



CERTIFICATION

AOAC Research Institute *Performance Tested Methods*SM

Certificate No.
101002

The AOAC Research Institute hereby certifies the method known as:

VitaFast® B12 Microbiological Microtiter Plate Test for the Determination of Vitamin B12

manufactured by
Institut für Produktqualität GmbH
Wagner-Régeny-Str. 8
12489 Berlin
Germany

distributed by
R-Biopharm AG
An der neuen Bergstraße 17
64297 Darmstadt
Germany

This method has been evaluated in the AOAC Research Institute *Performance Tested Methods*SM Program and found to perform as stated in the applicability of the method. This certificate indicates an AOAC Research Institute Certification Mark License Agreement has been executed which authorizes the manufacturer to display the AOAC Research Institute *Performance Tested Methods*SM certification mark on the above-mentioned method for the period below. Renewal may be granted by the Expiration Date under the rules stated in the licensing agreement.

A handwritten signature in black ink that reads "Scott Coates".

Scott Coates, Senior Director
Signature for AOAC Research Institute

Issue Date	December 3, 2022
Expiration Date	December 31, 2023

AUTHORS ORIGINAL VALIDATION: Jessica Kerr and Kurt Johnson MODIFICATION MARCH 2017: Wolfgang Weber	SUBMITTING COMPANY R-Biopharm Inc. 7950 Old US 27 South Marshall, MI 49068	Current Sponsor R-Biopharm AG An der neuen Bergstraße 17 64297 Darmstadt Germany
---	--	---

METHOD NAME VitaFast® B12 Microbiological Microtiter Plate Test for the Determination of Vitamin B12	CATALOG NUMBER P1002
--	--------------------------------

INDEPENDENT LABORATORY Silliker Canada Co. 90 Gough Road Markham, ON L3R 5V5 Canada	AOAC EXPERTS AND PEER REVIEWERS Sneh Bhandari ¹ , Michael Rychlik ² ¹ Silliker Laboratories, Illinois, USA ² Technische Universität München, GERMANY ³ Modification March 2017 (10)
--	---

APPLICABILITY OF METHOD
Target analyte – B vitamin cyanocobalmin (B12)

Matrixes – (1 g) - Cereals, multivitamin pills, powders, beverages like fruit juice & milk

Performance claims – The performance characteristics of VitaFast® Vitamin B12 meet the following specifications:

- 1) Time required for completion of the sample extraction was 2 hours and less than 48 hours for the test implementation.
- 2) The test kit components are stable as indicated on the test kit labels (shelf life is 12 months).
- 3) Analytical Sensitivity was found at LOD 0.021 µg / 100 g as measured by 100 blank samples from 10 different lots. LOQ was set at 0.03 µg Vitamin B12 / 100 g sample, which corresponds to standard 1 of the curve.
- 4) Accuracy was investigated by analysis of reference materials from five proficiency programs, and by commercial product analysis and spike recovery studies. In general recovery was within acceptable limits.
- 5) The VitaFast test kit was shown to have a high degree of precision, with inter-assay variances below 10 % for all matrixes.
- 6) The VitaFast plate test is not sensitive to temperature changes between 36 °C and 38 °C, incubation time between 44 and 52 hours, or assay medium volumes between 145 and 155 µl.

ORIGINAL CERTIFICATION DATE October 14, 2010	CERTIFICATION RENEWAL RECORD Renewed annually through December 2023.
--	--

METHOD MODIFICATION RECORD 1. March 2017 Level 2	SUMMARY OF MODIFICATION 1. Manufacturing location change to Wagner-Régeny-Str. 8, Berlin.
--	---

Under this AOAC <i>Performance Tested Methods</i> SM License Number, 101002 this method is distributed by: R-Biopharm AG	Under this AOAC <i>Performance Tested Methods</i> SM License Number, 101002 this method is distributed as: VitaFast® B12 Microbiological Microtiter Plate Test for the Determination of Vitamin B12
--	---

PRINCIPLE OF THE METHOD (1)

Vitamin B12 is extracted from a homogenized sample and the extract is diluted. A Vitamin B12 assay medium and standards or the diluted sample extract are pipetted to the wells of a microtiter plate coated with *Lactobacillus delbrueckii* subsp. *lactis* (*leichmannii*). The growth of the organism is dependent on the vitamin content of the sample, or standard. Following the addition of Vitamin B12 as a standard or as a compound of the sample, the bacteria grow until the vitamin is consumed. The incubation is done in the dark at 37 °C (98.6 °F) for 44 - 48 h. The intensity of growth in relation to the extracted vitamin B12 is measured as turbidity and compared to the standard curve. After the incubation period, absorbances of each well are measured using a microtiter plate reader at 610 - 630 nm (alternatively at 540 - 550 nm). Results are interpolated from the standard calibration curve which covers a range from 0.03 - 0.18 µg / 100 g.

DISCUSSION OF THE VALIDATION STUDY (1)

The VitaFast Vitamin B12 test kit is calibrated according to a standard curve of five standard concentrations, using 4-parameter fitting software. The curve shown in figure 1 is typical. Variation within the curve is consistently minor, at a level of variance below 10 %. Stability is also demonstrated over the entire shelf life of the product, and regular quality tests ensure this is true for all lots produced.

The independent laboratory study confirmed the accuracy and repeatability of the VitaFast method. Although the VitaFast method did seem to produce results that were higher than those generated by the reference method, results of both reference materials were well within the range of acceptance. Analysis of the autoclaved extract from the reference method on the VitaFast microtiter plate produced a result above the upper limit of the NIST sample. Nevertheless, the VitaFast method when implemented as outlined in the product insert performed as expected for both sample types.

Table 6. Intra-assay variance of food samples (triplicate analysis per sample dilution) (1)

Sample description (conc. indicated on label in µg / 100 g (ml))	Dilution factor	Mean result in µg / 100 g (ml)	Mean result of dilutions in µg / 100 g (ml)	Coefficient of variation in %
Vitamin pills (4.3 - 5.8)	30	1.37	1.41	4.5
	40	1.37		
	60	1.48		
Yoghourt strawberry, cranberry, raspberry (0.2)	2	0.24	0.25	4.6
	4	0.26		
	8	0.26		
Multivitamin bonbon (3.5)	20	3.4	3.7	7.2
	40	3.8		
	80	3.9		
Vitamin premix (3500)	20000	3597	3398	5.6
	40000	3220		
	80000	3377		
Ham sausage (2.0)	30	1.89	1.99	7.1
	40	2.09		
Children yoghurt (0.2)	8	0.25	0.25	2.9
	32	0.24		
Sirup (none)	2	0.34	0.36	4.3
	4	0.37		
	8	0.36		

Table 7. Intra-assay variance of food samples (1)

Sample description	Concentration indicated on label in µg / 100g (ml)	Mean result of dilutions in µg / 100 g (ml)	Coefficient of variation in %
Dextrose powder RM – Vit001 internal Reference material	1.0	0.98 (n=9) 0.93 (n=9) 1.08 (n=9)	7.7
Cherry bonbon	3.5	3.1 (n=4)	4.6
Multi vitamin pills	65	73 (n=6)	5.7
Energy drink	2	2.0 (n=4)	1.9
Multivitamin juice drink 1	1	1.35 (n=4)	4.3
Multivitamin juice drink 2	0.15	0.21 (n=4)	5.5

Table 8 . Comparison of results from various analytical methods performed internally and externally (1)

Sample description	Concentration indicated on label in µg / 100g (ml)	VitaFast	Other Methods
		Mean result of dilutions in µg / 100 g (ml)	
Drink food without lactose	0.70	0.74 (n=4)	0.71 internal HPLC
Drink food extra	0.47	0.29 (n=6)	0.29 internal HPLC 0.34 external HPLC
Hospital milk drink standard	0.21	0.21 (n=4)	0.22 internal HPLC 0.20 external HPLC
Hospital milk drink extra	0.21	0.32 (n=6)	0.26 intern HPLC 0.31 extern HPLC
Cereals	1.0	1.29 (n=6)	1.33 internal HPLC
Fruit mix	1.2	1.61 (n=6)	1.56 internal HPLC
Juice milk drink	0.20	0.20 (n=4)	0.17 external VitaFast
Banana milk pudding	0.65	0.82 (n=6)	0.90 (external Lab 1) 0.76 (external Lab 2) 0.89 (external Lab 3) classic microbiological assay AOAC 960.46

REFERENCES CITED

- Kerr, Jessica, and Johnson, Kurt., Evaluation of the VitaFast® B12 (Cyanocobalamin): Microbiological Microtiter Plate Test for the Determination of B12, AOAC *Performance Tested Methods*SM certification number 101002.
- AOAC Research Institute Validation Outline for VitaFast® B12 (Cyanocobalamin): Microbiological Microtiter Plate Test for the Determination of B12, Approved – October 2010.
- Higdon, J. Linus Pauling Institute, Oregon State University. 2008. Micronutrient Information Center: Vitamin B12. [Accessed online January 25, 2008: <http://lpi.oregonstate.edu/infocenter/vitamins/pa/>]
- Food and Nutrition Board, Institute of Medicine. 1998. Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin and Choline. [Accessed online April 20, 2009: http://www.nap.edu/catalog.php?record_id=6015#toc]
- European Food Information Council. 2006. Vitamins: What they do and where to Find them. [Accessed online april 15, 2009: <http://www.eufic.org/article/en/page/MARCHIVE/expid/miniguide-vitamins/#9>]
- Health Canada. 2005. Addition of Vitamins and Minerals to Foods. [Accessed online January 25, 2008: http://www.hc-sc.gc.ca/fn-an/nutrition/vitamin/fortification_final_doc_1-eng.php]
- U.S. Food and Drug Administration. 2009. Fortify Your Knowledge about Vitamins. [Accessed online April 15, 2009: <http://www.fda.gov/consumer/updates/vitamins111907.html>]
- Ball, G.F.M. 1998. Bioavailability and Analysis of Vitamins in Foods. Chapman & Hall.
- Allen, L.H. 2003. B Vitamins: Proposed Fortification Levels for Complementary Foods for Young Children. J. Nutr. 133: 3000S-3007S
- Weber, W., Evaluation of Modification Report for Location Change, AOAC *Performance Tested Methods*SM certification number 101002. Approved March 2017.