REPORT OF MIGRATION AT 23ºC OF COMPOUNDS BASED IN 14944-3/2008 REGULATION FROM PRODUCTS USED TO BE IN CONTACT WITH WATER FOR HUMAN CONSUMPTION

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		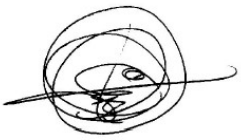
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1. INTRODUCTION AND GENERAL INFORMATION.

The company KRYSTALINE TECHNOLOGY, S.A. has required a migration study of a solid material used to be in contact with water intended for human consumption.

LABORATORY DATA:

LABAQUA S.A.

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CLIENT DATA:

KRYSTALINE TECHNOLOGY, S.A.

Address:

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03203-Elche/Elx

España

2. ELEMENTS OF STUDY DESCRIPTION.

Material pieces and application. The sample is a material intended to contain commercial water. Coating in cement plates coated by the customer.

Commercial name and batch: KRYSTALINE ADD1
Reception data in LABAQUA: 17/07/2020 10:54h
Manufactured: KRYSTALINE TECHNOLOGY, S.A.

Samples remitted by: KRYSTALINE TECHNOLOGY, S.A.

Samples prepared by: KRYSTALINE TECHNOLOGY, S.A.

Assay pieces preparation: The samples consist of 10 reference concrete / mortar specimens (for the test blank) and 10 concrete / mortar specimens with Krystaline Add1 additive (for the sample) with the following dimensions:

Sample dimensions:
S_{Total} = 1.28 dm^2 each piece, 10 total pieces
Volume: 2L
Relación S/V = **6.4 dm^{-1}**

Figure 1. Picture of the test piece.

3. EXPERIMENTAL PROCEDURE.

This study is based on "UNE-EN ISO 14944-3: 2008 *"Influencia de los materiales con base de cemento sobre el agua destinada al consumo humano, Método de ensayo. Parte 3: Migración de sustancias desde materiales con base de cemento*" Regulation

When the migration water was obtained, the water sample was analyzed, indicated in the Annex I, in order to calculate the *migration rate*.

According with this Regulation and with CEN/CENELEC regulations, all the European countries are required to reach the specifications indicated.

Table 1. General information about the migration test:

Parameter	Data
Total number of samples	20 pieces (10 pieces for the assay blank and 10 pieces for the sample with the additive)
Final water volume	2 L
Disinfection process	Not appropriate for this test
Total surface area	**1.28 dm^2/piece,**
S/V Ratio	**6.4 dm^{-1}**
Origin Water assay and temperature	Clorated water (1ppm) at 23.2±1ºC for 72±1h,
Test deviations	No deviations.
Incidences	No incidences
Static contact periods: **3 periods of 24h** **1 period of 72h** **1 period of 24h**	03/08/2020 10:00h – 04/08/2020 10:00h 04/08/2020 10:00h – 05/08/2020 10:00h 05/08/2020 10:00h – 06/08/2020 10:00h 06/08/2020 10:00h – 09/08/2020 10:15h 09/08/2020 10:00h – 10/08/2020 10:00h
Date and time of the start of the migration test	10/08/2020 10:00h – 13/08/2020 10:00h
Date and time of the finish of the migration test	13/08/2020 10:00h

Reagents used:

- Tap water from the laboratory.
- Chlorinated water with 1ppm of active chlorine
- Ordinary laboratory equipment
- Chronometer ID Plan 1873, ID Calibration 25126. (Laboratory code G-154)
- Bath of water ID Calibración 42667. Laboratory code (B-131)

Migration steps:

- Sampling, shipment and preservation. The sample was provided by the company KRYSTALINE TECHNOLOGY, S.A. No special preservation condition was required.
- Sample preparation. The client covered the cement sheets. The samples consist of 10 reference concrete / mortar specimens (for the test blank) and 10 concrete / mortar specimens with Krystaline Add1 additive (for the sample)
- Pieces treatment. The previous treatments consist on a washing step with a continuous water flow (rate between 1 to 3 m/min) during 60±5 minutes.
- Static contact period. The sheets were complete immersed in 2 liters of water during 3 periods of 24h, 1 period of 72h and 1 period of 24h. No disinfection process has been required.
- Migration assay. The sheets were immersed in 2L of Chlorinated water at 1ppm at 23±1ºC for 72±1h. At the same time, a blank without samples pieces, have been also carried out in the same conditions than the samples.
- Analysis. The final concentration of the organic compounds was determined by means of the analytical methods indicated in the Annex I.

4. RESULTS.

Sample codification.

The Table 2 show the number of each analysis reports.

Table 2. Sample denomination.

	Code	Sample name	Total migration period (hours)
Analysis date 03/08/2020	5385453	CONTROL 10 P	72±1h
Analysis date 03/08/2020	5385454	KRYSTALINE ADD1	72±1h

Analytical results:

The final report with analytical results is in Annex I. Likewise the results of the Organic Compounds Analysis are in Annex II.

In the next Table the analytical results are showed.

5385453 (CONTROL 10 P)

Acrylamide	< 0.05	µg/L
Aldrin	< 0.01	µg/L
Aluminium	**79**	**µg/L**
Ammonium	< 0.10	mg/L
Antimony	< 2	µg/L
Arsenic	< 2	µg/L
Barium	**10**	**µg/L**
Screening of Organic Compounds BS EN 15768	**Informe adjunto**	**--**
Benzo–(g,h,i)–perylene	< 0.01	µg/L
Benzo–a–pyrene	< 0.005	µg/L
Benzo–b–fluoranthene	< 0.01	µg/L
Benzo–k–fluoranthene	< 0.01	µg/L
Beryllium	< 2	µg/L
Bicarbonates	< 4.0	mg/L
Boron	< 10	µg/L
Bromates	< 10	µg/L
Cadmium	< 1	µg/L
Calcium	**12.4**	**mg/L**
Carbonates	**24.9**	**mg/L**
Total Organic Carbon (TOC)	< 0.5	mg/L
Total Cyanides	< 5	µg/L
Combined residual chlorine	< 0.05	mg/L
Free residual chlorine	**1.04**	**mg/L**
Total residual chlorine	**1.03**	**mg/L**
Vinyl chlorine	< 0.1	µg/L
Chloride	**4.4**	**mg/L**
Cobalt	< 2	µg/L
Cooper	< 2	µg/L
Colour	< 1.0	mg/L Pt/Co
Conductivity at 20ºC	**375**	**µS/cm**
Chrome	< 2	µg/L

Dieldrin	< 0.01	µg/L
Epichlorohydrin	< 0.10	µg/L
Fluorides	< 0.10	mg/L
Heptachlor	< 0.01	µg/L
Heptachlor epoxide	< 0.01	µg/L
Iron	< 10	µg/L
Indene–(1,2,3–c,d,)–pyrene	< 0.01	µg/L
Langelier's index	**2.54**	**--**
Manganese	< 2	µg/L
Mercury	< 0.20	µg/L
Nickel	< 2	µg/L
Nitrates	< 0.5	mg/L
Nitrites	< 0.05	mg/L
Odor	**1**	**Ind. de dil.**
Oxidability	**0.37**	**mg/ O_2 /L**
pH	**11.2**	**U. pH.**
Silver	< 2	µg/L
Lead	< 2	µg/L
Selenium	< 2	µg/L
Sodium	**4.8**	**mg/L**
Sulphates	**1.3**	**mg/L**
Temperature	**21.0**	**ºC**
Turbidity	< 0.20	UNF
Vanadium	< 2	µg/L
Zinc	< 2	µg/L

5385454 (KRYSTALINE ADD1)

Acrylamide	< 0.05	µg/L
Aldrin	< 0.01	µg/L
Aluminium	**121**	**µg/L**
Ammonium	< 0.10	mg/L
Antimony	< 2	µg/L
Arsenic	< 2	µg/L
Barium	**15**	**µg/L**
Screening of Organic Compounds BS EN 15768	**Informe adjunto**	**--**
Benzo–(g,h,i)–perylene	< 0.01	µg/L
Benzo–a–pyrene	< 0.005	µg/L
Benzo–b–fluoranthene	< 0.01	µg/L
Benzo–k–fluoranthene	< 0.01	µg/L
Beryllium	< 2	µg/L
Bicarbonates	< 4.0	µg/L
Boron	< 10	µg/L
Bromates	< 10	µg/L
Cadmium	< 1	µg/L
Calcium	**17.6**	**mg/L**
Carbonates	**23.0**	**mg/L**
Total Organic Carbon (TOC)	< 0.5	mg/L
Total Cyanides	< 5	µg/L
Combined residual chlorine	< 0.05	mg/L
Free residual chlorine	**0.95**	**mg/L**
Total residual chlorine	**0.99**	**mg/L**
Vinyl chlorine	< 0.1	µg/L
Chloride	**4.0**	**mg/L**
Cobalt	< 2	µg/L
Cooper	< 2	µg/L
Colour	< 1.0	mg/L Pt/Co
Conductivity at 20ºC	**280**	**µS/cm**
Chrome	< 2	µg/L

Dieldrin	< 0.01	µg/L
Epichlorohydrin	< 0.10	µg/L
Fluorides	< 0.10	mg/L
Heptachlor	< 0.01	µg/L
Heptachlor epoxide	< 0.01	µg/L
Iron	< 10	µg/L
Indene–(1,2,3–c,d,)–pyrene	< 0.01	µg/L
Langelier's index	**2.57**	**--**
Manganese	< 2	µg/L
Mercury	< 0.20	µg/L
Nickel	< 2	µg/L
Nitrates	< 0.5	mg/L
Nitrites	< 0.05	mg/L
Odor	**1**	**Ind. de dil.**
Oxidability	< 0.20	mg/ O_2 /L
pH	**11.1**	**U. pH.**
Silver	< 2	µg/L
Lead	< 2	µg/L
Selenium	< 2	µg/L
Sodium	**3.3**	**mg/L**
Sulphates	**1.3**	**mg/L**
Temperature	**21.2**	**ºC**
Turbidity	< 0.20	UNF
Vanadium	< 2	µg/L
Zinc	< 2	µg/L

Following the Regulation, the migration rate (M) was calculated with the next equation:

$$M = c_n / (S / V \cdot t) \text{ [mg dm}^{-2}\text{d}^{-1}\text{]}$$

where:

M = Migration rate

c_n = The concentration obtained (expressed as mg/L and calculated with ($c_n = a_n - b_n$) where a_n is the concentration obtained in the migration and b_n the concentration obtained in the blank).

t = Migration period (**3 days**)

S/V = rate surface / volume in dm^{-1} (**6.4 dm^{-1}**)

Migration rate calculation:

Table 2.1. Results 5385454 at 23±2 ºC.

COMPOUNDS ANALYZED INCLUDED IN THE REPORT (ANNEX I)			***Concentration and rate of migration***	
	b_n^T	***a_n^T***	***c_n^T***	***M_n^T***
Acrylamide	< 0,05 µg/L	< 0,05 µg/L	< 0,05 µg/L	< 2.60 ×10^{-6} mg/dm^2 día
Aldrin	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 ×10^{-6} mg/dm^2 día
Aluminium	**79 µg/L**	**121 µg/L**	**42 µg/L**	**2.19 ×10^{-3} mg/dm^2 día**
Ammonium	< 0.10 mg/L	< 0.10 mg/L	< 0.10 mg/L	< 5.21 ×10^{-3} mg/dm^2 día
Antimony	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 ×10^{-4} mg/dm^2 día
Arsenic	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 ×10^{-4} mg/dm^2 día
Barium	**10 µg/L**	**15 µg/L**	**5 µg/L**	**2.60 ×10^{-4} mg/dm^2 día**
Benzo–(g,h,i)–perylene	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 ×10^{-6} mg/dm^2 día

Benzo–a–pyrene	< 0,005 µg/L	< 0,005 µg/L	< 0,005 µg/L	< 2.60 ×10^{-7} mg/dm^2 día
Benzo–b–fluoranthene	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 ×10^{-6} mg/dm^2 día
Benzo–k–fluoranthene	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 ×10^{-6} mg/dm^2 día
Beryllium	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 ×10^{-4} mg/dm^2 día
Bicarbonates	< 4,0 mg/L	< 4,0 mg/L	< 4,0 mg/L	< 2.08 ×10^{-1} mg/dm^2 día
Boron	< 10 µg/L	< 10 µg/L	< 10 µg/L	< 5.21 ×10^{-4} mg/dm^2 día
Bromates	< 10 µg/L	< 10 µg/L	< 10 µg/L	< 5.21 ×10^{-4} mg/dm^2 día
Cadmium	< 1 µg/L	< 1 µg/L	< 1 µg/L	< 5.21 ×10^{-5} mg/dm^2 día
Calcium	**12,4 mg/L**	**17,6 mg/L**	**5,2 mg/L**	**2.71 ×10^{-1} mg/dm^2 día**
Carbonates	24,9 mg/L	23,0 mg/L	< 2,0 mg/L	1.04×10^{-1} mg/dm^2 día
Total Organic Carbon (TOC)	< 0,5 mg/L	< 0,5 mg/L	< 0,5 mg/L	< 2.60 ×10^{-2} mg/dm^2 día
Total Cyanides	< 5 µg/L	< 5 µg/L	< 5 µg/L	< 2.60 ×10^{-4} mg/dm^2 día
Vinyl chlorine	< 0,1 µg/L	< 0,1 µg/L	< 0,1 µg/L	< 5.21 ×10^{-5} mg/dm^2 día
Chlorine	4,4 mg/L	4,0 mg/L	< 1,0 mg/L	< 5.21 ×10^{-2} mg/dm^2 día
Cobalt	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 ×10^{-4} mg/dm^2 día
Cooper	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 ×10^{-4} mg/dm^2 día
Chrome	2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 ×10^{-4} mg/dm^2 día
Dieldrin	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 ×10^{-6} mg/dm^2 día

Epichlorohydrin	< 0.10 µg/L	< 0.10 µg/L	< 0.10 µg/L	< 5.21 $\times 10^{-5}$ mg/dm^2 día
Heptachlor	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 $\times 10^{-6}$ mg/dm^2 día
Heptachlor epoxide	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 $\times 10^{-6}$ mg/dm^2 día
Iron	< 10 µg/L	< 10 µg/L	< 10 µg/L	< 5.21 $\times 10^{-4}$ mg/dm^2 día
Indene–(1,2,3–c,d,)–pyrene	< 0,01 µg/L	< 0,01 µg/L	< 0,01 µg/L	< 5.21 $\times 10^{-6}$ mg/dm^2 día
Manganese	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 $\times 10^{-4}$ mg/dm^2 día
Mercury	< 0,20 µg/L	< 0,20 µg/L	< 0,20 µg/L	< 1.04 $\times 10^{-5}$ mg/dm^2 día
Nickel	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 $\times 10^{-4}$ mg/dm^2 día
Silver	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 $\times 10^{-4}$ mg/dm^2 día
Lead	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 $\times 10^{-4}$ mg/dm^2 día
Selenium	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 $\times 10^{-4}$ mg/dm^2 día
Sodium	4,8 mg/L	3,3 mg/L	< 1,0 mg/L	< 5.21$\times 10^{-2}$ mg/dm^2 día
Sulphates	1,3 mg/L	1,3 mg/L	< 1,0 mg/L	< 5.21$\times 10^{-2}$ mg/dm^2 día
Vanadium	< 2 µg/L	< 2 µg/L	< 2 µg/L	< 1.04 $\times 10^{-4}$ mg/dm^2 día
Zinc	< 2 µg/L	2 µg/L	< 2 µg/L	< 1.04 $\times 10^{-4}$ mg/dm^2 día
Screening of Organic Compunds	< 10,0 µg/L	< 10,0 µg/L	< 10,0 µg/L	< 5.21 $\times 10^{-4}$ mg/dm^2 día

5. CONCLUSIONS.

- The final liquid obtained in the migration process at 23±2ºC in the test water has been analyzed in order to determine some compounds included and indicated in table 2.1 and calculated the migration rate.
- In the sample codified as 5385454 KRYSTALINE ADD1 migration of metals like Aluminum, Barium and Calcium, were detected. In the case of Aluminum, does not exceed the value set by the RD-140/2003 which establishes a maximum value of 200µg/L. In the case of Barium and Calcium, there is not a maximum value set by the RD-140/2003.
- The product codified as 5385454 (KRYSTALINE ADD1) meets all the criteria set out in RD 140/2003 Regulation, for use in materials with drinking water.

6. ANNEX

ANNEX I. Analysis report for the samples 5385453 and 5385454.
ANNEX II. Screening of organic compounds.