.00058	0.787	1.289	0.46	-
Watch (Marathon)		0.06485	0.00038	0.122	0.171	0.06	-
Watch (Traser)		0.0297	0.0000916	0.069	0.0912	0.03	-



Conclusion

- A Gas/MS was used to analyze the gaseous tritium component in GTLSs.
- As a result, the amount of gaseous tritium in one sample ranged from 0.09×10⁻⁶ g to 6.48×10⁻⁶ g. This is a level of 0.03 GBq to 2.31 GBq (converted to the radiation unit).
- Most of the product groups were found to be significantly lower than the exemption amount of tritium (1 GBq) set by the Korean Nuclear Safety Act (or the International Nuclear Safety Organization), but there were some products that exceeded this limit.
- Moreover, additional analysis using other equipment is required for solids and liquids with adsorbed tritium.