TITLE

"A CURABLE CEMENTITIOUS COMPOSITION AND USES THEREOF"

FIELD OF THE INVENTION

This invention relates to a curable cementitious composition, methods for producing a porous cementitious barrier and uses thereof. In particular, the invention relates to providing drainage for a retaining wall. However, it should be appreciated that the curable cementitious composition may be used for other purposes requiring a porous barrier.

BACKGROUND OF THE INVENTION

Retaining walls are a common method of retaining soil. The requirements of a functional retaining wall are structural stability, durability against the exposed environment and the provision of drainage.

To complete a retaining wall, typically earth is excavated, a block wall or concrete wall is then erected, gravel is then bagged and stacked adjacent the block wall, weep holes are located in the wall at various locations along the length of the wall, pipes are located through the weep holes to drain any water that passes through the gravel to the base of the wall, and the excavated soil is then placed behind the retaining wall.

It is important that the drainage system functions correctly as retaining walls are rarely designed to withstand ponded water pressure. Ponded water pressure can triple or quadruple the loading on the retaining wall if allowed to develop. Often this additional pressure will cause the retaining wall to fail

with serious consequences.

The stacked bags of gravel located behind the wall provide a good drainage system. However, sometimes a bag may split. The pressure of the earth then spreads the earth through the gravel preventing water from flowing through the gravel reducing the efficiency of the drain. If many bags spit then ponded water may occur which is undesirable.

Another problem with using bagged gravel is that it is very time consuming to produce the drainage system. Gravel must be individually placed into bags by shovelling the gravel into a bagging machine. The bags must then be stacked on top of each other. The making and placing of the bags of gravel usually take considerably more time than the construction of the block wall.

The porous cementitious barrier of PCT/AU03/00475 allows water to flow through the structure, but is often not strong enough to form a retaining wall without a contiguous load bearing structure.

OBJECT OF THE INVENTION

It is an object of the invention to overcome or alleviate the aforementioned disadvantages or provide the consumer with a useful or commercial choice.

SUMMARY OF THE INVENTION

In one form, though not necessarily the broadest or only form, the invention resides in a curable cementitious composition comprising:

a. aggregate;

b. cementitious material;

c. sand;

d. fibrous material; and

e. water reducing agent

In another form, the invention resides in a method for producing a porous cementitious product comprising the steps of:

a. mixing a composition comprising:

i. aggregate;

ii. cementitious material;

iii. sand;

iv. fibrous material;

v. water reducing agent; and

vi. water; and

b. curing the composition to form the porous cementitious product.

Preferably, the porous cementitious product is in the form of a block.

In another form, the invention resides in a retaining wall comprising the porous cementitious product produced according to the method of the aforementioned aspect

In another form, the invention resides in a cured, porous cementitious product having a permeability of 250-400 L/min/m^2 and a compressive strength of 20-30 MPa.

In one embodiment, the cured, porous cementitious product is

produced according to the method of the aforementioned aspect.

Throughout this specification, unless the context requires otherwise, the words "comprise", "comprises" and "comprising" will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

DETAILED DESCRIPTION OF PREFFERED EMBODIMENTS

The amount of aggregate used preferably ranges from 1000 to 2000 kg/m^3 and may be 1000, 1200, 1300, 1400, 1450, 1500, 1550, 1600, 1700, 1800 or 2000 kg/m^3. Preferably, the amount of aggregate ranges from 1450 to 1550 kg/m^3.

The size of the aggregate typically varies from between 5 mm and 100 mm aggregate. Aggregate of 20mm sizing is preferred, but sizes of 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 or 100mm may be used. The dose rate is dependent upon the other materials used and the density of the aggregate used. The type of material used as an aggregate is well known in the art and may include air-cooled blast furnace slag. Different sized aggregates may be combined in the curable cementitious composition.

The amount of cementitious material used preferably ranges from 50 to 500 kg/m^3 and may be 50, 100, 130, 150, 170, 175, 180, 185, 190, 195, 210, 230, 250, 300, 350, 400, 450 or 500 kg/m^3. Preferably, the amount of cementitious material ranges from 175 to 195 kg/m^3. The cementitious material may be GP cement or granulated blast furnace slag.

The amount of sand used preferably ranges from 20 to 600 kg/m^3 and

may be 20, 50, 70, 80, 90, 100, 150, 200, 300, 400 or 500 kg/m^3. Preferably the amount of sand ranges from 70 to 90 kg/m^3.

The sand used in the composition may be coarse sand (3-15 mm) which is naturally occurring. Manufactured sand (0.001-2.5 mm), a by-product of quarrying, may also be used.

The amount of fibre used preferably ranges from 0.2 to 10 kg/m^3 and may be 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4,1.6, 1.8, 2.0, 3.0, 4.0, 5.0, 6.0, 8.0 or 10 kg/m^3. More preferably the amount of fibre used ranges from 0.4 to 2 kg/m^3.The fibrous material may be a monofilament polypropylene. The use of fibre reduces the incidence of plastic shrinkage cracking. It also increases the strain capacity and thus reduces plastic cracking. Monofilament polypropylene is preferred, but other man made or natural fibre may be used. The length of the fibres used may range from 5 to 65 mm. Preferably, the length of the fibres is 12 mm or 56 mm. Fibres of differing lengths may be combined in the curable cementitious composition.

Water reducing agents reduce the amount of water required to make a concrete of equal slump or increase the slump of concrete at the water content. A standard water reducing agent allows a reduction of up to 10% of water content in the mix. A mid range water reducing agent allows a reduction of between 10 and 15% of water content in the mix. A high range water reducing agent allows a reduction of between 15 and 40% of water content in the mix. High range water reducing agents are also known as super plasticizers. A very high range super plasticizer allows a reduction in water of over 40%. A reduction in the water to cement ratio increases the

strength of the concrete and thus the use of high or very high range water reducing agents allow the production of a higher strength concrete that is still workable.

The amount of water reducing agent preferably ranges from 20 to 2000 mL/m^3, and may be 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 200, 250, 300, 500, 750, 1000, 1500 or 2000 mL/m^3. Preferably, the amount of water reducing agent ranges from 30 to 300 mL/m^3. Particularly preferably, the amount of water reducing agent ranges from 40 to 150 mL/m^3.

A super plasticizer, being a particular type of high range water reducer, may be present in the composition. The amount of super plasticizer may preferably be between 5 to 5000 mL/m^3, or may be 5, 10, 50, 100, 300, 400, 500, 1000, 1500, 2000, 3000, 4000 or 5000 mL/m^3. Preferably the amount of super plasticizer ranges from 300 to 500 mL/m^3.

A high performance fly ash may be present in the composition. The amount of high performance fly ash may preferably be between 0.5 and 200 kg/m^3, or may be 0.5, 1.0, 5.0, 10, 25, 50, 75, 100, 125, 150 or 200 kg/m^3.

A retarder may be present in the composition. The amount of retarder may be between 20 and 400 mL/m^3 or may be 20, 50, 100, 150, 200, 250, 300, 350 or 400 mL/m^3. Retarding admixtures slow down the hydration of cement, lengthening the set time. They are beneficially used in hot weather conditions in order to overcome the accelerating effects of higher temperatures and large masses of concrete on setting time.

An accelerator may be present in the composition. The amount of

accelerator may be between 200 and 4000 mL/m^3, or may be 200, 500, 1000, 1500, 2000, 2500, 3000, 3500 or 4000 mL/m^3. Accelerator admixtures shorten the set time of concrete, allowing use in cold weather conditions, early removal of forms, early surface finishing and in some cases early load application.

An air-entrainment agent may be present in the composition. Air entrainment agents entrain small air bubbles into the concrete. This enhances durability in the freeze-thaw cycles of cold climates. The amount of air-entrainment agent may be between 20 to 500 mL/m^3, or may be 20, 50, 100, 150, 200, 250, 300, 350, 400, 450 or 500 mL/m^3.

A microsilica powder may be present in the composition. Microsilica powders increase concrete compressive and flexura strengths, increase durability, reduce permeability and improve the hydraulic abrasion erosion resistance. This protects concrete that may come into contact with chlorides from deicing salts or marine environments. The amount of microsilica powder may be between 0.5 and 200 kg/m^3, or may be 0.5, 1.0, 5.0, 10, 25, 50, 75, 100, 125, 150, 175 or 200 kg/m^3.

The curable cementitious composition may be made into blocks, panels or may be poured freely such as in the case of a slab.

The curable cementitious composition may be formed adjacent other structures such as panels or blocks.

Example 1

A porous cementitious block has been produced from a curable cementitious composition that used the following ratio of components:

1520 kg/m^3 of 20 mm aggregate;

185 kg/m^3 of cementitious material;

80 kg/m^3 of sand;

1.0 kg/m^3 of fibrous material;

55 kg/ m^3 of fly ash;

380 mL/ m^3 of super plasticiser; and

90 mL/ m^3 of water reducing agent.

The composition was mixed with water in a standard manner and solid porous blocks were produced using standard techniques. The porous blocks produced allowed water to flow through them at a flow rate of 334 L/min/m^2 and had a compressive strength of 24 MPa.

It should be appreciated that various other changes and modifications may be made to the embodiment described without departing from the spirit or scope of the invention.

Claims:

1. A curable cementitious composition for producing a porous cementitious product comprising:
    a. aggregate;
    b. cementitious material;
    c. sand;
    d. fibrous material; and
    e. water reducing agent.
2. A curable cementitious composition according to claim 1, wherein the water reducing agent is present in an amount of 20 to 2000 mL/m^3.
3. A curable cementitious composition according to claim 1, wherein the water reducing agent is present in an amount of 30 to 300 mL/m^3.
4. A curable cementitious composition according to claim 1, wherein the water reducing agent is present in an amount of 40 to 150 mL/m^3.
5. A curable cementitious composition according to claim 1, comprising;
    a. 1000 to 2000 kg/m^3 aggregate;
    b. 50 to 500 kg/m^3 cementitious material;
    c. 20 to 600 kg/m^3 sand;
    d. 0.2 to 10 kg/m^3 fibrous material; and
    e. 20 to 2000 mL/m^3 water reducing agent
6. A curable cementitious composition according to any of the preceding claims, further comprising super plasticizer.
7. A curable cementitious composition according to claim 6, comprising 5 to 5000 mL/m^3 of super plasticizer.

8. A curable cementitious composition according to any of the preceding claims, further comprising fly ash.

9. A curable cementitious composition according to claim 8, comprising 0.5 to 200 kg/m^3 of fly ash.

10. A method for producing a porous cementitious product comprising the steps of:

a. mixing a composition comprising:

i. aggregate;

ii. cementitious material;

iii. sand;

iv. fibrous material;

v. water reducing agent; and

vi. water; and

b. curing the composition to form the porous cementitious product.

11. The method according to claim 10, wherein the composition is according to any one of claims 1 to 9.

12. A porous cementitious product when produced according to the method of claim 10 or 11.

13. The porous cementitious product of claim 12 in the form of a block.

14. A retaining wall comprising the porous cementitious product of claim 12 or 13.

15. A cured, porous cementitious product having a permeability of 250-400 L/min/m^2 and a compressive strength of 20-30 MPa.

16. The cured, porous cementitious product of claim 15, when produced by the method of claim 10 or claim 11.