

DRIED URINE TEST SPECIFICATIONS

Bromine

Clinical Information

Bromine is a common component of flame proofing agents, fumigants, medications, food products, and pool/spa sanitizers. Bromine has no known function in the body but high environmental exposure can lead to excess accumulation. If iodine status is low, bromine competes with iodine for tyrosine binding sites within thyroglobulin and thereby impedes thyroid hormone synthesis. In the US the daily bromine intake is estimated to be 2-8 mg from grains, nuts and fish. Dietary bromine intake in the Netherlands, France, Ukraine and Japan is estimated to be 9.4, 4, 3.5, and 11.4 mg/day, respectively. Dietary bromine is well absorbed in the gut, is distributed in the extracellular fluid, is not known to concentrate in any specific organs, and is mostly excreted in the urine. The half-life of bromine in the body is approximately 12 days. Dried urine analysis can indicate excessive bromine exposure.

Two dried urine samples are collected for bromine testing; first morning and last night. The bromine content is averaged for the two samples, which we have found to correlate excellently with results from a simultaneous 24-hour urine collection.

Bromine levels are corrected using urinary creatinine to allow for variations in hydration status.

The reference range is 700—4800 µg bromine/g creatinine.

References:

Zava TT, Zava DT. Determination of iodine, bromine, selenium and arsenic by ICP-DRC-MS using urine dried on filter paper. *Thyroid* 2013;23(1):A21. (Poster presented at 83rd Annual Meeting of the American Thyroid Association, Oct 16-20, 2013, San Juan, Puerto Rico).
Allain P, Mauras Y, Dougé C, et al Determination of iodine and bromine in plasma and urine by inductively coupled plasma mass spectrometry. *Analyst*. 1990;115:813-5.
Bromism. In: Parfitt K, ed. *Martindale* 32nd ed. Pharmaceutical Press, 1999:1620-3.
Pavelka S. Metabolism of bromide and its interference with the metabolism of iodine. *Physiol Res*. 2004;53 Suppl 1:S81-90.
Zava TT, Kapur S, Zava DT. Iodine and creatinine testing in urine dried on filter paper. *Anal Chim Acta* 2013;764:64-9.

Assay Method: ICP-MS

Intra-assay Precision

Intra-assay precision was determined by choosing three dried urine samples spanning the reference range for bromine, and analyzing them 20 times within the same run. Results are shown below:

Mean Bromine Concentration (µg/L)	Standard Deviation	Coefficient of Variation (C.V. %)
573	26.9	4.7
3597	100.7	2.8
6800	278.8	4.1

Inter-assay Precision

Inter-assay precision was determined by choosing three samples spanning the reference range for bromine, and analyzing them in 12 different runs. Results are shown below:

Mean Bromine Concentration (µg/L)	Standard Deviation	Coefficient of Variation (C.V. %)
683	58.1	8.5
3596	230.1	6.4
6718	309.0	4.6

Accuracy

To test the accuracy of the dried urine assay for bromine, external urine controls containing known concentrations of bromine were analyzed. An inter-laboratory comparison was also performed with matching samples. Results are shown below:

External Control	Expected Bromine (µg/L)	ZRT Bromine (µg/L)	Inter-Laboratory Comparison	Other Lab Result (µg/L)	ZRT Result (µg/L)
SeroNorm Trace Elements Level 1	3000	3033	Sample 1	897	935
SeroNorm Trace Elements Level 2	3000	2910	Sample 2	2600	2703

Analyte Stability

The dried urine bromine samples are stable for more than one month at room temperature and for more than six months when stored at -80°C. Three freeze-thaw cycles did not cause a significant change in concentration.

Specimen Collection

Kits for dried urine collection contain two filter paper collection strips, easy-to-follow instructions, and a mailer to return the sample for analysis.