

Mixtures of cement and polymer-treated clay for durable cut-off walls

DuraBUILDmaterials, a consortium of research laboratories of Ghent University, is seeking partners interested in commercializing a new type of clay barrier for cut-off walls.

Introduction

Cement-clay grouts are often used in contaminated soils as parts of barrier systems (e.g. cut-off walls). Deterioration of concrete by sulfates of an external source is a commonly observed durability problem in cement structures exposed to seawater, contaminated soils or groundwater containing high concentrations of sulfate ions. This durability problem, also known as sulfate attack, results from a series of chemical reactions between sulfate ions, cement paste and moisture.

Technology

Researchers at Ghent University have developed cement-HYPER clay mixtures that are less permeable and less sensitive to the microstructural deleterious changes caused by the interaction between cement hydration products and sulfates. Samples prepared with HYPER clay technology achieved a lower permeability compared to cement-bentonite (CB) samples containing untreated clay, as well as superior durability characteristics, while showing strength and stiffness comparable to mixtures of cement and untreated bentonite.

"HYPER clay" is an industrially useful and easy method to engineer clayey materials. It is made by mixing the clay with a solution comprising an anionic polymer, such as sodium carboxymethyl cellulose, and subsequently dehydrating the slurry of clayey material and polymer in order to expel the water molecules and adsorb the polymer on the clay surface, giving it its superior sealing and durability characteristics.

Applications

- Vertical cement-bentonite cut-off walls

Other applications of HYPER CLAY include:

- Landfills: horizontal cover systems and bottom liners
- Sealing of construction joints
- Underground waterproof systems
- Drilling fluids
- Soil-bentonite backfills

Advantages

- Cement-bentonite mixtures with HYPER Clay technology show lower permeability and are less sensitive to sulfate attack than regular CB mixtures; this provides better and more durable sealing capacity in cut-off walls.
- Cement-bentonite mixtures with HYPER Clay technology show strength and stiffness comparable to regular CB mixtures; the solidity of cut-off walls with HYPER Clay is identical as with conventional cut-off walls.

Status of development

Preliminary quality tests were performed, such as swelling, viscosity, filtration and bleeding, in order to choose the best mixture. Hydraulic conductivity and small-strain shear modulus of samples prepared with untreated and polymer-treated clays were simultaneously measured using a flexible wall permeability cell provided with bender elements.

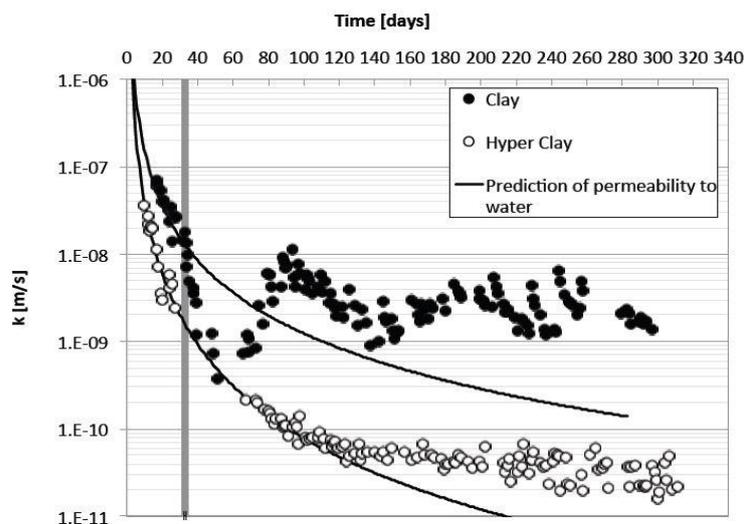
Partnership

Ghent University is looking for a partner interested in developing Cement - HYPER clay as a commercial product for cut-off walls.

Intellectual property

An international patent application WO2012025564 was filed on 24 August 2011 (priority date 27 August 2010). European patent application EP2608901 and US patent application US2013/0145959 are in examination phase.

Figure



The Figure shows that the hydraulic conductivity of an untreated clay increased considerably after permeation with an aggressive solution containing sulfates (25 g/L Na_2SO_4). Conversely, HYPER clay maintained a very low hydraulic conductivity showing its clear chemical resistance to sulfate attack.

The Inventor

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Keywords

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