

Evaluation of Greiner **VACUETTE**[®] NH Trace Element Sodium Heparin tubes for trace elements determination

Background:

Greiner-Bio-One, Austria has sold plastic evacuated tubes (**VACUETTE**[®]) for venous blood collection since 1986. In addition to the standard product line, Greiner-Bio-One also has an extensive range of special tubes including tubes for trace element testing.

Sodium heparin activates antithrombins, thus blocking the coagulation cascade and producing a whole blood/ plasma sample instead of clotted blood plus serum.

The tubes are composed of clear plastic. The caps are made of plastic with rubber stopper.

Study Objective:

Trace elements are inorganic components that are found in the body in a concentration of < 0.01% of the body mass, which are amounts of < 10⁻⁶ g/g bodyweight. Normal ranges of the tested trace elements are listed below in Table 1.

The aim of evaluation of **VACUETTE**[®] NH Trace Element Sodium Heparin tubes was to demonstrate the analytical performance and suitability for trace element analysis in blood for a variety of trace elements.

Study design and procedure:

The study and its results are applicable to all **VACUETTE**[®] NH Trace Element Sodium Heparin tubes.

For the study, the following product was used:

Sample	Draw Volume	Description
454030	4 ml	VACUETTE [®] Trace Element NH Sodium Heparin

10 tubes were filled to the fill line with Millipore water (filling was carried out without any metal-containing devices). After filling, the tubes were inverted 8 times. Standards, controls and the samples were measured by ICP-MS. The tubes were tested for the following trace elements:

Table 1

Element	Normal range in	
	whole blood [ppb] ¹	Plasma/Serum [ppb] ¹
Ag Silver	N.A.	<0.3
Al Aluminium	< 5	5
As Arsenic	< 12	12
Ba Barium	100	80

Element	Normal range in	
	whole blood [ppb] ¹	Plasma/Serum [ppb] ¹
Be Beryllium	< 3.8	4
Bi Bismuth	N.A.	< 0.5
Cd Cadmium	<1.0	N.A.
Cr Chromium	3-6	< 0.4
Co Cobalt	0.5-3.9	0.6
Cu Copper	1.6-1190	< 1400
Hg Mercury	1.0	N.A.
I Iodine	N.A.	40-80
Li Lithium	N.A.	< 70
Mn Manganese	6.0-11.0	0.3-1.1
Mo Molybdenum	1-10	< 6
Ni Nickel	0.05-1.05	< 1.2
Pb Lead	< 100	N.A.
Se Selenium	60-125	55-103
Sb Antimony	< 3.0	N.A.
Sn Tin	N.A.	< 5
Te Tellurium	0.15	N.A.
Th Thorium	< 0.5	< 0.04
Tl Thallium	< 0.8	N.A.
U Uranium	0.1	< 60
Zn Zinc	400-750	700-1500

¹ see Ref (1)
N.A. Not available

Results

Testing results of **VACUETTE**[®] NH Trace Element Sodium Heparin tubes are shown in Table 2.

Table 2

Element	Typical contamination level in empty VACUETTE [®] NH Trace Element Sodium Heparin tube [ppb]
Ag Silver	< 1.0 ¹
Al Aluminium	< 2.6
As Arsenic	< 1.0 ¹
Ba Barium	< 1.0 ¹

Element	Typical contamination level in empty VACUETTE [®] NH Trace Element Sodium Heparin tube [ppb] ¹
Be Beryllium	< 1.0 ¹
Bi Bismuth	< 1.3
Cd Cadmium	< 0.2 ¹
Cr Chromium	< 1.0 ¹
Co Cobalt	< 1.0 ¹
Cu Copper	< 1.0 ¹
Hg Mercury	< 0.2 ¹
I Iodine	< 1.0 ¹
Li Lithium	< 1.0 ¹
Mn Manganese	< 1.0 ¹
Mo Molybdenum	< 1.0 ¹
Ni Nickel	< 1.0 ¹
Pb Lead	< 0.2 ¹
Se Selenium	< 1.0 ¹
Sb Antimony	< 1.0 ¹
Sn Tin	< 1.0 ¹
Te Tellurium	< 1.0 ¹
Th Thorium	< 1.0 ¹
Tl Thallium	< 0.2 ¹
U Uranium	< 1.0 ¹
Zn Zinc	< 2.9

¹ detection limit of ICP-MS

Conclusion:

From these results it can be concluded that the Greiner **VACUETTE**[®] NH Trace Element Sodium Heparin tube is suitable for trace element analysis in blood for the tested trace elements except Aluminium (Al) and Bismuth (Bi). In this case the **VACUETTE**[®] AH Ammonium Heparin tube would be a good alternative. The contamination level found for Zinc (Zn) is far below the normal range of Zn in whole blood.

References:

- (1) Woittiez J., Iyengar V, Trace Elements in Human Clinical Specimens: Evaluation of Literature Data to Identify Reference values; Clinical Chemistry, Vol. 34, No. 3, 1998
- (2) Thomas L., Labor und Diagnose. TH-Books, 7. Auflage (2008)
- (3) Tietz N.W., Clinical Guide to Laboratory Tests. W.B. Saunders Company, third edition (1995)
- (4) Guder W.G., Narayanan S., Wisser H., Zwata B., Samples: From the Patient to the Laboratory. Wiley-VCH, third revised edition (2003)
- (5) FDA Approval Greiner Trace Element Tubes