

ATILH

ASSOCIATION TECHNIQUE DE L'INDUSTRIE DES LIANTS HYDRAULIQUES

7, Place de la Défense • 92974 Paris La Défense Cedex •

Bureau de Normalisation des Liants Hydrauliques

Analysis Certificate

REFERENCE POWDER N°9

Portland Cement (CEM I 52,5 N)

1- PARTICIPATION AND TESTS PERFORMING

Each year the Association Technique de l'Industrie des Liants Hydrauliques (ATILH) organises an interlaboratory test campaign involving in particular the cement industry laboratories, the cement end-user laboratories and Research and Inspection Centers within the construction materials field.

This participation is compulsory for laboratories accredited by COFRAC for cement testing. The tests are carried out in accordance with standardised methods if they exist, otherwise according to routine or traditional methods.

2- DATA STATISTICAL ANALYSIS

Outliers are eliminated via the STUDENT's test with a confidence level of 98 %. A reiteration is set at this threshold in order to keep only those values which are related to the "Normal or Gaussian" distribution, the latter being entirely defined by the 2 parameters : mean and standard deviation. The coefficient of variation, symbolised by "V", is the ratio between the standard deviation " σ " and the mean value " \bar{x} ".

3- SPECIFIC SURFACE AND PARTICLE SIZE ANALYSIS

For the calibration of the Blaine permeability apparatus, follow the requirements of the EN 196-6 standard, paying particular attention to the temperature corrections, if any. To determine the volume of the compacted layer, it is not essential to use the standard powder (but ensure that a sufficient quantity is taken so that the mass of the mercury does not modify the compaction of the powder layer). For the particle size analysis, the reference standards are ISO 13320-1 for laser diffraction analysis and NF X 11-640 for air-jet-sieving (Alpine apparatus).

Table I

	Mean \bar{x}	Dispersion characteristics (Reproducibility)	
		σ	V (%)
Particle density (g/ cm ³)	3.15	0.02	0.58
Blaine Specific surface (cm ² /g)	4175	94	2.26

Table 2

Particle Size Analysis by laser Diffraction (ISO 13320-1)			Air-jet Sieving (alpine apparatus) (NF X11-640)		
Equivalent size aperture a (µm)	% <a	σ (%) (Reproducibility)	Aperture size a (µm)	% <a	σ (%) (Reproducibility)
1.25	9.1	3.5			
2	14.1	4.1			
3.15	20.6	4.3			
4	24.5	4.4			
6.3	34.0	4.2			
8	39.6	4.1			
12.5	52.4	4.0			
16	60.6	4.3			
25	76.8	4.4			
31.5	84.6	3.8			
40	90.8	3.0	40	94.5	1.2
50	95.4	2.5	50	96.8	0.7
63	98.3	1.4	63	98.5	0.6
80	99.3	0.7	80	99.5	0.2
100	99.8	0.4	100	99.8	0.1

4- CHEMICAL COMPOSITION

Table 3

Elements	Chemical analysis (EN 196-2)			X-ray fluorescence analysis (NF X 15-467)*		
	%	Standard deviation σ (Reproducibility)	Coefficient of variation V (%)	%	Standard deviation σ (Reproducibility)	Coefficient of variation V (%)
Loss of ignition	1.46	0.10	6.91			
SiO ₂	20.47	0.17	0.83	20.44	0.13	0.64
Al ₂ O ₃	4.66	0.11	2.44	4.64	0.08	1.72
Fe ₂ O ₃	3.01	0.09	2.83	3.00	0.05	1.57
CaO	64.00	0.25	0.39	63.98	0.21	0.32
MgO	2.20	0.10	4.37	2.22	0.07	3.02
Na ₂ O	0.26	0.04	15.69	0.22	0.05	27.01
K ₂ O	0.76	0.03	4.11	0.79	0.03	3.22
SO ₃	2.74	0.05	1.91	2.74	0.05	1.89
TiO ₂	0.20	0.01	6.36			
P ₂ O ₅	0.07	0.02	24.52			
Insoluble	0.45	0.08	17.68			
Free CaO	1.09	0.22	20.21			

* One European standard is in progress (EN 196-2.2)

5- MINERALOGICAL COMPOSITION

Table 4

Mineralogical phase	C ₄ AF	C ₃ A	C ₃ S	C ₂ S
Mean mineralogical composition (%)	9	7	62	12

6- RECOMMENDATIONS

Break to open the phial, empty the powder into a flask of approximate capacity 150 cm³ and shake it in order to homogenize. Carry out the tests immediately, in principle the very day of opening.



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