Effect Chemical Grouting Method on the Protection of Autoclaved Aerated Concrete Masonry Against Water and Moisture

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Summary

Removal of moisture from masonry and protection of constructions against water and moisture is an important part of building industry. Contribution concerns with problems of moisture content, its classification and moisture level and techniques of moisture removal. It describes use of hydrophobic grouting solution Freezteq DPC for protection of autoclaved aerated concrete masonry against water and moisture.

Keywords: Autoclaved aerated concrete, moisture content of masonry, hydrophobization, chemical grouting method

Introduction

Older constructions but also completely new ones may have functionless damp resistance, or the service life of damp resistance may be exceeded, or eventually there is no damp-proofing in the object. Therefore the recovery of wet masonry and structure protection against water is an inseparable and important part of the building industry [4].

Moisture of building structures

According to Standard ČSN 73 0610 [5] moisture of masonry is classified by Table 1. Mentioned classification refers to buildings with rooms and space for a stay of persons made from common building materials with absorptiveness over 10%.

For common practice the classification according to Table 1 is sufficient, but from viewpoint of applicability of grouting methods it is not enough. The authors of WTA 4-4-96 Direction realised the insufficiency and established the term "moisture level" evaluating a content of moisture in the masonry in regard to its porosity. It means in practice that besides determining moisture content in mass percents, also the open porosity of material is necessary to determine [6].

The non-pressure grouting may be used till moisture level of approximately 50%, superior limit of 80% is given for pressure grouting [8].

Techniques of damp construction recovery

Direct methods

- air methods,
- mechanical methods - undercutting, damp proof driving, Massari method,
- chemical grouting methods,
- electro-osmotic methods.

Matter of chemical grouting methods

Creating the damp-resistant shield (barrier) by chemical substance inserted into prepared boreholes in damp brickwork [8] – it is the matter of grouting methods. Grouting solution reacts in the boreholes, e.g. it hardens, gels, etc., what creates the damp-resistant shield.

Experiment

For testing, blocks from three kinds of autoclaved aerated concretes were used (Table 2). Two of them were produced on the base of fly ash Unipol (now non-existing plant in Dolná Streda) with

Table 1. Classification of brickwork moisture according to ČSN 73 0610

Tabela 1. Klasyfikacja wilgoci murarskich według ČSN 73 0610

Moisture level	Mass moisture of brickwork in %
Very low	$W_h < 3$
Low	$3 \leq W_h < 5$
Increased	$5 \leq W_h < 7,5$
High	$7,5 \leq W_h < 10$
Very high	$W_h > 10$

Table 2. Composition of tested types of aerated autoclaved concretes

Tabela 2. Skład testowanych rodzajów betonu komórkowego

Technology of production	Sample labelling	Component [kg/m^3]									
		Fly ash		Sand sediment	Pro-growth sediment	Cement	Lime	Water	Al - additive	Setting regulator	Blown-out additive
		Classic	Fluid								
Unipol	**A**	240	–	–	–	–	96	160	0,4	0,2	0,2
	B	180	60	–	–	–	96	170	0,4	0,2	0,2
Siporex	**C**	–	–	230	95	70	38	56	2,3	9,2	–

dimensions 400x300x250 mm, and one was made on the base of sand Siporex (Ytong, or Xella in Šaštín - Stráže) with dimensions 600 × 300 × 250 mm.

At given amount of a fly ash (240 kg/m^3), tested aerated autoclaved concretes differed from each other by changing ratio and type of ash.

Grouting solution FREEZTEQ DPC System

- Is highly effective non-compressive system patented in Great Britain and abroad for elimination of masonry dampness,
- Is suitable for dehumidifying every type of masonry,
- Uses frozen cylinder tablets (length 210 mm, diameter 20 mm) of sodium methylsiliconate water solution which are placed into bored holes in mortar joints of brick walls,
- Tablets diffuse in masonry and create damp-resistant barrier, which inhibits further dampness intrusion and capillary action into masonry [8].

Brickwork from examined autoclaved aerated concretes

There were built 6 walls from A, B, C autoclaved aerated concrete blocks – four were from blocks made on base of fly ash and two were from blocks on base of sand. Freezteq sticks were placed in three of them, and three walls were comparing. The placement of Freezteq sticks was done in accordance with instruction from producer.

Moisture content

Values of volume moisture measured on walls built from particular types of autoclaved aerated concrete (6 measuring points in bottom line and 6 measuring points in upper line of walls) were noted in the figures and subsequently transferred into chart.

Conclusion

Out of comparing walls (without tablets), the autoclaved aerated concrete C achieved the lowest values of moisture what is caused by lowest amount of capillary pores in it, and by the finest texture resulting from its composition. Autoclaved aerated concrete B had the worst results. It is the direct effect of its structure (most capillary pores, highest whole porosity, crudest texture). Comparing to silica sand and cinder (A), significantly higher absorptiveness of the fluid ash had an impact, too. Moisture level in walls with tablets were copying values measured in comparing walls, but the moisture content was reduced due to the effect of FREEZTEQ-DPC agent. The best effectiveness was achieved in autoclaved aerated concrete C in which silica sand was used as the filler. Moisture content did not increase after inserting the tablets. On the contrary, moisture kept growing after insertion of the tablets in autoclaved aerated concretes A and B, what means that complete stop of capillary action was not provided. This may be a confirmation of lower effectiveness of FREEZTEQ-DPC agent in structures with cruder texture and higher porosity. In conclusion it may be stated that the effectiveness of FREEZTEQ-DPC agent was proved in compliance with data provided by producer on the properly made walls from autoclaved aerated concrete blocks [9].

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Skuteczność dodatku hydrofobizującego w celu ochrony autoklawizowanego betonu przed wodą i wilgocią

Usuwanie wilgoci z murów i ochrona konstrukcji przed wodą i wilgocią jest ważną częścią przemysłu budowlanego. Chodzi tu o problemu z zawartością wilgoci, jej klasyfikacją oraz poziomem wilgoci i jej usuwaniem. Referat opisuje użycie hydrofobowego zaczynu Freezteq DPC w celu ochrony muru z betonu komórkowego przed wodą i wilgocią.

Słowa kluczowe: Autoklawizowany beton, zawartość wilgoci w murze, hydrofobizacja, metoda hydrofobizowania