Report

Comparative study peroxide test strips

1. Abstract

In this comparative study, various test strips of MACHEREY-NAGEL's (MN) product line QUANTOFIX® and Merck's* product lines MQuant®* or Reflectoquant®* were evaluated for their accuracy in the visual and reflectometric determination of peroxide in water and yogurt. 31 individuals tested samples with concentrations of 0 mg/L, 0.5 or 1 mg/L and 10 mg/L hydrogen peroxide. The accuracy of the MACHEREY-NAGEL test strips (95% for Peroxide 25 and 96% for Peroxide 100) in water was at least comparable to that of the Merck* test strips (92% for Peroxide 25 and 88% for Peroxide 100). The same is true for the accuracy of the MACHEREY-NAGEL (44% for Peroxide 25 and 72% for Peroxide 100) and Merck* (32% for Peroxide 25 and 46% for Peroxide 100) test strips in yogurt samples.

2. Study design

2.1 Objection

The objective of the study was to determine the accuracy of peroxide determination of various test strips from the QUANTOFIX® (MN) and MQuant®* or Reflectoquant®* (Merck*) product lines in water (visual and reflectometric) and yogurt (visual).

2.2 Products

The following products were compared in different test setups (I, II, and III):

#	Konzentration	Product (MN)	Product (Merck*)	Matrix
I	0 · 0.5 · 10 mg/L H_2O_2 visual	QUANTOFIX® Peroxide 25 REF 91319 LOT 319343	MQuant®* Peroxide 25 REF 1100110001 LOT HC328402	water, yogurt
II	0 · 1 · 10 mg/L H_2O_2 visual	QUANTOFIX® Peroxide 100 REF 91312 LOT 312342	MQuant®* Peroxide 100 REF 1100810001 LOT HC328959	water, yogurt
III	0 · 1 · 10 mg/L H_2O_2 reflectometric	QUANTOFIX® Peroxide 25 REF 91319 LOT 319343 QUANTOFIX® Relax V.3 REF 91346	Reflectoquant®* Peroxide 25 REF 1169740001 LOT 33228401 RQflex®* 20 Reflectoquant®* REF 117246	water

2.3 Persons

31** of our employees were selected as test persons. Their gender, age and experience levels are shown in the table below.

Gender		Age		Experience level	
female	10	18-35	19	none	6
Male	21	36-55	10	barely	14
divers	0	>55	1	experienced	10
not specified	0	not specified	1	not specified	1

2.4 Preparative peroxide determination

Execution I – Peroxide 25 in water

The persons were asked to visually examine three samples of unknown peroxide concentration, each with a test strip as described on the package, and read and record the corresponding value on the color scale.

The samples were diluted from 30% hydrogen peroxide solution (Merck* REF 1.08597.1000) with demineralized water to 0.5 mg/L and 10 mg/L H_2O_2 and checked with the *NANOCOLOR*® Peroxide 2 photometric test (MN REF 985871). Demineralized water was used as the blank.

Execution I – Peroxide 25 in yogurt

The persons were asked to visually examine three samples of unknown peroxide concentration using one test strip each, and to read and record the corresponding value on the color scale. The test was performed according to the special instructions for the determination of peroxide in yogurt from MACHEREY-NAGEL or Merck*.

Commercially available natural yogurt with a fat content of 1.5% was used. Hydrogen peroxide solution 30% (Merck* REF 1.08597.1000) was added to the yogurt and homogenized with a spatula so that the samples were concentrated to 0.5 mg/L and 10 mg/L H_2O_2. The concentration was tested using MQuant®* peroxide test strips.

Samples were freshly prepared shortly before for each group of four individuals.

Execution II – Peroxide 100 in water

The persons were asked to visually examine three samples of unknown peroxide concentration, each with a test strip as described on the package, and read and record the corresponding value on the color scale.

The samples were diluted from 30% hydrogen peroxide solution (Merck* REF 1.08597.1000) with demineralized water to 1 mg/L and 10 mg/L H_2O_2 and checked with the *NANOCOLOR*® Peroxide 2 photometric test (MN REF 985871). Demineralized water was used as the blank.

Execution II – Peroxide 100 in yogurt

The persons were asked to visually examine three samples of unknown peroxide concentration using one test strip each, and to read and record the corresponding value on the color scale. The test was performed according to the special instructions for the determination of peroxide in yogurt from MACHEREY-NAGEL or Merck*.

Commercially available natural yogurt with a fat content of 1.5% was used. Hydrogen peroxide solution 30% (Merck* REF 1.08597.1000) was added to the yogurt and homogenized with a spatula so that the samples were concentrated to 1 mg/L and 10 mg/L H_2O_2. The concentration was tested using MQuant®* peroxide test strips.

Samples were freshly prepared shortly before for each group of four individuals.

Execution III – Peroxide 25 (reflectometric) in water

The persons were asked to evaluate three samples of unknown peroxide concentration with one test strip each using the appropriate reflectometer and record the reading. The manufacturer's specifications were followed.

The samples were diluted from 30% hydrogen peroxide solution (Merck* REF 1.08597.1000) with demineralized water to 1 mg/L and 10 mg/L and checked with the *NANOCOLOR*® Peroxide 2 photometric test (MN REF 985871). Demineralized water was used as the blank.

3. Results

3.1 Execution I

3.1.1 Water

The cross diagram for Execution I in water compares the target peroxide concentrations with the actual concentrations for the MACHEREY-NAGEL and Merck* test strips. The number of correctly read concentrations is marked in green. If the determined value is within +/- 1 test field of the target concentration, it is marked in yellow. A red mark means that the value determined by the user is more than one test field off the actual value.

I	MN				Merck*			
Water	Target H_2O_2 [mg/L]				Target H_2O_2 [mg/L]			
Measured H_2O_2 [mg/L]	0	0.5	10		0	0.5	10	
0	29	2	-		0	29	-	-
0.5	2	29	-		0,5	-	26	-
2	-	-	-		2	1	4	-
5	-	-	-		5	-	-	2
10	-	-	30		10	-	-	28
25	-	-	1		25	-	-	-

3.1.2 Yogurt

The cross diagram for Execution I in yogurt compares the target peroxide concentrations with the actual concentrations for the MACHEREY-NAGEL and Merck* test strips. The number of correctly read concentrations is marked in green. If the determined value is within +/- 1 test field of the target concentration, it is marked in yellow. A red mark means that the value determined by the user is more than one test field off the actual value.

I	MN				Merck*			
Yogurt	Target H_2O_2 [mg/L]				Target H_2O_2 [mg/L]			
Measured H_2O_2 [mg/L]	0	0.5	10		0	0.5	10	
0	4				0	1		
0.5	25	17			0.5	28	23	
2	2	14	1		2	1	7	6
5			10		5			19
10			20		10			5
25					25			

3.2 Execution II

3.2.1 Water

The cross diagram for Execution II in water compares the target peroxide concentrations with the actual concentrations for the MACHEREY-NAGEL and Merck* test strips. The number of correctly read concentrations is marked in green. If the determined value is within +/- 1 test field of the target concentration, it is marked in yellow. A red mark means that the value determined by the user is more than one test field off the actual value.

II	MN				Merck*			
Water	Target H_2O_2 [mg/L]				Target H_2O_2 [mg/L]			
		0	1	10		0	1	10
Measured H_2O_2 [mg/L]	0	31	4	-	0	31	-	-
	1	-	27	-	1	-	26	-
	3	-	-	-	3	-	5	-
	10	-	-	31	10	-	-	25
	30	-	-	-	30	-	-	6
	100	-	-	-	100	-	-	-

3.2.3 Yogurt

The cross diagram for Execution II in yogurt compares the target peroxide concentrations with the actual concentrations for the MACHEREY-NAGEL and Merck* test strips. The number of correctly read concentrations is marked in green. If the determined value is within +/- 1 test field of the target concentration, it is marked in yellow. A red mark means that the value determined by the user is more than one test field off the actual value.

II	MN				Merck*			
Yogurt	Target H_2O_2 [mg/L]				Target H_2O_2 [mg/L]			
		0	1	10		0	1	10
Measured H_2O_2 [mg/L]	0	24	2	-	0	1	-	-
	1	7	27	-	1	29	26	-
	3	-	2	15	3	1	5	15
	10	-	-	16	10	-	-	16
	30	-	-	-	30	-	-	-
	100	-	-	-	100	-	-	-

3.3 Execution III

The cross diagram for Execution III compares the target peroxide concentrations with the actual concentrations for the MACHEREY-NAGEL and Merck* test strips. The number of correctly read concentrations (±20%) is marked in green. In addition, a mean value was calculated for all determinations.

III	MN						Merck*					
Water	Target H_2O_2 [mg/L]						Target H_2O_2 [mg/L]					
		0		1		10		0		1		10
					<8.0	-					<8.0	3
					8.0-8.5	-					8.0-8.5	-
			<0.8	-	8.6-9.0	1			<0.8	1	8.6-9.0	4
			0.8-0.9	14	9.1-9.5	-			0.8-0.9	-	9.1-9.5	-
	<0.5	31	1.0	8	9.6-10.0	3	<0.2	1	1.0	2	9.6-10.0	3
Measured H_2O_2 [mg/L]			1.1-1.2	7	10.1-10.5	2	0.2-0.3	8	1.1-1.2	4	10.1-10.5	8
			1.3-1.4	2	10.6-11.0	4	0.4-0.5	13	1.3-1.4	6	10.6-11.0	4
			1.5-1.6	-	11.1-11.5	7	0.6-0.7	6	1.5-1.6	10	11.1-11.5	7
			1.7-1.8	-	11.6-12.0	3	0.8-0.9	2	1.7-1.8	5	11.6-12.0	2
			1.9-2.0	-	12.1-12.5	4	>0.9	1	1.9-2.0	2	12.1-12.5	-
			>2.0	-	12.6-13.0	2			>2.0	2	12.6-13.0	-
					>13.0	5					>13.0	-
Ø		<0.5		1.0		11.8	Ø		0.4		1.5		9.8

3.4 Determination of accuracy

The accuracy of the peroxide determination is determined from the results described in sections 3.1 and 3.2. Accuracy is the ratio of correctly assigned readings (marked in green) to the total number of determinations.

	MACHEREY-NAGEL	Merck*
Execution I / Water	95%	92%
Execution I / Yogurt	44%	32%
Execution II / Water	96%	88%
Execution II / Yogurt	72%	46%

4. Result

This comparative study shows that MACHEREY-NAGEL's QUANTOFIX® Peroxid 25 / 100 test strips and Merck's MQuant®* Peroxid 25 / 100 or Reflectoquant®* test strips are equivalent in accuracy in water and yogurt.

*Merck, MQuant®, Reflectoquant®, and RQflex® are registered trademarks of Merck KGaA, which is not affiliated with MACHEREY-NAGEL GmbH & Co. KG.

**In some cases, test persons skipped individual stations, so that only 30 results could be evaluated.