BECEWA V.Z.W.
Krijgslaan 281 - 9000 GENT

Research on the chemical, organoleptic and bacteriological influence of PC Bentostrip according to NBN S 29 – 003 (*)

1. Introduction

The aim of this test is to study the influence of elastomeric material on the organoleptic, chemical (migration) and bacteriological properties of drinking water that comes in contact with the material.

The test is executed according to NBN S 29 - 003 (elastomeric material). As elastomer was used the product PC Bentostrip supplied by the company ECC.

2. Principle

The material to be studied is brought into contact with a simulation liquid under defined conditions. After which this liquid is compared with a control liquid:

a. The odor, taste, colour and turbulence in order to evaluate the organoleptic properties of the drinking water.
b. The chemical oxygen demand (C.O.D.) in order to evaluate the migration of organic material and chemicals.
c. The coliform bacteria and the oxygen consumption in order to evaluate the stimulation of bacterial growth.

*: translation of the original report in Dutch

3. The organoleptic control and control of the migration

3.1. Procedure

The liquid and the prepared samples of ca 1 dm^2 (table 1) are put in a closed glass recipient with one litre of liquid A and incubated at room temperature in the dark. The total duration of the test is 3 times 24 hours, with a renewal of the simulation liquid after 24 and 48 hours. Before analysing, the residual chlorine is neutralised by addition of sodium thiosulphate.

Table 1: simulation liquid A and samples

Parameter	Composition
Simulation liquid A	420 mg NaHCO3 + 1 mg free chlorine per litre distilated water
Samples	1 hour under running water, washing with simulation liquid A

The odor, colour, turbidity, C.O.D. and concentration on chemicals which might migrate are analysed in comparison with a clear solution A. In order to have migration, heavy metals are the target compounds.

3.2. Maximum concentration

Table 2: maximum allowable values

Parameter	Unit	Limit
Odor (25°C)	TON	6
Taste (25°C)	FTN	6
Colour	CU	5
Turbidity	NTU	1
COD	mg O_2/l	10
Specific migration*:	mg/6dm^2	60

* The standard for the migrating chemicals is determined by the user, in accordance with the reglementation in use. According to the Royal Decision from 25/08/1976 the global specific migration is maximum 60 mg/6 dm^2.

4. Control of the stimulation of the bacterial growth

4.1. Execution

A sample with a contact surface of 1 dm² is put in a glass recipient with 900 ml of water, after being sterilised with alcohol and rinsed with sterilised water. 100 ml of bacterial inoculum, coming from a sewer treatment plant is added and contains the organisms mentioned in table 3. For comparison the same liquid with bacteria but without the PC Bentostrip is tested. The recipients are incubated at room temperature in the dark (22 – 25°C). Each 3,5 days the liquid is stirred and renewed. The sample is placed in 990 ml sterilised liquid with 10 ml of the original liquid. The number of coliform bacteria and the concentration of oxygen in the liquid is analysed.

Table 3: number of coliform bacterial and total counts in the bacterial inoculate

Parameter	Unit	Value	Limit
Coliform bacteria	/100 ml	present	present
Escherischia Coli	/100 ml	21	-
Total counts (37°C)	/ml	1.500	< 10.000
Total counts (22°C)	/ml	12.000	< 100.000

4.2. Requirements

The difference between the concentration on solubilised oxygen in the control and the test liquid of the last 4 analyses may not exceed 4 mg O_2/l. In the last test liquid, nor in the control liquid coliform bacteria are allowed. A visible layer on the surface of the liquid or turbidity in the liquid that is an indication of bacterial growth, is tolerable.

5. Results

5.1. Organoleptic control and control of the migration

The results on the odor, colour, taste, turbidity and chemical oxygen consumption, minus the content of the control sample, are mentioned in table 4. On no occasion odor and turbulence was found. In the first two test liquids a slight taste of 4 FTN has been found. At the colour test a colour of 10 KE was found in the second test liquid, this colour was reduced to 5 KE in the 3rd test liquid. The COD was on testperiod lower than 10 mg O_2/l.

Table 4: results of organoleptic tests

Parameter (test code)	Unit	Value	Value	Value
	Hour	*24*	*48*	*72*
Odor (SAP-48)	TON	<1	<1	<1
Taste (SAP-049)	FTN	4	4	
Colour (SAP-046)	CU	<5	10	5
Turbulence (SAP-047)	NTU	<1	<1	<1
COD (SAP-007)	mg O_2/l	<10	<10	<10

In the last test liquid (after 72 hours) the results are acceptable for odor, taste, colour, turbidity and COD.

5.2. Control of the specific migration

The results of the specific migration in the remaining test liquid, minus the amount in the control liquid, are mentioned in table 5. On no occasion migration of cadmium, chrome, nickel, zinc, cobalt nor maganese has been found. A concentration of 1,2 mg/dm² of aluminium has been found in the third test liquid and for iron a concentration of 0,08 and 0,39 mg/dm² in respectively the second and third liquid.

None of these chemicals has a concentration of more than 60 mg/6dm² and the total migration of 1,59 mg/dm² in the last test liquid is lower than the limit.

Table 5: results of migration chemicals

Parameter (test code)	Unit	Value	Value	Value
Time	Hour	24	48	72
Conductivity (20°C) (SAP-003)	µS/cm	100	83	70
pH (SAP-004)		9,02*	9,11*	9,15*
Cadmium (Cd) (SAP-101)	mg/dm²	<0,005	<0,005	<0,005
Chrome (Cr) (SAP-102)	mg/dm²	<0,002	<0,002	<0,002
Nickel (Ni) (SAP-105)	mg/dm²	<0,005	<0,005	<0,005
Zinc (Zn) (SAP-108)	mg/dm²	<0,01	<0,01	<0,01
Aluminium (Al) (SAP-109)	mg/dm²	<0,5	<0,5	1,20
Cobalt (Co) (SAP-115)	mg/dm²	<0,020	<0,020	<0,020
Iron (Fe) (SAP-117)	mg/dm²	<0,05	0,08	0,39
Maganese (Mn) (SAP-118)	mg/dm²	<0,02	<0,02	<0,02

* value without correction of the pH of the control (=9,01)

5.3. Bacteriological tests

The results of the bacteriological tests are mentioned in table 6. The initial amount of coliform bacteria disappeared already after 3,5 days. The COD (difference between test liquid and control liquid) was during the first week higher than 3,5 mg O_2/l and during the second week even higher than 4 mg O_2/l. But, during the last two weeks the difference decreased to less than 3 mg O_2/l.

The test liquid was turbid during the first week. This film could not be characterised as microbacterial. There was no total count (37°C) after 2 weeks.

In the last 4 test liquids the COD was lower than the limit value of 4 mg O_2/l and no coliform bacteria have been found in the last test liquid. The turbidity was not due bacterial growth.

Table 6: results of bacteriological tests

Time (days)	Coliform	Total counts	COD
Unit	*/ml*	*/ml*	*mg O_2/l*
0*	> 10	15	-
3,5	< 1	159	3,63
7	< 1	-	-
10,5	< 1	-	4,30
14	< 1	<1	4,57
17,5	< 1	-	1,68
21	< 1	< 1	1,63
24,5	< 1	-	1,32
28	< 1	-	1,19
31,5	< 1	-	2,82

* : time 0 is a theoretical calculated value
- :not determined

6. Conclusion

The research on the chemical, organoleptic and bacteriological quality of the drinking water after contact with PC Bentostrip (elastomeric material) demonstrates that according to the Royal Decision (KB) of 25 August 1976 (KB in annex of the KB of 12 September 1972 concerning the fabrication, commerce and use of products that are destined to come in contact with food):

The elastomer PC Bentostrip is acceptable to the requirements of NBN S 29-003.

G. Genouw	M. Vercruysse
Head of the laboratory	Managing director