

FITkit®

FITkit® Hev b1
CAT K3-350-020

Instructions for use of FITkit® Hev b 1
in quantitative determination of Hev b 1
in natural rubber latex products

Quattromed is an innovative biotech company providing medical diagnostics services and performing custom research programs for biopharmaceutical industry.

Our main focus of activities is in protein expression and production combined with protein-protein interaction studies. In-house proprietary technologies are used combined with extensive process know-how and partnership with academic and industrial groups.



Quattromed Ltd

Nooruse 9

50411 Tartu

Estonia

Phone: + 372 737 7070

Fax: + 372 737 7077

E-mail: quattromed@quattromed.com

www.quattromed.com





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1. Introduction

Products containing natural rubber latex (NRL) from the rubber tree *Hevea brasiliensis* are widely used due to the economical price and advantageous processing properties of natural rubber, although adverse reactions against a number of allergenic proteins contained in the NRL are well known and documented. The NRL-containing products used by e.g. healthcare personnel, such as surgical gloves and various other devices (like catheters, tubes, masks, etc.) contribute to the major portion of these adverse reactions. In healthcare, the NRL-based medical devices exhibit a potential danger not only to the personnel but also to the patients undergoing an examination or a surgery. Additionally, even the general population becomes in a daily contact with diverse NRL-containing products, such as household gloves, condoms and balloons, manufactured by the dipping procedure, and also with tubes, tires, erasers and like.

Currently, latex allergy is recognized as a serious world-wide health problem: up to 15 % of the health care workers and approximately 1 % of the whole population are allergic to NRL. The clinical manifestations of latex allergy range from mild contact urticaria to fatal anaphylaxis and the seriousness of the condition is accentuated by the fact that the first sign of sensitization can manifest as a life-threatening reaction.

Latex allergens are proteins or polypeptides eluting from the manufactured products upon contact with skin, mucous membranes or other tissues. According to the current allergen nomenclature system maintained by the International Union of Immunological Societies (IUIS) under the WHO, thirteen allergens, which have been characterized at the primary structure level and are contained in the official allergen list, are named as Hev b 1, Hev b 2, Hev b 3, Hev b 4, Hev b 5, Hev b 6 (includes Hev b 6.01, Hev b 6.02 and Hev b 6.03), Hev b 7.02, Hev b 8, Hev b 9, Hev b 10, Hev b 11, Hev b 12 and Hev b 13. At present, four of these allergens (Hev b 1, Hev b 3, Hev b 5 and Hev b 6.02) have unequivocally been demonstrated in manufactured latex products. According to the current literature these four allergens are clinically most relevant.

FITkit® Hev b 1 test is the first commercial quantitative test to measure Hev b 1 immunologically in NRL products. By the use of specific monoclonal antibodies, sensitivity and specificity are guaranteed irrespective of presence of any other proteins or chemical substances derived from the manufacturing process of NRL products.

2. Principle of method

FITkit® Hev b 1 test is based on the enzyme immunometric assay technique. Microtiter wells are coated with one Hev b 1-specific monoclonal antibody that binds Hev b 1 from the sample. After incubation, unbound material is removed by washing the wells. In the second

incubation, horse radish peroxidase (HRP) labeled Hev b 1-specific monoclonal antibody binds to Hev b 1 molecules bound on the microtiter plate in the first incubation. After washing, HRP substrate is added and the intensity of the color produced is directly proportional to the Hev b 1 concentration of the sample.

3. Contents of kit

The kit contains reagents listed below, sufficient for 96 wells.

- 3.1 FITkit® Hev b 1 Microwell Plate
Cat F3-301-001
96 wells coated with mouse monoclonal Hev b 1 antibody, packed in a laminate bag. The plate is ready for use.
- 3.2 FITkit® Hev b 1 Assay Buffer,
15 ml
Cat F3-301-041
Ready for use. Colored red. The Assay Buffer contains phosphate, sodium chloride, EDTA, bovine plasma albumin (BPLA), detergent and preservative Proclin 300®.
- 3.3 FITkit® Hev b 1 Calibrators
Cat F3-301-031...036
Each vial contains 0,5 ml Hev b 1 calibrator in a stabilized buffer. The calibration is based on the analysis of Hev b 1 in reversed phase chromatography and N-terminal sequencing. The calibrator values are 0, 10, 50, 200, 500 and 1000 µg/l. Ready for use.
- 3.4 FITkit® Hev b 1 Control
Cat F3-301-081
The control is made from field latex in a stabilized solution containing BPLA, detergents and preservatives. Reconstitute the lyophilized control with 500 µl of distilled water.
- 3.5 FITkit® Hev b 1 Enzyme Conjugate, 15 ml
Cat F3-301-016
Ready for use. Monoclonal anti-Hev b 1 antibody conjugated to horse radish peroxidase (HRP) in a buffered solution containing stabilizers, BPLA, detergent and preservative Proclin 300®.
- 3.6 FITkit® PBS Wash Concentrate, 50 ml
Cat F3-300-042
Before use dilute to 500 ml (1:10) with distilled water. Sometimes crystals may be present at +2...+8° C, but they dissolve upon diluting and at room temperature.
- 3.7 FITkit® HRP Substrate Solution, 15 ml
Cat F3-300-043
ABTS (2,2'-azino-di[3-ethylbenzthiazoline-6-sulphonate]) Peroxidase Substrate
Ready for use.
- 3.8 FITkit® Stopping Solution, 15 ml
Cat F3-300-044
1 % Sodium dodecyl sulphate (SDS). SDS precipitates at low temperatures, but redissolves upon warming to room temperature.
Ready for use.

4. Storage conditions

The kit should be stored at +2...+8 °C.

The unopened kit is stable until the expiry date printed on the kit label. The expiry date of each unopened component is printed on the label of the individual component.

Once opened the microwell plate and liquid components are stable for eight weeks at +2...+8 °C.

After reconstitution, the control should be used on the same working day.

After dilution of the PBS Wash Concentrate, the washing solution is stable for eight weeks at room temperature.

5. Preparation of samples

NRL products can be extracted in PBS (phosphate buffered saline). For instance, 1 g of rubber product can be cut into pieces and extracted in 5 ml PBS. After extraction, the rubber products are removed and the extract is centrifuged (~1900 g for 15 minutes). Once extracted, the sample can be diluted with PBS to the appropriate level if necessary. Samples should be determined on the day of extraction or frozen (-20° C) if Hev b 1 determination is performed later. It is recommended that an unknown sample is tested in several dilutions in PBS.

6. Materials and equipment required but not supplied

- Pipette with disposable plastic tips (25 µl for calibrators and samples) (500 µl for the reconstitution of the control)
- Multichannel pipette with disposable plastic tips: 100 µl (assay buffer, enzyme conjugate, substrate, stopping solution)
- Lid or sealing tape for microwell plate
- Reagent troughs
- Plate shaker
- Aspiration device or microwell washer
- Photometer (plate or strip reader), 414 nm or 405 nm

7. Precautions and notes

- Protect the plate from draught, strong light or direct sunlight during the test procedure.
- Pipetting of samples should always be done using new clean tips for each well to prevent contamination of the calibrators with the assay buffer.
- Careful aspiration of the washing solution is essential for good assay precision. It is recommended that the washing procedure mode is checked to get the best precision.
- Timing of the incubation steps is important to the performance of the assay. Pipetting of calibrators, control

and samples should be done without interruption. Pipetting of the calibrators and samples should not exceed 10 minutes to avoid assay drift. Each plate should include a standard curve.

- Adding of substrate starts a kinetic reaction that is terminated by dispensing the Stopping Solution. Keep the incubation times for each well the same by adding the reagents at timed intervals.
- Absorbance values are stable for 60 minutes if protected from light.
- Plate readers measure absorbance vertically. Do not touch the bottoms of the wells.
- A wavelength of 405 nm can be used if 414 nm is not available. Absorbances are slightly lower at 405 nm than at 414 nm.

8. Procedure of test

8.1 Preparation of reagents and equipment

Allow all reagents to reach room temperature before use. Reconstitute the control and let it dissolve for approx. 2 hours, mix gently. Dilute the PBS Wash Concentrate. Mark the wells to be used on the plate.

8.2 Test procedure

- 8.2.1 Dispense 100 µl of Assay Buffer in each well.
- 8.2.2 Pipette 25 µl of calibrator, control and sample into

appropriate wells in duplicate.

- 8.2.3 Cover the plate. Incubate the plate for 60 minutes at room temperature on a plate shaker (100–200 rpm).
- 8.2.4 Aspirate and wash the wells 4 times with 300 µl of washing solution.
- 8.2.5 Dispense 100 µl of Enzyme Conjugate into the wells.
- 8.2.6 Cover the plate. Incubate the plate for 30 minutes at room temperature on a plate shaker (100–200 rpm).
- 8.2.7 Aspirate and wash the wells 4 times with 300 µl of washing solution.
- 8.2.8 Add 100 µl of HRP Substrate Solution at fixed time points into each well.
- 8.2.9 Cover the plate. Incubate the plate for 15 minutes at room temperature on a plate shaker (100–200 rpm).
- 8.2.10 Stop the reaction by adding 100 µl of Stopping Solution into each well at the same fixed time points as in step 8.2.8 so that exactly the same substrate reaction time is achieved. Shake the plate for 1–2 minutes to mix the solutions.
- 8.2.11 Measure the absorbance at 414 nm using a plate or strip reader. If the plate is not read immediately, protect the plate from light.

8.3 Summary: test procedure

Preparative steps

1.



Bring all reagents to room temperature.

2.



Reconstitute Test control with 500 μ l of water. Let it stand for 2 hours. Mark the wells to be used.

3.



Dilute 50 ml Wash Concentrate with 450 ml of water.

Test procedure

4.



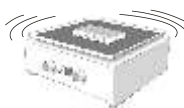
Dispense 100 μ l Assay Buffer.

5.



Add 25 μ l calibrators, controls and product extracts into appropriate wells.

6.



Incubate for 60 min with shaking at RT.

7.



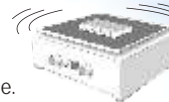
Wash 4 times.

8.



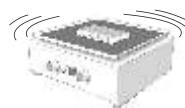
Dispense 100 μ l Enzyme Conjugate.

12.



Incubate for 15 min with shaking at RT.

9.



Incubate for 30 min with shaking at RT.

13.



Dispense 100 μ l Stopping Solution.

10.



Wash 4 times.

14.



Shake for 1–2 minutes and measure at 414 nm (or 405 nm). Fit the curve and read off results.

11.



Dispense 100 μ l Substrate Solution.

8.4 Calculation of results

Calculate the mean absorbance from each duplicate. Subtract blank values (0-calibrator) from the mean absorbances.

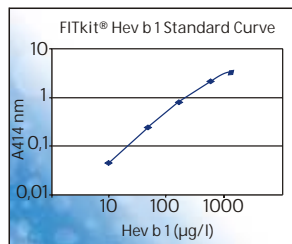
Plot the absorbances against the respective Hev b 1 concentrations on a log-log scale. Software that fits the standard curve can be used to calculate results of samples.

Read off the concentrations of the controls and samples. If samples have been diluted, multiply the result with the dilution factor.

Worksheet and standard curve of typical assay (Not to be used for calculation of actual test results.)

Quality control

Each kit contains FITkit® Hev b 1 Control which should give results within the specified range given in a separate certificate of analysis enclosed in the kit.



FITkit® Hev b 1 test

Wells	Identity	Conc. µg/l	A414 nm	A _{414nm} -blank	Conc. µg/l
A1-A2	Calibr. A	0	0,075		
B1-B2	Calibr. B	10	0,118	0,043	
C1-C2	Calibr. C	50	0,308	0,233	
D1-D2	Calibr. D	200	0,914	0,839	
E1-E2	Calibr. E	500	1,996	1,921	
F1-F2	Calibr. F	1000	2,993	2,918	
G1-G2	Sample 1	unknown	0,235	0,160	34,0
H1-H2	Sample 2	unknown	0,588	0,513	115
A3-A4	Sample 3	unknown	1,414	1,342	332

9. Expected values

Results obtained from 13 different glove brands extracted to PBS (1 g glove/5 ml PBS) in 2 hrs at room temperature are given below in Table1.

Table 1. Hev b 1 content of different glove brands extracted in PBS

Extract	Type	Glove Material	Hev b 1 µg/l
1	Examination	Latex (powdered)	17
2	Examination	Latex (powder free)	<10
3	Examination	Latex (powder free)	<10
4	Examination	Latex (powder free)	<10
5	Examination	Latex (powdered)	50
6	Surgical	Latex (powder free)	<10
7	Surgical	Latex (powder free)	<10
8	Surgical	Synthetic (powdered)	<10
9	Examination	Nitrile (protein free)	<10
10	Examination	Vinyl	<10
11	Surgical	Latex (powdered)	<10
12	Surgical	Latex (powdered)	23
13	Surgical	Latex (powder free)	11



10. Performance characteristics

10.1 Detection limit

The detection limit of Hev b 1 test was defined by the minimum Hev b 1 concentration deviating by 2 SD from that of the zero calibrator. The test was performed by using 16 replicate determinations of the zero calibrator and calibrator B. On the basis of this test the detection limit of Hev b 1 assay is 1.2 µg/l.

Table 2. Repeatability

Sample	Number of replicates	Mean (µg/l)	SD (µg/l)	CV%
1	16	10	0.6	5.6
2	16	130	6.0	4.6
3	16	321	9.0	2.8

Table 3. Reproducibility

Sample	Number of assays	Mean (µg/l)	SD (µg/l)	CV%
1	5	22	1.5	6.8
2	5	34	1.9	5.6
3	5	231	10.5	4.6

10.2 Precision

Repeatability (intra-assay variation) and reproducibility (inter-assay variation) were determined by analysing three samples containing low, medium and high concentration of Hev b 1. The results are given in Tables 2 and 3.

10.3 Recovery

50, 200 and 1000 µg/l concentrations of purified Hev b 1 calibrator were added to equal volumes of three samples containing a low (34 µg/l), medium (121 µg/l) and high (327 µg/l) concentration of Hev b 1.

Determination of Hev b 1 was done using unspiked samples and samples spiked with Hev b 1 calibrators. The theoretical concentration and the recovered concentrations were calculated. The results are shown in Table 4.

Table 4. Recovery

Sample	Added conc. (µg/l)	Expected conc. (µg/l)	Obtained conc. (µg/l)	Recovery %
Low	0		34	100
	50	42	49	117
	200	117	102	87
	1000	517	639	124
Medium	0		121	100
	50	85	95	112
	200	160	179	112
	1000	560	667	119
High	0		327	100
	50	188	199	106
	200	263	243	92
	1000	663	691	104



10.4 Linearity (dilution test)

Three samples containing 31, 128 and 296 µg/l of Hev b 1, were diluted with PBS 1:2, 1:5, 1:10 and 1:20, if

appropriate. The concentration of each diluted and original sample was measured. The results given as the percentage of the original concentration corrected with the dilution factors are given in Table 5.

Table 5. Linearity

Sample	Dilution	Conc. (µg/l)	%
1	undiluted	31	100
	1:2	32	103
	1:5	131	102
	1:10	131	100
2	undiluted	128	100
	1:2	131	102
	1:5	131	100
	1:10	134	102
3	undiluted	296	100
	1:2	283	96
	1:5	309	104
	1:10	347	117
	1:20	392	132

10.5 Specificity

Cross-reactions

Cross-reactions with Hev b 6.02, Hev b 3, Hev b 5 and Hev b 7 were tested using concentrations in weight-to-weight basis. No cross-reactions

were detected, thus the cross reactivities are less than 0.01%, 0.05%, 0.02% and 0.01%, respectively. The results are given in Table 6.

Table 6. Cross-reactions

Substance	Concentration tested	Cross-reaction (w/w)
Hev b 6.02	100 000 µg/l	< 0.01 %
Hev b 3	20 000 µg/l	< 0.05 %
Hev b 5	50 000 µg/l	< 0.02 %
Hev b 7	86 000 µg/l	< 0.01 %

Interfering substances

Several accelerators, antioxidants and detergents used in the rubber industry were tested using the interfering substance in PBS and in the solution containing Hev b 1. The test was performed in the presence and absence of each substance.

Substances tested: 0.1% and 0.02% solutions of pure ZDEC, ZDBC, SDBC, AS100, Arbostab Z, ZMBT, P25, BKF, Ralox LC, MB2, Setsit 104 and 0.1% and 0.02% (v/v) solutions of ZDEC, ZDBC, ZMBT, MBT, TMTD, DPTT, ZnO, Sulfur, TiO₂, Wingstay made from dispersions thereof. Inhibition of binding varied 0-45%.

Solutions containing 0.005% of Triton X114, Surfynol TG, Surfynol DF37, Foamaster VL, Sodium Caprylate, Cellosize, Igepal CA630 and Alginate N40 were tested in the same way, inhibition of binding was less than 18%. Darvan #1 in the 0.0005% solution inhibited the binding of Hev b 1 by 25%.

No substance alone gave any background in the assay.

11. Literature

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