

DESCRIPTION

Title of the Invention: ADMIXTURE COMPOSITION FOR
HYDRAULIC COMPOSITION

Field of the Invention

[0001]

The present invention relates to admixture compositions for hydraulic compositions.

Further, the present invention relates to dispersant compositions for hydraulic compositions, hydraulic compositions, and methods for producing hydraulic compositions, and methods of improving flowability of hydraulic compositions.

Further, the present invention relates to hydration heat suppressants for hydraulic compositions, hydraulic compositions and methods of suppressing hydration heat of hydraulic compositions.

Background of the Invention

[0002]

Dispersants for hydraulic compositions are chemical admixtures to be used in order to disperse cement particles to reduce the unit water content necessary for providing a desired slump and improve workability and the like of hydraulic compositions. As the dispersants, there are conventionally known ligninsulfonic acid-based

dispersants, naphthalene-based dispersants such as naphthalenesulfonic acid-formaldehyde condensates, polycarboxylic acid-based dispersants such as copolymers of a monomer having a carboxylic acid with a monomer having an alkylene glycol chain, and melamine-based dispersants such as melaminesulfonic acid-formaldehyde condensates.

[0003]

Although the ligninsulfonic acid-based dispersants and the polycarboxylic acid-based dispersants are inexpensive and have high water reducing performance, they also pose the problem of high hardening retardancy, which leads to the problems of delays in the finishing process on the surfaces of concrete placed and the demolding of the mold that reduce the productivity of concrete and prolong the construction period.

[0004]

JP-A 61-281054 describes a concrete admixture containing a cement dispersant and a specific nonionic surfactant in a predetermined weight ratio.

JP-A 2003-165755 describes a workability improver to improve the workability of a cement composition containing a specific polyalkylene oxide derivative and/or a specific hydrocarbon derivative. JP-A 2003-165755 also describes a cement water reducer containing the above workability improver and a water reducer.

JP-A 55-023047 describes a slurry composed of a hydraulic composition containing a β -naphthalenesulfonic acid-formaldehyde condensate and a nonionic surfactant having an oxyethylene chain, and water.

JP-A 60-011255 describes a cement additive composed of a formalin condensate of a metal naphthalenesulfonate, and a polyoxyethylene-based compound.

JP-A 48-028525 describes a method for producing a concrete product, in which a desired concrete product is formed by using a concrete having an anionic surfactant added therein, and the formed product is cured with steam under atmospheric pressure.

[0005]

On the other hand, the use of a surfactant as a cement admixture is also conventionally proposed. JP-A 50-150724 describes a cement admixture containing a sulfate ester-type anionic surfactant and a polyoxyalkylene-based or polyhydric alcohol-based nonionic surfactant.

[0006]

In recent years, upsizing of concrete structures in the civil engineering and building fields has been progressed and there has increased the so-called mass concrete construction work, in which a large amount of concrete is placed, including piers and anchors of long large bridges, footings of multistory buildings, and bottom slabs of LNG tanks and atomic power plants. In

these mass concretes, whereas heat is generated by hydration of cement, heat dissipation is insufficient. Therefore, the heat is accumulated in the interior of concrete structures to raise the temperature, and generate a thermal stress due to a temperature difference from the exterior, to thereby generate thermal cracks in some cases.

[0007]

A method of preventing the thermal cracking conceivably involves suppressing the temperature rise of concretes or improving the heat dissipation condition. In order to suppress the temperature rise of concretes, a super retarder, such as a carboxylate, a gluconate or a silicofluoride, which retards the hydration reaction of cements, is added to concrete mixtures. However, this method can only exhibit the effect of retarding the hydration time of cements, that is, the effect of prolonging the setting time, and results in that the final level of temperature rise and the temperature rise rate is equal to or slightly lower than in the case of concretes having no additives, thus exhibiting no much effect to be expected.

[0008]

In the case of using mixed cements, two-component-mixed cements composed of a slag and a normal or moderate heat portland cement as main components, or three-component-mixed cements composed of a slag, a normal

portland cement and a fly ash are used. However, problems of these mixed cements are that facilities for mixing cement and blending materials, facilities for stocking mixed cements, and the like are newly necessitated, leading to the running-up of initial investments, and the like.

[0009]

Furthermore, as construction methods, a method (pipe cooling method) involving burying pipes in concrete structures in advance and flowing water therein to cool the concrete structures, and a method (pre-cooling method) involving previously cooling concrete materials are known. However, the pipe cooling method has problems in work efficiency improvement, and specifically, the problems thereof are that construction work becomes complex and requires much time and labor, and costs higher than usual construction work. The pre-cooling method has problematic points also in countermeasures in construction work aspects, and specifically, the problems thereof are that the pre-cooling method is not economical due to a high price of a cooling agent (for example, liquid nitrogen) to be used for cooling.

[0010]

Satoshi Tanaka, Masayuki Ueno, Yoshihide Shimoyama, "Cement Science and Concrete Technology (Properties of Concrete with Organic Hydration Heat Controlling Compound)", Japan Cement Association, No. 52, pp.218-

223(1998) discloses that addition of a sorbitol fatty acid ester to a concrete mixture makes no change in the final temperature rise by hydration of a concrete, but has the effect of reducing the heat generation rate.

Further, JP-A 6-171997 discloses a cement additive containing a compound obtained by esterification of a polyhydric alcohol with a higher fatty acid, and also discloses that by adding the cement additive to a concrete mixture, the temperature rise and the temperature rise rate of a concrete is conveniently suppressed.

Further, JP-A 10-158046 discloses an admixture for a highly flowable concrete, containing water-soluble polymers including a polyalkylene glycol, a fatty acid ester derivative and an acrylic polymer derivative, and a polycarboxylate.

Summary of the Invention

[0011]

The present invention provides dispersant compositions for hydraulic compositions that can provide the hydraulic compositions excellent in flowability.

[0012]

Then, it has become clear that the case of using a cement additive described in JP-A 6-171997 has the problematic point that the hydration reaction is greatly retarded and that the setting and the strength developing

time are thus retarded to prolong the construction work period.

[0013]

The present invention provides hydration heat suppressants for hydraulic compositions that can suppress the temperature rise by the hydration heat when a hydraulic powder and water are brought into contact.

[0014]

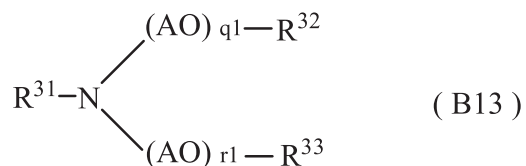
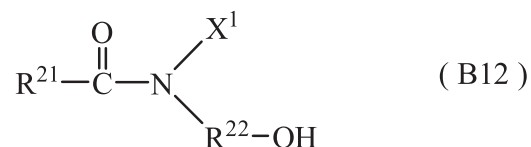
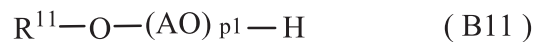
The present invention relates to an admixture composition for a hydraulic composition, the admixture composition containing:

(A) at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less; and

(B1) at least one type of nonionic surfactant selected from nonionic surfactants represented by the following general formula (B11), nonionic surfactants represented by the following general formula (B12) and nonionic surfactants represented by the following general formula (B13).

[0015]

[Formula 1]



In the formulae, R^{11} and R^{31} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21} is a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22} is an alkylene group having 2 or more and 4 or less carbons;

X^1 is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by $-R^{22}-OH$;

R³² and R³³ are each a hydrogen atom or an alkyl group with 1 or more and 3 or less carbons;

AO is an alkyleneoxy group with 2 or more and 4 or less carbons;

p1 is a number of 3 or more and 100 or less; and

q1 and r1 are each a number of 0 or more, and the sum of q1 and r1 is a number of 0.5 or more and 100 or less.

[0016]

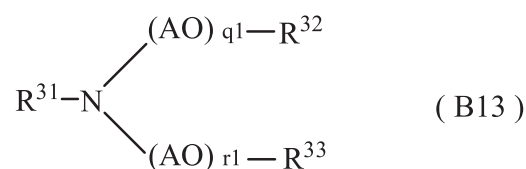
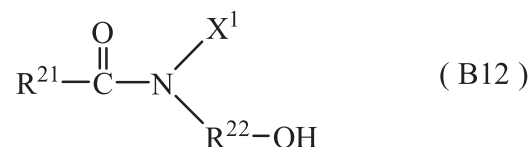
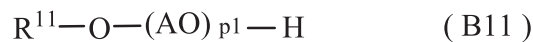
The present invention relates to a dispersant composition for a hydraulic composition, the dispersant composition containing:

(A) at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less (hereinafter, referred to as component (A)); and

(B1) at least one type of nonionic surfactant selected from nonionic surfactants represented by the following general formula (B11), nonionic surfactants represented by the following general formula (B12) and nonionic surfactants represented by the following general formula (B13) (hereinafter, referred to as component (B1)).

[0017]

[Formula 2]



[0018]

In the formulae, R^{11} and R^{31} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21} is a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22} is an alkylene group with 2 or more and 4 or less carbons;

X^1 is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by $-R^{22}-OH$;

R³² and R³³ are each a hydrogen atom or an alkyl group with 1 or more and 3 or less carbons;
AO is an alkyleneoxy group with 2 or more and 4 or less carbons;
p1 is a number of 3 or more and 100 or less; and
q1 and r1 are each a number of 0 or more, and the sum of q1 and r1 is a number of 0.5 or more and 100 or less.

[0019]

Further, the present invention relates to a hydraulic composition containing a hydraulic powder, water, component (A) and component (B1),

wherein the total content of component (A) and component (B1) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

[0020]

Further, the present invention relates to a method for producing a hydraulic composition, the method including mixing a hydraulic powder, water, component (A) and component (B1),

wherein component (A) and component (B1) are mixed so that the total content of component (A) and component (B1) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

[0021]

Further, the present invention relates to a method of improving flowability of a hydraulic composition, the method including adding, to a hydraulic composition containing water and a hydraulic powder, component (A) and component (B1) in a total amount thereof of 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

[0022]

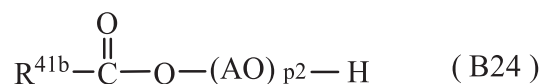
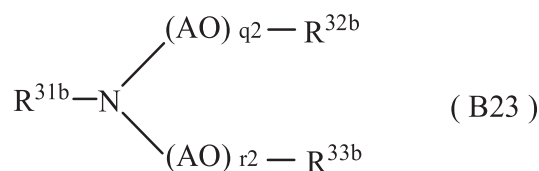
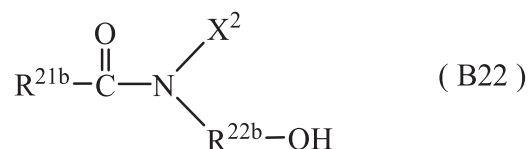
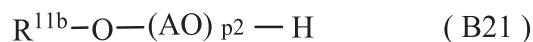
The present invention relates to an admixture composition for a hydraulic composition, the admixture composition containing:

(A) at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less; and

(B2) at least one type of nonionic surfactant having an HLB value of 2 or higher and 11 or lower and selected from nonionic surfactants represented by the following general formula (B21), nonionic surfactants represented by the following general formula (B22), nonionic surfactants represented by the following general formula (B23) and nonionic surfactants represented by the following general formula (B24).

[0023]

[Formula 3]



[0024]

In the formulae, R^{11b} and R^{31b} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21b} and R^{41b} are each a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22b} is an alkylene group with 2 or more and 4 or less carbons;

X² is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by -R^{22b}-OH;

R^{32b} and R^{33b} are each a hydrogen atom or an alkyl group with 1 or more and 3 or less carbons;

AO is an alkyleneoxy group with 2 or more and 4 or less carbons;

p₂ is a number of 0.5 or more and 20 or less; and

q₂ and r₂ are each a number of 0 or more, and the sum of q₂ and r₂ is a number of 0.5 or more and 20 or less.

[0025]

The present invention relates to a hydration heat suppressant for a hydraulic composition, the hydration heat suppressant containing:

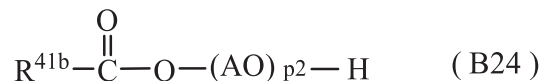
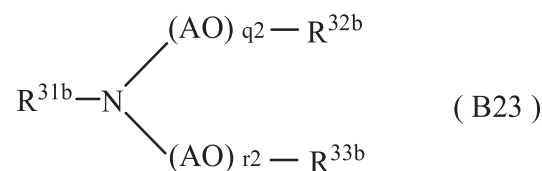
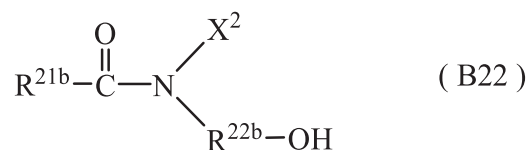
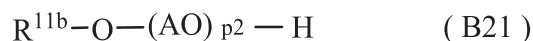
(A) at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less (hereinafter, referred to as component (A)); and

(B2) at least one type of nonionic surfactant having an HLB value of 2 or higher and 11 or lower and selected from nonionic surfactants represented by the following general formula (B21), nonionic surfactants represented by the following general formula (B22), nonionic surfactants represented by the following general formula (B23) and nonionic surfactants represented by the

following general formula (B24) (hereinafter, referred to as component (B2)).

[0026]

[Formula 4]



[0027]

In the formulae, R^{11b} and R^{31b} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21b} and R^{41b} are each a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups

having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22b} is an alkylene group having 2 or more and 4 or less carbons;

X² is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by -R^{22b}-OH;

R^{32b} and R^{33b} are each a hydrogen atom or an alkyl group having 1 or more and 3 or less carbons;

AO is an alkyleneoxy group having 2 or more and 4 or less carbons;

p2 is a number of 0.5 or more and 20 or less; and

q2 and r2 are each a number of 0 or more, and the sum of q2 and r2 is a number of 0.5 or more and 20 or less.

[0028]

Further, the present invention relates to a hydraulic composition containing a hydraulic powder, water, component (A) and component (B2), wherein the total content of component (A) and component (B2) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

[0029]

Further, the present invention relates to a method for producing a hydraulic composition, the method including mixing a hydraulic powder, water, component (A) and component (B2),

wherein component (A) and component (B2) are mixed so that the total content of component (A) and component

(B2) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

[0030]

Further, the present invention relates to a method of suppressing hydration heat of a hydraulic composition, the method including adding, to a hydraulic composition containing water and a hydraulic powder, component (A) and component (B2) in a total amount thereof of 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

[0031]

According to the present invention, there are provided dispersant compositions for hydraulic compositions that can provide the hydraulic compositions excellent in flowability.

[0032]

Further, according to the present invention, there are provided hydration heat suppressants for hydraulic compositions, hydraulic compositions, and methods of suppressing hydration heat of hydraulic compositions, that are capable of suppressing the temperature rise by the hydration heat when a hydraulic powder and water are brought into contact.

Brief Description of Drawing

[0033]

[Figure 1] Figure 1 is a schematic diagram illustrating a method of measuring the adiabatic temperature rise by hydration heat of cement in Examples.

Embodiments of the Invention

[0034]

[Admixture composition for a hydraulic composition]

The present invention relates to an admixture composition for a hydraulic composition, the admixture composition containing component (A) and component (B1). The admixture composition for a hydraulic composition can be used, for example, as a dispersant composition for a hydraulic composition according to the present invention.

Further, the present invention relates to an admixture composition for a hydraulic composition, the admixture composition containing component (A) and component (B2). The admixture composition for a hydraulic composition can be used, for example, as a hydration heat suppressant for a hydraulic composition according to the present invention.

[0035]

[Dispersant composition for a hydraulic composition]

The details of the mechanism of developing the effect of the dispersant composition for a hydraulic composition according to the present invention is not clear, but are presumed as follows.

Since polyols such as sugars generally have the property of being adsorbed on cement particles, it is presumed that a (poly)glycoside of component (A) is adsorbed on the cement particle surface in the state that the hydrophobic group of the (poly)glycoside of component (A) is directed to a liquid phase. It is also presumed that the hydrophobic group of a nonionic surfactant of component (B1) is coordinated to the hydrophobic group of the (poly)glycoside of component (A) to form an associated body. It is presumed that by the formation of such a pseudo-associated body, a steric repulsive force is developed between cement particles to improve flowability of a hydraulic composition.

[0036]

<Component (A)>

Component (A) is at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less.

[0037]

The number of carbons of the alkyl group or the alkenyl group of component (A) is, in view of ease of formation of the associated body with component (B1) and the water solubility, 8 or more, and 20 or less, preferably 18 or less, more preferably 16 or less,

further preferably 14 or less and furthermore preferably 12 or less.

[0038]

Component (A) preferably has an alkyl group with 8 or more and 20 or less carbons.

[0039]

The degree of sugar condensation of component (A) is, in view of the water solubility, 1 or more, and 5 or less, preferably 4 or less, more preferably 3 or less and further preferably 2 or less.

[0040]

A sugar constituting component (A) specifically includes glucose, maltose and sucrose. Component (A) is preferably at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less, and preferably at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less.

[0041]

<Component (B1)>

Component (B1) is at least one type of nonionic surfactant selected from nonionic surfactants represented by the above general formula (B11) (hereinafter, referred to as component (B11)), nonionic surfactants represented

by the above general formula (B12) (hereinafter, referred to as component (B12)) and nonionic surfactants represented by the above general formula (B13) (hereinafter, referred to as component (B13)).

[0042]

In the general formula (B11), R^{11} is preferably a group selected from alkyl groups having 8 or more and 22 or less carbons and substituted aryl groups having 8 or more and 22 or less carbons, and more preferably a group selected from alkyl groups having 8 or more and 22 or less carbons. The number of carbons of the alkyl groups having 8 or more and 22 or less carbons is preferably 12 or more, and preferably 20 or less. The number of carbons of the substituted aryl groups having 8 or more and 22 or less carbons is preferably 14 or more, and preferably 22 or less. The substituted aryl groups include substituted aryl groups substituted by an aralkyl group having 8 or more and 16 or less carbons, such as a monobenzylphenyl group, a dibenzylphenyl group, a mono-styrenated phenyl group and a di-styrenated phenyl group, and phenyl groups substituted by an alkyl group having 8 or more and 12 or less carbons, such as an octylphenyl group and a nonylphenyl group.

In the general formula (B11), AO is an alkyleneoxy group having 2 or more and 4 or less carbons. AO preferably contains an alkyleneoxy group having 2 or 3

carbons, and further an alkyleneoxy group having 2 carbons.

In the general formula (B11), p_1 is an average number of added moles of AO, and is, in view of the water solubility and the flowability of a hydraulic composition, preferably 2 or more and more preferably 3 or more, and preferably 50 or less, more preferably 60 or less, further preferably 45 or less, furthermore preferably 20 or less and furthermore preferably 4.5 or less.

[0043]

In the general formula (B12), R^{21} is preferably a group selected from alkyl groups having 7 or more and 21 or less carbons. The number of carbons of the alkyl groups having 7 or more and 21 or less carbons is preferably 9 or more, and preferably 18 or less.

In the general formula (B12), R^{22} is preferably an alkylene group having 2 carbons.

In the general formula (B12), an alkyl group having 1 or more and 3 or less carbons out of X^1 is preferably an alkyl group having 1 carbon. Then, a group represented by $-R^{22}-OH$ is preferably one in which R^{22} is an alkylene group having 2 carbons. X^1 is preferably an alkyl group having 1 or more and 3 or less carbons.

[0044]

In the general formula (B13), R^{31} is preferably a group selected from alkyl groups having 8 or more and 22

or less carbons. The number of carbons of the alkyl groups having 8 or more and 22 or less carbons is preferably 9 or more, and preferably 18 or less.

In the general formula (B13), AO is an alkyleneoxy group having 2 or more and 4 or less carbons. AO preferably contains an alkyleneoxy group having 2 or 3 carbons, and further an alkyleneoxy group with 2 carbons.

In the general formula (B13), q1 and r1 are each a number of 0 or more, and the sum of q1 and r1 is preferably 1.0 or more and more preferably 1.5 or more, and preferably 6 or less, more preferably 4.5 or less, further preferably 3.5 or less, furthermore preferably 3.0 or less and furthermore preferably 2.5 or less.

[0045]

Component (B1) is, in view of improving the flowability of a hydraulic composition, preferably at least one type selected from component (B12) and component (B13), and more preferably at least one type selected from component (B13).

[0046]

<Composition, optional components, and others>

In the dispersant composition for a hydraulic composition according to the present invention, the molar ratio between component (A) and component (B1), (A)/(B1), is preferably 0.05 or higher and 20.0 or lower in view of improving the flowability of a hydraulic composition and suppressing the hardening retardation thereof. The molar

ratio (A)/(B1) is more preferably 0.1 or higher, further preferably 0.2 or higher and furthermore preferably 0.3 or higher, and more preferably 15 or lower, further preferably 10 or lower and furthermore preferably 7.5 or lower.

When component (B1) is component (B11), the molar ratio (A)/(B1) is, from the same viewpoint, preferably 0.4 or higher, more preferably 1 or higher and further preferably 2 or higher, and preferably 10 or lower and more preferably 8 or lower.

When component (B1) is component (B12), the molar ratio (A)/(B1) is, from the same viewpoint, preferably 0.1 or higher, more preferably 0.15 or higher and further preferably 0.2 or higher, and preferably 0.5 or lower and more preferably 0.3 or lower.

When component (B1) is component (B13), the molar ratio (A)/(B1) is, from the same viewpoint, preferably 0.1 or higher and more preferably 0.2 or higher, and preferably 0.5 or lower and more preferably 0.4 or lower.
[0047]

In the dispersant composition for a hydraulic composition according to the present invention, the mass ratio (A)/(B1) of component (A) and component (B1) is, in view of improving the flowability of a hydraulic composition and suppressing the hardening retardation thereof, preferably 0.05 or higher, more preferably 0.1 or higher, further preferably 0.15 or higher,

furthermore preferably 0.3 or higher and furthermore preferably 0.5 or higher, and preferably 4.0 or lower, more preferably 2.0 or lower, further preferably 1.0 or lower and furthermore preferably 0.5 or lower.

[0048]

One of indices indicating suppression of the hardening retardation of a hydraulic composition is an initiation time of the hydration reaction, which is evaluated in Examples to be described later. When the initiation time of the hydration reaction is short, the hardening initiation of hydraulic compositions such as concrete is early to thereby attain the necessary strength early, and therefore, demolding can be carried out early, which leads to improvement in the productivity of the hydraulic compositions and shortening of the construction work period. In other words, suppressing the hardening retardation of hydraulic compositions enables, for example, the time necessary until demolding and the time for curing necessary to attain a predetermined strength to be shortened, leading to shortening of the construction work period. The molar ratio (A)/(B1) in the above range is preferable from such viewpoints. It is presumed that in the above range of the molar ratio, since a pseudo-associated body of component (A) with component (B1) can be easily formed to develop high dispersibility in a small amount adsorbed, the amount of the surfactant adsorbed on the cement

surface can be reduced, and that as a result, the hardening retardancy is more suppressed.

[0049]

The dispersant composition for a hydraulic composition according to the present invention contains, in the solid content thereof, component (A) in an amount of preferably 1% by mass or higher, more preferably 5% by mass or higher and further preferably 10% by mass or higher, and preferably 70% by mass or lower, more preferably 50% by mass or lower and further preferably 30% by mass or lower. Here, the solid content of the dispersant composition for a hydraulic composition refers to components excluding water.

[0050]

The dispersant composition for a hydraulic composition according to the present invention contains, in the solid content thereof, component (B1) in an amount of preferably 1% by mass or higher, more preferably 5% by mass or higher and further preferably 10% by mass or higher, and preferably 70% by mass or lower, more preferably 50% by mass or lower and further preferably 30% by mass or lower.

[0051]

The dispersant composition for a hydraulic composition according to the present invention can further contain defoaming agent (C) (hereinafter,

referred to as component (C)). Here, component (A) and component (B1) are excluded from component (C).

[0052]

Component (C) includes one or more defoaming agents selected from silicone-based defoaming agents, fatty acid ester-based defoaming agents, ether-based defoaming agents, polyalkylene oxide-based defoaming agents, alkyl phosphate-based defoaming agents and acetylene glycol-based defoaming agents.

As component (C), preferable is one or more defoaming agents selected from silicone-based defoaming agents, fatty acid ester-based defoaming agents and ether-based defoaming agents.

The silicone-based defoaming agent is preferably dimethylpolysiloxane.

The fatty acid-based defoaming agent is preferably a water-insoluble polyalkylene glycol fatty acid ester.

The ether-based defoaming agent is preferably a polyalkylene glycol alkyl ether.

The polyalkylene oxide-based defoaming agent is preferably a block copolymer of ethylene oxide and propylene oxide.

The alkyl phosphate-based defoaming agent is preferably tributyl phosphate, isotributyl phosphate or sodium octyl phosphate.

The acetylene glycol-based defoaming agent is preferably 2,4,7,9-tetramethyl-5-decyne-4,7-diol or an alkylene oxide adduct thereof.

[0053]

As component (C), the fatty acid ester-based defoaming agent is preferable in view of being capable of suppressing the strength reduction.

[0054]

The silicone-based defoaming agent is preferably an emulsion type thereof compatible with water.

Commercially available products of the silicone-based defoaming agent of emulsion type compatible with water include KM-70 and KM-73A (both, Shin-Etsu Silicone Co., Ltd.), TSA series (Momentive Performance Materials Japan LLC), FS Antifoam series (Dow Corning Toray Co., Ltd.) and Antifoam E-20 (Kao Corp.).

[0055]

Commercially available products of polyalkylene glycol fatty acid esters in the fatty acid ester-based defoaming agents include Rheodol TW-L120 (Kao Corp.), and Nicofix and Foamlex (both, Nicca Chemical Co., Ltd.).

[0056]

Commercially available products of polyalkylene glycol alkyl ethers in the ether-based defoaming agents include SHOHOZAI No. 1, SHOHOZAI No. 5 and SHOHOZAI No. 8 (all, Kao Corp.), SN Defoamer 15-P and Foamaster PC (both, San Nopco Ltd.).

[0057]

Commercially available products of polyethylene oxide-polypropylene oxide block copolymers in the polyalkylene oxide-based defoaming agents include block copolymers of ethylene oxide and propylene oxide, for example, Pluronic (TM) products (BASF SE).

[0058]

Commercially available products of the acetylene glycol-based defoaming agent include Surfynol (TM) 400 series (Air Products and Chemicals, Inc.).

[0059]

When the dispersant composition for a hydraulic composition according to the present invention contains component (C), the content thereof is preferably 0.01% by mass or higher, more preferably 0.1% by mass or higher and further preferably 1.0% by mass or higher, and preferably 30% by mass or lower, more preferably 20% by mass or lower and further preferably 10% by mass or lower, based on the solid content of the dispersant composition.

[0060]

The dispersant composition for a hydraulic composition according to the present invention can contain components (excluding the components corresponding to components (A) to (C)), such as conventional cement dispersants, water-soluble polymer compounds, air-entraining agents, cement wetting agents,

expansive admixtures, waterproofing agents, retarders, quick setting agents, thickeners, flocculants, drying shrinkage-reducing agents, strength-enhancing agents, hardening accelerators and preservatives.

[0061]

The form of the dispersant composition for a hydraulic composition according to the present invention may be either of liquid or solid. When the dispersant composition for a hydraulic composition according to the present invention is a liquid, it preferably contains water.

[0062]

The content of water when the dispersant composition for a hydraulic composition is a liquid containing water is, in the composition, preferably 10% by mass or higher, more preferably 30% by mass or higher and further preferably 50% by mass or higher in view of workability in preparation of the hydraulic composition, and preferably 90% by mass or lower and more preferably 70% by mass or lower in view of improving flowability of the hydraulic composition.

[0063]

In view of improving flowability of the hydraulic composition, the content of component (A) when the dispersant composition for a hydraulic composition is a liquid containing water is preferably 1% by mass or higher, more preferably 5% by mass or higher and further

preferably 10% by mass or higher, and preferably 70% by mass or lower, more preferably 50% by mass or lower and further preferably 30% by mass or lower in the composition.

[0064]

In view of improving flowability of the hydraulic composition, the content of component (B1) when the dispersant composition for a hydraulic composition is a liquid containing water is preferably 1% by mass or higher, more preferably 5% by mass or higher and further preferably 10% by mass or higher, and preferably 70% by mass or lower, more preferably 50% by mass or lower and further preferably 30% by mass or lower in the composition.

[0065]

In view of improving flowability of the hydraulic composition, the total content of component (A) and component (B1) when the dispersant composition for a hydraulic composition is a liquid containing water is preferably 10% by mass or higher, more preferably 20% by mass or higher and further preferably 30% by mass or higher, and preferably 90% by mass or lower, more preferably 70% by mass or lower and further preferably 50% by mass or lower in the composition.

[0066]

[Hydration heat suppressant for a hydraulic composition]

The details of the mechanism of developing the effect of the hydration heat suppressant for a hydraulic composition according to the present invention is not clear, but are presumed as follows.

Since polyols such as sugars generally have the property of being adsorbed on cement particles, it is presumed that a (poly)glycoside of component (A) is adsorbed on the cement particle surface. Further, since the nonionic surfactant of component (B2) has a predetermined HLB and therefore high lipophilicity, it is presumed that the nonionic surfactant is coordinated to the alkyl group or the alkenyl group of component (A) to form an oil film on the cement particle surface. It is conceivable that the oil film prevents cement particles from contacting with water to suppress the hydration heat of the cement.

[0067]

<Component (A)>

Component (A) is at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less.

[0068]

The number of carbons of the alkyl group or the alkenyl group of component (A) is, in view of suppressing the hydration heat of a hydraulic composition, 8 or more,

and 20 or less, preferably 18 or less, more preferably 16 or less, further preferably 14 or less and furthermore preferably 12 or less.

[0069]

Component (A) preferably has an alkyl group with 8 or more and 20 or less carbons.

[0070]

The degree of sugar condensation of component (A) is, in view of suppressing the hydration heat of a hydraulic composition, 1 or more, and 5 or less, preferably 4 or less, more preferably 3 or less and further preferably 2 or less.

[0071]

A sugar constituting component (A) specifically includes glucose, maltose and sucrose. Component (A) is preferably at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less, and preferably at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less.

[0072]

<Component (B2)>

Component (B2) is at least one type of nonionic surfactant having an HLB value of 2 or higher and 11 or

lower and selected from nonionic surfactants represented by the above general formula (B21) (hereinafter, referred to as component (B21)), nonionic surfactants represented by the above general formula (B22) (hereinafter, referred to as component (B22)), nonionic surfactants represented by the above general formula (B23) (hereinafter, referred to as component (B23)), and nonionic surfactants represented by the above general formula (B24) (hereinafter, referred to as component (B24)).

[0073]

The HLB of component (B2) is, in view of suppressing the hydration heat of a hydraulic composition, 2 or higher, preferably 5 or higher and more preferably 6 or higher, and 11 or lower, preferably lower than 11, more preferably 10 or lower, further preferably 9 or lower and furthermore preferably 7 or lower.

Here, the HLB is an abbreviation of Hydrophile Lipophile Balance, and is an index to know whether a compound is hydrophilic or lipophilic. Usual nonionic surfactants have an HLB value of 0 to 20. A lower HLB value indicates a stronger lipophilicity.

[0074]

In the present invention, HLBs of component (B21), component (B22) and component (B23) are values calculated by the Griffin method. HLB by the Griffin method is calculated by the following expression.

$$\text{HLB} = 20 \times \text{a total sum of formula weights of hydrophilic parts} / \text{molecular weight}$$

Further, in the present invention, the HLB of component (B24) is calculated by the Atlas method. HLB by the Atlas method is calculated by the following expression.

$$\text{HLB} = 20 \times (1 - S/A)$$

S: a saponification value of an ester being component (B24)

A: a neutralization value of a fatty acid in the ester being component (B24)

[0075]

In the case of using two or more nonionic surfactants, the HLB of a mixture thereof in the mixing ratio thereof in the composition is in the above predetermined range.

Here, HLB in the case of using two or more nonionic surfactants is calculated as a weighted average of HLBs of the nonionic surfactants with respect to the weight ratio.

[0076]

In the general formula (B21), R^{11b} is preferably a group selected from alkyl groups having 8 or more and 22 or less carbons and substituted aryl groups having 8 or more and 22 or less carbons, and more preferably a group selected from alkyl groups having 8 or more and 22 or less carbons. The number of carbons of the alkyl groups

having 8 or more and 22 or less carbons is preferably 9 or more, and preferably 18 or less. The number of carbons of the substituted aryl groups having 8 or more and 22 or less carbons is preferably 14 or more, and preferably 18 or less. The substituted aryl groups include phenyl groups substituted by an alkyl group having 8 or more and 12 or less carbons, such as an octylphenyl group and a nonylphenyl group.

In the general formula (B21), AO is an alkyleneoxy group having 2 or more and 4 or less carbons. AO preferably contains an alkyleneoxy group having 2 or 3 carbons, and further an alkyleneoxy group having 2 carbons.

In the general formula (B21), p2 is an average number of added moles of AO, and is, in view of suppressing the hydration heat of a hydraulic composition, preferably 1.0 or more and more preferably 1.5 or more, and preferably 10 or less, more preferably 6 or less, further preferably 4.5 or less, furthermore preferably 3.5 or less and furthermore preferably 2.5 or less.

[0077]

In the general formula (B22), R^{21b} is preferably a group selected from alkyl groups having 7 or more and 21 or less carbons. The number of carbons of the alkyl groups having 7 or more and 21 or less carbons is preferably 9 or more, and preferably 17 or less.

In the general formula (B22), R^{22b} is preferably an alkylene group having 2 carbons.

In the general formula (B22), an alkyl group having 1 or more and 3 or less carbons out of X^2 is preferably an alkyl group having 1 carbon. Also, a group represented by $-R^{22b}-OH$ is preferably one in which R^{22b} is an alkylene group having 2 carbons. X^2 is preferably an alkyl group having 1 or more and 3 or less carbons.

[0078]

In the general formula (B23), R^{31b} is preferably a group selected from alkyl groups having 8 or more and 22 or less carbons. The number of carbons of the alkyl groups having 8 or more and 22 or less carbons is preferably 9 or more, and preferably 18 or less.

In the general formula (B23), AO is an alkyleneoxy group having 2 or more and 4 or less carbons. AO preferably contains an alkyleneoxy group having 2 or 3 carbons, and further an alkyleneoxy group having 2 carbons.

In the general formula (B23), q_2 and r_2 are each a number of 0 or more, and the sum of q_2 and r_2 is preferably 1.0 or more and more preferably 1.5 or more, and preferably 6 or less, more preferably 4.5 or less, further preferably 3.5 or less and furthermore preferably 2.5 or less.

[0079]

In the general formula (B24), R^{41b} is preferably a group selected from alkyl groups having 7 or more and 21 or less carbons. The number of carbons of the alkyl groups having 7 or more and 21 or less carbons is preferably 9 or more, and preferably 17 or less.

In the general formula (B24), AO is an alkyleneoxy group having 2 or more and 4 or less carbons. AO preferably contains an alkyleneoxy group having 2 or 3 carbons, and further an alkyleneoxy group having 2 carbons.

In the general formula (B24), p2 is an average number of added moles of AO, and is, in view of suppressing the hydration heat of a hydraulic composition, preferably 1 or more and more preferably 3 or more, and preferably 10 or less and more preferably 6 or less.

[0080]

Component (B2) is preferably at least one type selected from component (B21) and component (B23), and more preferably at least one type selected from component (B23).

[0081]

<Composition, optional components, and others>

In the hydration heat suppressant for a hydraulic composition according to the present invention, the molar ratio between component (A) and component (B2), $(A)/(B2)$, is preferably 0.10 or higher, more preferably 0.20 or

higher and further preferably 0.25 or higher, and preferably 10.0 or lower, more preferably 3.0 or lower, further preferably 2.0 or lower, furthermore preferably 1.0 or lower, furthermore preferably 0.50 or lower, furthermore preferably 0.40 or lower, furthermore preferably 0.35 or lower and furthermore preferably 0.30 or lower, in view of suppressing the hydration heat of the hydraulic composition.

[0082]

In the hydration heat suppressant for a hydraulic composition according to the present invention, the mass ratio between component (A) and component (B2), $(A)/(B2)$, is preferably 0.05 or higher, more preferably 0.1 or higher, further preferably 0.15 or higher, furthermore preferably 0.3 or higher and furthermore preferably 0.5 or higher, and preferably 4.0 or lower, more preferably 2.0 or lower, further preferably 1.0 or lower and furthermore preferably 0.5 or lower, in view of suppressing the hydration heat of the hydraulic composition.

[0083]

The hydration heat suppressant for a hydraulic composition according to the present invention contains, in the solid content thereof, component (A) in an amount of preferably 1% by mass or higher, more preferably 5% by mass or higher and further preferably 10% by mass or higher, and preferably 70% by mass or lower, more

preferably 50% by mass or lower and further preferably 30% by mass or lower. Here, the solid content of the hydration heat suppressant for a hydraulic composition refers to components excluding water.

[0084]

The hydration heat suppressant for a hydraulic composition according to the present invention contains, in the solid content thereof, component (B2) in an amount of preferably 5% by mass or higher, more preferably 15% by mass or higher and further preferably 30% by mass or higher, and preferably 90% by mass or lower, more preferably 75% by mass or lower and further preferably 60% by mass or lower.

[0085]

The hydration heat suppressant for a hydraulic composition according to the present invention can further contain a defoaming agent of component (C). Here, component (A) and component (B2) are excluded from component (C). Specific examples and preferable forms of component (C) are the same as described for the dispersant composition for a hydraulic composition according to the present invention. When the hydration heat suppressant for a hydraulic composition according to the present invention contains component (C), the content thereof is preferably 0.01% by mass or higher, more preferably 0.1 % by mass or higher and further preferably 1.0% by mass or higher, and preferably 30% by mass or

lower, more preferably 20% by mass or lower and further preferably 10% by mass or lower, in the solid content of the hydration heat suppressant.

[0086]

The hydration heat suppressant for a hydraulic composition according to the present invention can further contain other components. Examples thereof include AE agents, retarders, foaming agents, thickeners, gas-forming agents, waterproofing agents, superplasticizers, early strengthening agents, solubilizers and compatibilizers.

Since nonionic surfactants having an HLB of 2 or higher and 11 or lower like component (B2) are usually insoluble to water, the hydration heat suppressant for a hydraulic composition according to the present invention is preferably used concurrently with a solubilizer. Examples of the solubilizer include hydrophilic organic solvents such as methanol, ethanol, propanol, ethylene glycol, propylene glycol, neopentyl glycol, diethylene glycol, glycerol, butyl glycol, butyl diglycol, butyl triglycol and benzyl alcohol; and one or more thereof can be used. The solvent is, in view of flammability and compatibility, preferably ethylene glycol, propylene glycol or glycerol, and more preferably propylene glycol.

[0087]

The hydration heat suppressant for a hydraulic composition according to the present invention can be,

for example, a one-pack composition containing component (A) and component (B2). In this case, the hydration heat suppressant can further contain defoaming agent (C). The hydration heat suppressant can further contain water. Alternatively, component (A) and component (B2) may be added separately to a hydraulic composition.

[0088]

[Hydraulic compositions]

The present invention provides a hydraulic composition containing a hydraulic powder, water, component (A) and component (B1), wherein the total content of component (A) and component (B1) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

Specific examples and preferable forms of component (A) and component (B1) in the hydraulic composition according to the present invention are the same as in the dispersant composition for a hydraulic composition according to the present invention.

[0089]

The hydraulic powder to be used for the hydraulic composition according to the present invention containing component (B1) refers to a powder having the hardenability through the hydration reaction, and includes cement and gypsum. The powder is preferably a cement such as normal portland cement, belite cement, moderate heat cement, high-early-strength cement,

ultrahigh-early-strength cement or sulfate-resisting cement, or may also be blast furnace slag cement, fly ash cement or silica fume cement, which is obtained by adding to the above-mentioned cements a powder having the pozzolanic action and/or latent hydraulic property, such as blast furnace slag, fly ash or silica fume, or a stone powder (calcium carbonate powder). Here, when the hydraulic powder contains, in addition to a powder having the hardenability through hydration reaction such as cement, powders selected from a powder having the pozzolanic action, a powder having the latent hydraulic property and a stone powder (calcium carbonate powder), the amounts of these are counted in the amount of the hydraulic powder in the present invention. Further, when a powder having the hardenability through hydration reaction contains a high-strength admixture, the amount of the high-strength admixture is also counted in the amount of the hydraulic powder. This shall apply also to the parts by mass or the mass ratio relating to the mass of the hydraulic powder.

[0090]

In a hydraulic powder to be used for the hydraulic composition according to the present invention containing component (B1), the content of gypsum is preferably 20% by mass or lower, more preferably 15% by mass or lower, further preferably 10% by mass or lower and furthermore preferably 5% by mass or lower. The gypsum is selected

from anhydrous gypsum, hemihydrate gypsum and dihydrate gypsum.

A more preferable hydraulic powder to be used for the hydraulic composition according to the present invention containing component (B1) is a cement having a content of gypsum of preferably 20% by mass or lower, more preferably 15% by mass or lower, further preferably 10% by mass or lower and furthermore preferably 5% by mass or lower. The cement may contain the above-mentioned powder having the pozzolanic action and/or latent hydraulic property, a stone powder (calcium carbonate powder) or the like.

[0091]

In the hydraulic composition according to the present invention containing component (B1), the water/hydraulic powder ratio (mass percentage (% by mass) of water to a hydraulic powder in a slurry; usually abbreviated to W/P, and when the powder is a cement, abbreviated to W/C) is preferably 15% by mass or higher and more preferably 20% by mass or higher, and preferably 50% by mass or lower and more preferably 45% by mass or lower, in view of developing flowability even when the amount of water in the blend is small.

[0092]

In the hydraulic composition according to the present invention containing component (B1), the total content of component (A) and component (B1) is, per 100

parts by mass of the hydraulic powder, 0.05 parts by mass or higher, preferably 0.1 parts by mass or higher, more preferably 0.15 parts by mass or higher, and further preferably 0.5 parts by mass or higher, and in view of setting retardancy of the hydraulic composition, 4.0 parts by mass or lower, preferably 2.0 parts by mass or lower and more preferably 1.0 part by mass or lower.

[0093]

In the hydraulic composition according to the present invention containing component (B1), the molar ratio between component (A) and component (B1), $(A)/(B1)$, is preferably 0.05 or higher and 20.0 or lower. The molar ratio $(A)/(B1)$ is more preferably 0.1 or higher, further preferably 0.2 or higher and furthermore preferably 0.3 or higher, and more preferably 15 or lower, further preferably 10 or lower and furthermore preferably 7.5 or lower.

When component (B1) is component (B11), the molar ratio, $(A)/(B1)$, is preferably 0.4 or higher, more preferably 1 or higher and further preferably 3 or higher, and preferably 10 or lower and more preferably 8 or lower.

When component (B1) is component (B12), the molar ratio, $(A)/(B1)$, is preferably 0.1 or higher, more preferably 0.15 or higher and further preferably 0.2 or higher, and preferably 0.5 or lower and more preferably 0.3 or lower.

When component (B1) is component (B13), the molar ratio (A)/(B1), is preferably 0.1 or higher and more preferably 0.2 or higher, and preferably 0.5 or lower and more preferably 0.4 or lower.

[0094]

In the hydraulic composition according to the present invention containing component (B1), the mass ratio between component (A) and component (B1), (A)/(B1), is, in view of improving flowability of the hydraulic composition and suppressing hardening retardation thereof, preferably 0.05 or higher, more preferably 0.1 or higher, further preferably 0.15 or higher, furthermore preferably 0.3 or higher and furthermore preferably 0.5 or higher, and preferably 4.0 or lower, more preferably 2.0 or lower, further preferably 1.0 or lower and furthermore preferably 0.5 or lower.

[0095]

In the hydraulic composition according to the present invention containing component (B1), the content of component (A) is, per 100 parts by mass of the hydraulic powder, preferably 0.01 parts by mass or higher, more preferably 0.05 parts by mass or higher and further preferably 0.15 parts by mass or higher, and in view of suppressing setting retardation, preferably 1.0 part by mass or lower, more preferably 0.5 parts by mass or lower and further preferably 0.3 parts by mass or lower.

The content of component (B1) is, per 100 parts by mass of the hydraulic powder, preferably 0.05 parts by mass or higher, more preferably 0.15 parts by mass or higher and further preferably 0.3 parts by mass or higher, and preferably 1.0 part by mass or lower, more preferably 0.6 parts by mass or lower and further preferably 0.4 parts by mass or lower.

[0096]

The hydraulic composition according to the present invention containing component (B1) can further contain a defoaming agent of component (C). Specific examples and preferable forms of component (C) are the same as described for the dispersant composition for a hydraulic composition according to the present invention. In the case of using component (C), the hydraulic composition according to the present invention contains component (C) in an amount of preferably 0.00005 parts by mass or more, more preferably 0.00025 parts by mass or more and further preferably 0.0005 parts by mass or more, and preferably 0.1 parts by mass or less, more preferably 0.075 parts by mass or less and further preferably 0.05 parts by mass or less, per 100 parts by mass of the hydraulic powder.

[0097]

The hydraulic composition according to the present invention containing component (B1) can further contain dispersant (D) (hereinafter, referred to as component (D)). The dispersant includes one or more dispersants

selected from ligninsulfonic acid-based polymers, polycarboxylic acid-based polymers, naphthalene-based polymers, melamine-based polymers and phenolic polymers, and is, in view of dispersibility, preferably one or more dispersants selected from polycarboxylic acid-based copolymers, ligninsulfonic acid-based copolymers and naphthalenesulfonic acid-based copolymers, and more preferably one or more dispersants selected from ligninsulfonic acid-based polymers and polycarboxylic acid-based polymers.

[0098]

As the naphthalene-based polymer, there can be used a naphthalenesulfonic acid-formaldehyde condensate (Mighty 150 or the like, manufactured by Kao Corp.); as the melamine-based polymer, a melaminesulfonic acid-formaldehyde condensate (for example, Mighty 150-V2, manufactured by Kao Corp.); as the phenolic polymer, a phenolsulfonic acid-formaldehyde condensate (a compound described in JP-A 49-104919, or the like); and as the ligninsulfonic acid-based polymer, a ligninsulfonate (MasterPozolith No. 70, manufactured by BASF SE, Ultrazine NA, manufactured by Borreguard AS, San X and Vanillex, Pearllex, manufactured by Nippon Paper Chemical Co., Ltd., and the like).

[0099]

As the polycarboxylic acid-based copolymer, there can be used a copolymer (for example, a compound

described in JP-A 8-12397, or the like) of a monoester of a polyalkylene glycol with (meth)acrylic acid, with a carboxylic acid such as (meth)acrylic acid, a copolymer of an unsaturated alcohol having a polyalkylene glycol with a carboxylic acid such as (meth)acrylic acid, a copolymer of an unsaturated alcohol having a polyalkylene glycol with a dicarboxylic acid such as maleic acid, or the like. Here, (meth)acrylic acid means a carboxylic acid selected from acrylic acid and methacrylic acid.

[0100]

When the hydraulic composition according to the present invention containing component (B1) contains component (D), the content of component (D) is preferably 0.01 parts by mass or higher and more preferably 0.05 parts by mass or higher, and preferably 2 parts by mass or lower and more preferably 1 part by mass or lower, per 100 parts by mass of the hydraulic powder, in view of workability.

[0101]

The hydraulic composition according to the present invention containing component (B1) preferably contains aggregate. Examples of the aggregate include aggregate selected from fine aggregate and coarse aggregate. Examples of the fine aggregate include aggregate of No. 2311 in JIS A0203-2014. Examples thereof include river sand, land sand, pit sand, sea sand, lime sand, silica sand and crushed sand thereof, blast furnace slag fine

aggregate, ferronickel slag fine aggregate, light-weight fine aggregate (artificial and natural) and reclaimed fine aggregate. Further, examples of the coarse aggregate include aggregate of No. 2312 in JIS A0203-2014. Examples thereof include river gravel, land gravel, pit gravel, sea gravel, lime gravel and crushed gravel thereof, blast furnace slag coarse aggregate, ferronickel slag coarse aggregate, light-weight coarse aggregate (artificial and natural) and reclaimed coarse aggregate. The fine aggregate and the coarse aggregate each may be used by mixing different kinds thereof, or used singly.

[0102]

When the hydraulic composition containing component (B1) is a concrete, the amount of the coarse aggregate to be used is, in terms of the bulk volume, preferably 50% or more, more preferably 55% or more and further preferably 60% or more, and preferably 100% or less, more preferably 90% or less and further preferably 80% or less, in view of developing the strength of the hydraulic composition, reducing the amount of the hydraulic powder such as a cement to be used, and improving the filling property in formwork and the like. The bulk volume means a proportion of a volume (including voids) of the coarse aggregate per 1 m³ of the concrete.

When the hydraulic composition containing component (B1) is a concrete, the amount of the fine aggregate to

be used is, in view of improving the filling property in formwork and the like, preferably 500 kg/m³ or more, more preferably 600 kg/m³ or more and further preferably 700 kg/m³ or more, and preferably 1,000 kg/m³ or less and more preferably 900 kg/m³ or less.

When the hydraulic composition containing component (B1) is a mortar, the amount of the fine aggregate to be used is preferably 800 kg/m³ or more, more preferably 900 kg/m³ or more and further preferably 1,000 kg/m³ or more, and preferably 2,000 kg/m³ or less, more preferably 1,800 kg/m³ or less and further preferably 1,700 kg/m³ or less.
[0103]

The hydraulic composition containing component (B1) includes concretes. Among these, concretes using cement are preferable. The hydraulic composition according to the present invention is useful in any fields including self-leveling, refractories, plasters, light-weight or heavy-weight concretes, AE concretes, repairing, prepacked concretes, tremies, foundation improvements, grouting and winter concretes.
[0104]

The hydraulic composition according to the present invention containing component (B1) can also contain further other components. Examples thereof include AE agents, retarders, foaming agents, thickeners, gas-forming agents, waterproofing agents and superplasticizers.

[0105]

The present invention provides a hydraulic composition containing a hydraulic powder, water, component (A) and component (B2), wherein the total content of component (A) and component (B2) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

Specific examples and preferable forms of component (A) and component (B2) in the hydraulic composition according to the present invention containing component (B2) are the same as in the hydration heat suppressant for a hydraulic composition according to the present invention. The molar ratio (A)/(B2) is preferably in the same range as for the hydration heat suppressant for a hydraulic composition according to the present invention. Further, the mass ratio (A)/(B2) is preferably in the same range as for the hydration heat suppressant for a hydraulic composition according to the present invention.

[0106]

The hydraulic powder refers to a powder having the hardenability through hydration reaction, and includes cement and gypsum.

The cement includes normal portland cement, high-early-strength portland cement, ultrahigh-early-strength portland cement, sulfate-resisting portland cement, low-heat portland cement, white portland cement and ecocement (for example, JIS R5214). Among these, preferable is a

cement selected from normal portland cement, sulfate-resisting portland cement and white portland cement; and more preferable is normal portland cement.

[0107]

The hydraulic powder such as cement may contain a powder having the pozzolanic action and/or latent hydraulic property, such as blast furnace slag, fly ash or silica fume, a stone powder (calcium carbonate powder), or the like. As the hydraulic powder, blast furnace slag cement, fly ash cement or silica fume cement can be used, for example.

[0108]

In the hydraulic powder to be used for the hydraulic composition according to the present invention containing component (B2), the content of gypsum is preferably 20% by mass or lower, more preferably 15% by mass or lower, further preferably 10% by mass or lower and furthermore preferably 5% by mass or lower.

A more preferable hydraulic powder to be used for the hydraulic composition according to the present invention containing component (B2) is cement having a content of gypsum of preferably 20% by mass or lower, more preferably 15% by mass or lower, further preferably 10% by mass or lower and furthermore preferably 5% by mass or lower. This cement may contain the above-mentioned powder having the pozzolanic action and/or

latent hydraulic property, stone powder (calcium carbonate powder), or the like.

[0109]

In the hydraulic composition according to the present invention containing component (B2), the total content of component (A) and component (B2) is, per 100 parts by mass of the hydraulic powder, 0.05 parts by mass or higher, preferably 0.1 parts by mass or higher, more preferably 0.15 parts by mass or higher and further preferably 0.5 parts by mass or higher, and then in view of the hydration reaction retardancy, 4.0 % by mass or lower, preferably 2.0 parts by mass or lower and further preferably 1.0 part by mass or lower. Here, when the hydraulic powder contains, in addition to powders having the hardenability through hydration reaction such as cement, powders selected from a powder having the pozzolanic action, a powder having the latent hydraulic property, and a stone powder (calcium carbonate powder), the amounts of these are counted in the amount of the hydraulic powder in the present invention. Further when a powder having the hardenability through hydration reaction contains a high-strength admixture, the amount of the high-strength admixture is also counted in the amount of the hydraulic powder. This shall apply also to the parts by mass or the mass ratio relating to the mass of the hydraulic powder.

[0110]

In the hydraulic composition according to the present invention containing component (B2), the content of component (A) is, per 100 parts by mass of the hydraulic powder, preferably 0.01 parts by mass or higher, more preferably 0.05 parts by mass or higher and further preferably 0.15 parts by mass or higher, and in view of the hydration reaction retardancy, preferably 1.0 part by mass or lower, more preferably 0.5 parts by mass or lower and further preferably 0.3 parts by mass or lower.

In the hydraulic composition according to the present invention containing component (B2), the content of component (B2) is, per 100 parts by mass of the hydraulic powder, preferably 0.1 parts by mass or higher, more preferably 0.2 parts by mass or higher and further preferably 0.3 parts by mass or higher, and preferably 2.0 parts by mass or lower, more preferably 1.0 part by mass or lower and further preferably 0.6 parts by mass or lower.

[0111]

In the hydraulic composition according to the present invention containing component (B2), the water/hydraulic powder ratio (a mass ratio of water to a hydraulic powder in a slurry (a mass of water/a mass of the hydraulic powder $\times$ 100), usually abbreviated to W/P) is preferably 20% or higher, more preferably 30% or higher and further preferably 40% or higher, and

preferably 100% or lower, more preferably 80% or lower and further preferably 70% or lower, in view of workability and the economic efficiency.

[0112]

In the hydraulic composition according to the present invention containing component (B2), the water/cement ratio (the mass ratio of water to cement in a slurry (a mass of water/a mass of cement $\times$ 100), usually abbreviated to W/C) is preferably 20% or higher, more preferably 30% or higher and further preferably 40% or higher, and preferably 100% or lower, more preferably 80% or lower and further preferably 70% or lower, in view of workability and the economic efficiency.

[0113]

The hydraulic composition according to the present invention containing component (B2) can further contain aggregate. Examples of the aggregate include fine aggregate and coarse aggregate; the fine aggregate is preferably pit sand, land sand, river sand and crushed sand, and the coarse aggregate is preferably pit gravel, land gravel, river gravel and crushed gravel. Depending on applications, light-weight aggregate may be used. Here, the term of aggregate is according to "Concrete Soran" (June 10, 1998, published by Gijutsu Shoin).

[0114]

The aggregate can be used in the usual amount used for preparation of concrete, mortar and the like. When

the hydraulic composition is a concrete, the amount of the coarse aggregate used is, in view of properties of the concrete, in bulk volume, preferably 50% or more, more preferably 55% or more and further preferably 60% or more, and preferably 100% or less, more preferably 90% or less and further preferably 80% or less. Further, when the hydraulic composition is a concrete, the amount of the fine aggregate used is, in view of improving the filling property to formwork or the like, preferably 500 kg/m³ or more, more preferably 600 kg/m³ or more and further preferably 700 kg/m³ or more, and preferably 1,000 kg/m³ or less and more preferably 900 kg/m³ or less. When the hydraulic composition is a mortar, the amount of the fine aggregate used is preferably 800 kg/m³ or more, more preferably 900 kg/m³ or more and further preferably 1,000 kg/m³ or more, and preferably 2,000 kg/m³ or less, more preferably 1,800 kg/m³ or less and further preferably 1,700 kg/m³ or less.

[0115]

The hydraulic composition according to the present invention containing component (B2) can further contain a defoaming agent of component (C). Specific examples and preferable forms of component (C) are the same as in the hydration heat suppressant for a hydraulic composition according to the present invention. When the hydraulic composition according to the present invention contains component (C), the content of component (C) is preferably

0.01 parts by mass or higher and more preferably 0.05 parts by mass or higher, and preferably 2 parts by mass or lower and more preferably 1 part by mass or lower, per 100 parts by mass of the hydraulic powder, in view of workability.

[0116]

The hydraulic composition according to the present invention containing component (B2) can further contain dispersant (D) (hereinafter, referred to as component (D)). Specific examples and preferable forms of component (D) are the same as in the hydraulic composition according to the present invention containing component (B1). When the hydraulic composition according to the present invention containing component (B2) contains component (D), the content of component (D) is preferably 0.01 parts by mass or higher and more preferably 0.05 parts by mass or higher, and preferably 2 parts by mass or lower and more preferably 1 part by mass or lower, per 100 parts by mass of the hydraulic powder, in view of workability.

[0117]

The hydraulic composition according to the present invention containing component (B2) can further contain other components other than the above components. Examples thereof include AE agents, retarders, foaming agents, thickeners, gas-forming agents, waterproofing agents, superplasticizers and early strengthening agents.

Examples of the early strengthening agents include compounds selected from hydrochlorides, sulfates, nitrates, nitrites, cyanates, thiocyanates, thiosulfates and formates of alkali metals and alkaline earth metals, organic compounds selected from alkanolamines, glycerol derivatives, formaldehyde derivatives and catechol derivatives, and nanoparticles of hydration products (C-S-H and calcium hydroxide) of portland cement.

[0118]

The hydraulic composition according to the present invention containing component (B2) may be a concrete or a mortar. The hydraulic composition according to the present invention is useful in any fields including self-leveling, refractories, plasters, light-weight or heavy-weight concretes, AE concretes, repairing, prepacked concretes, tremies, foundation improvements, grouting and winter concretes.

[0119]

[Methods for producing hydraulic compositions]

The present invention provides a method for producing a hydraulic composition, the method including mixing a hydraulic powder, water, component (A) and component (B1),

wherein component (A) and component (B1) are mixed so that the total content of component (A) and component (B1) is 0.05 parts by mass or higher and 4.0 parts by

mass or lower per 100 parts by mass of the hydraulic powder.

In the method for producing a hydraulic composition according to the present invention using component (B1), specific examples and preferable forms of component (A) and component (B1) are the same as in the dispersant composition for a hydraulic composition according to the present invention. Further, specific examples and preferable forms of the hydraulic powder are the same as in the hydraulic composition according to the present invention using component (B1).

Matters described for the dispersant composition for a hydraulic composition and the hydraulic composition using component (B1) according to the present invention can suitably be applied to the method for producing a hydraulic composition according to the present invention using component (B1). In this case, the content of each component in the dispersant composition for a hydraulic composition and the hydraulic composition using component (B1) can be applied by being rephrased as an amount mixed.

[0120]

In the method for producing a hydraulic composition according to the present invention using component (B1), component (A) and component (B1) are mixed so that the total content of component (A) and component (B1) is, per 100 parts by mass of the hydraulic powder, 0.05 parts by

mass or higher, preferably 0.1 parts by mass or higher, more preferably 0.15 parts by mass or higher and further preferably 0.5 parts by mass or higher, and in view of suppressing the setting retardation of the hydraulic composition, 4.0 parts by mass or lower, preferably 2.0 parts by mass or lower and more preferably 1.0 part by mass or lower.

[0121]

In the method for producing a hydraulic composition according to the present invention using component (B1), component (A) and component (B1) are mixed so that the molar ratio between component (A) and component (B1), $(A)/(B1)$, is preferably 0.05 or higher and 20.0 or lower. The molar ratio $(A)/(B1)$ is more preferably 0.1 or higher, further preferably 0.2 or higher and furthermore preferably 0.3 or higher, and more preferably 15 or lower, further preferably 10 or lower and furthermore preferably 7.5 or lower.

When component (B1) is component (B11), the molar ratio $(A)/(B1)$ is preferably 0.4 or higher, more preferably 1 or higher and further preferably 3 or higher, and preferably 10 or lower and more preferably 8 or lower.

When component (B1) is component (B12), the molar ratio $(A)/(B1)$ is preferably 0.1 or higher, more preferably 0.15 or higher and further preferably 0.2 or

higher, and preferably 0.5 or lower and more preferably 0.3 or lower.

When component (B1) is component (B13), the molar ratio (A)/(B1) is preferably 0.1 or higher and more preferably 0.2 or higher, and preferably 0.5 or lower and more preferably 0.4 or lower.

[0122]

In the method for producing a hydraulic composition according to the present invention using component (B1), component (A) and component (B1) are mixed so that the mass ratio between component (A) and component (B1), (A)/(B1), is preferably 0.05 or higher, more preferably 0.1 or higher, further preferably 0.15 or higher, furthermore preferably 0.3 or higher and furthermore preferably 0.5 or higher, and preferably 4.0 or lower, more preferably 2.0 or lower, further preferably 1.0 or lower and furthermore preferably 0.5 or lower, in view of improving flowability of the hydraulic composition and suppressing the hardening retardation thereof.

[0123]

In the present invention, component (A) and component (B1) may be mixed separately with a hydraulic powder to produce a hydraulic composition. However, it is preferable that component (A) and component (B1) be previously mixed, and that then the mixture is mixed with the hydraulic powder. In production of a hydraulic composition, it is more preferable to use the dispersant

composition for a hydraulic composition according to the present invention using component (B1).

[0124]

Further, by mixing a hydraulic powder, water, component (A), component (B1) and component (C), a hydraulic composition containing the hydraulic powder, water, component (A), component (B1) and component (C) can also be produced.

Further, by mixing a hydraulic powder, water, component (A), component (B1) and component (D), a hydraulic composition containing the hydraulic powder, water, component (A), component (B1) and component (D) can also be produced.

Further, by mixing a hydraulic powder, water, component (A), component (B1), component (C) and component (D), a hydraulic composition containing the hydraulic powder, water, component (A), component (B1), component (C) and component (D) can also be produced.

Specific examples and preferable forms of component (C) and component (D) are, respectively, the same as described for the dispersant composition for a hydraulic composition according to the present invention.

[0125]

In the method for producing a hydraulic composition according to the present invention using component (B1), it is preferable that component (A), component (B1) and water be previously mixed and that then the mixture is

mixed with the hydraulic powder, in view of smoothly mixing component (A), component (B1) and a hydraulic powder such as a cement. There can be used the dispersant composition for a hydraulic composition according to the present invention containing water.

[0126]

In the method for producing a hydraulic composition according to the present invention using component (B1), preferable is mixing a hydraulic powder such as cement with the dispersant composition for a hydraulic composition according to the present invention. The dispersant composition for a hydraulic composition according to the present invention may be a powder or a liquid. In the dispersant composition for a hydraulic composition according to the present invention, it is preferable that component (A), component (B1) and further component (C) and component (D) be added so that the respective amounts added are within the above-mentioned amounts with respect to a hydraulic powder.

[0127]

The mixing of the hydraulic powder, water, component (A) and component (B1) can be carried out using a mixer such as a mortar mixer or a forced double-shaft mixer. The mixing is carried out preferably for 1 min or longer and more preferably 2 min or longer, and preferably 5 min or shorter and more preferably 3 min or shorter. In preparation of the hydraulic composition, there can be

used materials, chemicals and their amounts described for the hydraulic composition according to the present invention using component (B1).

[0128]

An obtained hydraulic composition is further filled in a mold and cured to be hardened. Examples of the mold include molds for buildings and molds for concrete products. Examples of a method of filling in a mold include a method of charging directly from a mixer, and a method of introducing a hydraulic composition into a mold by pumping.

[0129]

In curing of the hydraulic composition, heat-curing in order to promote hardening may be carried out to promote hardening. Here, the heat-curing can hold the hydraulic composition at a temperature of 40°C or higher and 80°C or lower to promote hardening.

[0130]

The present invention also provides a method for producing a hydraulic composition, the method including mixing a hydraulic powder, water, component (A) and component (B2), wherein component (A) and component (B2) are mixed in a total amount thereof of 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder. To this production method, there can suitably be applied matters described for the hydration heat suppressant for a hydraulic composition

and the hydraulic composition containing component (B2) according to the present invention and the following method of suppressing hydration heat of a hydraulic composition. Further, matters described for the method for producing a hydraulic composition according to the present invention containing component (B2) can suitably be applied to this production method.

[0131]

[Method of improving flowability]

[0132]

The present invention provides a method of improving flowability of a hydraulic composition, the method including adding, to a hydraulic composition containing water and a hydraulic powder, component (A) and component (B1) in a total amount thereof of 0.05 parts by mass or more and 4.0 parts by mass or less per 100 parts by mass of the hydraulic powder.

In the method of improving flowability according to the present invention, specific examples and preferable forms of component (A) and component (B1) are the same as in the dispersant composition for a hydraulic composition according to the present invention. Further, specific examples and preferable forms of the hydraulic powder are the same as in the hydraulic composition according to the present invention containing component (B1).

Matters described for the dispersant composition for a hydraulic composition and the hydraulic composition

containing component (B1) according to the present invention can suitably be applied to the method of improving flowability according to the present invention. In this case, the content of each component in the dispersant composition for a hydraulic composition and the hydraulic composition containing component (B1) can be applied by being rephrased as an amount mixed. Further, specific examples and preferable forms of the hydraulic composition in the method of improving flowability according to the present invention are the same as in the hydraulic composition according to the present invention containing component (B1). The hydraulic composition according to the present invention containing component (B1) can be used as an object.

[0133]

In the method of improving flowability according to the present invention, component (A) and component (B1) are added in a hydraulic composition in a total amount of component (A) and component (B1) of, per 100 parts by mass of a hydraulic powder, 0.05 parts by mass or higher, preferably 0.1 parts by mass or higher, more preferably 0.15 parts by mass or higher and further preferably 0.5 parts by mass or higher, and in view of the setting retardancy of the hydraulic composition, 4.0 parts by mass or lower, preferably 2.0 parts by mass or lower and more preferably 1.0 part by mass or lower.

[0134]

Further, in the method of improving flowability according to the present invention, component (A) and component (B1) are mixed so that the molar ratio (A)/(B1) thereof is preferably 0.05 or higher and 20.0 or lower. The molar ratio (A)/(B1) is more preferably 0.1 or higher, further preferably 0.2 or higher and furthermore preferably 0.3 or higher, and more preferably 15 or lower, further preferably 10 or lower and furthermore preferably 7.5 or lower.

When component (B1) is component (B11), the molar ratio (A)/(B1) is preferably 0.4 or higher, more preferably 1 or higher and further preferably 3 or higher, and preferably 10 or lower and more preferably 8 or lower.

When component (B1) is component (B12), the molar ratio (A)/(B1) is preferably 0.1 or higher, more preferably 0.15 or higher and further preferably 0.2 or higher, and preferably 0.5 or lower and more preferably 0.3 or lower.

When component (B1) is component (B13), the molar ratio (A)/(B1) is preferably 0.1 or higher and more preferably 0.2 or higher, and preferably 0.5 or lower and more preferably 0.4 or lower.

[0135]

Further, in the method of improving flowability according to the present invention, in view of improving flowability of the hydraulic composition and suppressing

hardening retardation thereof, component (A) and component (B1) are mixed so that the mass ratio (A)/(B1) thereof is preferably 0.05 or higher, more preferably 0.1 or higher, further preferably 0.15 or higher, furthermore preferably 0.3 or higher and furthermore preferably 0.5 or higher, and preferably 4.0 or lower, more preferably 2.0 or lower, further preferably 1.0 or lower and furthermore preferably 0.5 or lower.

[0136]

One example of the present invention includes a method of improving flowability of a hydraulic composition, the method including adding component (A) and component (B1) in their respective predetermined amounts in parts by mass above-mentioned when a hydraulic powder and water are mixed to prepare the hydraulic composition.

[0137]

[Method of suppressing hydration heat]

The method of suppressing hydration heat of a hydraulic composition according to the present invention includes adding, to a hydraulic composition containing water and a hydraulic powder, component (A) and component (B2) in a total amount thereof of 0.05 parts by mass or more and 4.0 parts by mass or less per 100 parts by mass of the hydraulic powder.

Specific examples and preferable forms of component (A) and component (B2) are the same as in the hydration

heat suppressant for a hydraulic composition according to the present invention. The molar ratio (A)/(B2) and the mass ratio (A)/(B2) are also preferably in the same range as in the hydration heat suppressant for a hydraulic composition according to the present invention.

Further, specific examples and preferable forms of the hydraulic powder in the method of suppressing hydration heat of a hydraulic composition according to the present invention are the same as in the hydraulic composition according to the present invention containing component (B2).

Further, specific examples and preferable forms of the hydraulic composition in the method of suppressing hydration heat of a hydraulic composition according to the present invention are the same as in the hydraulic composition according to the present invention containing component (B2). The method of suppressing hydration heat of a hydraulic composition according to the present invention can use the hydraulic composition according to the present invention containing component (B2) as an object.

[0138]

In the method of suppressing hydration heat of a hydraulic composition according to the present invention, component (A) and component (B2) are added in a total amount of component (A) and component (B2) of 0.05 parts by mass or more, preferably 0.1 parts by mass or more,

more preferably 0.15 parts by mass or more and further preferably 0.5 parts by mass or more, and in view of the hydration reaction retardancy, 4.0 parts by mass or less, preferably 2.0 parts by mass or less and more preferably 1.0 part by mass or less, per 100 parts by mass of a hydraulic powder.

In the method of suppressing hydration heat of a hydraulic composition according to the present invention, it is preferable that component (A) and component (B2) be added when the hydraulic composition is produced.

[0139]

In the method of suppressing hydration heat of a hydraulic composition according to the present invention, it is preferable that at least one of component (A) and component (B2) be used in a liquid state. Further, it is preferable that at least one of component (A) and component (B2) be dissolved in water or an organic solvent and used.

[0140]

The organic solvent includes methanol, ethanol, propanol, butanol, pentanol, hexanol, butanol, octanol, decanol, oleyl alcohol, isopropanol, isobutanol, isopentanol, 2-ethylhexanol, isostearyl alcohol, ethylene glycol, propylene glycol, 1,3-propanediol, 1,4-butanediol, neopentyl glycol, diethylene glycol, glycerol, butyl glycol, butyl diglycol, butyl triglycol, benzyl alcohol, diethyl ether, chloromethane,

dichloromethane, trichloromethane, chloroform, acetone, dimethyl ketone, methyl ethyl ketone, pentane, hexane, heptane, octane, nonane, decane, toluene, xylene, petroleum ether, paraffin, and vegetable fatty oil; and one or more types of these can be used. The organic solvent is, in view of flammability and compatibility with an ester compound being component (A), preferably one or more types selected from propylene glycol, butyl triglycol, paraffin and vegetable fatty oil, more preferably one or more selected from propylene glycol and butyl triglycol, and further preferably butyl triglycol.

[0141]

In the method of suppressing hydration heat of a hydraulic composition according to the present invention, when component (A) and/or component (B2) is dissolved in an organic solvent and used, the mass ratio between component (A) and/or component (B2) and the organic solvent, [component (A) and/or component (B2)]/organic solvent, is preferably 0.1 or higher and more preferably 0.2 or higher, in view of compatibility of the organic solvent with component (A) and/or component (B2), and preferably 9 or lower and more preferably 5 or lower, in view of the viscosity of a mixture of component (A) and/or component (B2) and the organic solvent.

[0142]

In the method of suppressing hydration heat of a hydraulic composition according to the present invention,

when component (A) and/or component (B2) is dissolved in water and used, the mass ratio, [component (A) and/or component (B2)]/water, is preferably 0.5 or higher and more preferably 1.0 or higher, and preferably 10.0 or lower and more preferably 5.0 or lower.

[0143]

In the method of suppressing hydration heat of a hydraulic composition according to the present invention, a defoaming agent of component (C) and a dispersant of component (D) can be added in the hydraulic composition. Specific examples and preferable forms of component (C) are the same as in the hydration heat suppressant for a hydraulic composition according to the present invention. Further, specific examples and preferable forms of component (D) are the same as in the hydraulic composition according to the present invention containing component (B1).

[0144]

In view of ease of diffusion in the hydraulic composition, the following procedure is preferred: component (A) and/or component (B2) and the organic solvent are previously mixed; then the dispersant being component (D) and water are mixed therein; and thereafter, the resultant is added to a hydraulic powder and mixed. Alternatively, a mixture of component (A) and/or component (B2) and the organic solvent, and a mixture of the dispersant being component (D) and water

may be separately prepared and separately added to the hydraulic powder, followed by mixing.

[0145]

The mixing of a hydraulic powder and water (preferably a mixture of a dispersant of component (D) and water), and the mixing of a hydraulic powder to which water (preferably a mixture of a dispersant of component (D) and water) has been added with component (A) and component (B2) (preferably a mixture of component (A) and/or component (B2) with an organic solvent) can be carried out using a mixer such as a mortar mixer or a forced double-shaft mixer. The mixing time is preferably 1 min or longer and more preferably 2 min or longer, and preferably 5 min or shorter and more preferably 3 min or shorter. In preparation of a hydraulic composition, there can be used materials, chemicals and their amounts described for the hydraulic composition according to the present invention containing component (B2).

[0146]

It is preferable that a hydraulic composition obtained by the method of suppressing hydration heat of a hydraulic composition according to the present invention be filled in a mold and cured to be hardened. Examples of the mold include molds for buildings, and molds for concrete products. Examples of a method of filling in a mold include a method of charging directly from a mixer,

and a method of introducing a hydraulic composition into a mold by pumping.

[0147]

In the present invention, the time from bringing a cement into contact with water in preparation of a hydraulic composition to demolding is preferably 16 hours or longer and 72 hours or shorter, in view of providing a strength necessary for the demolding and improving the production cycle.

[0148]

A hydraulic composition obtained by the method of suppressing hydration heat of a hydraulic composition according to the present invention can suitably be used for mass concrete production since the temperature rise and the temperature rise rate due to the hydration heat of the hydraulic composition can be suppressed to thereby reduce thermal cracking of the hydraulic composition. In Standard Specification of Concrete Structures (March, 2013, published by Japan Society of Civil Engineers), as rough criteria, mass concrete is defined to be concretes of 80 to 100 cm or larger in thickness in the case of broad slabs, and 50 cm or larger in thickness in the case of walls whose lower ends are restrained; and examples thereof in civil engineering structures include revetments walls, breakwaters, box culverts, bridge piers, bridges and dams, and those in building structures include columns, beams and floor boards.

Examples

[0149]

<Examples 1a and Comparative Examples 1a>

A mortar blend is shown in Table 1, and evaluation results are shown in Table 2. Compounds in Table were as follows.

Component (A)

- An alkyl polyglycoside: the number of carbons of the alkyl chain of 8 to 16, an average number of carbons of the alkyl chain of 10, a degree of sugar condensation of 1.1, a higher alcohol adduct of glucose

[0150]

Component (B1)

- A compound shown in Table 2 was used. Numerals in parentheses in Table 2 are average numbers of added moles of ethylene oxide, and represent p1 in the general formula (B11) or q1 + r1 in the general formula (B13).

[0151]

[Table 1]

W/C	Amount blended (g)		
	W	C	S
50%	200	400	700

[0152]

The mass ratio between water and a hydraulic powder, W/C, was 50% (50 parts by mass of water per 100 parts by

mass of the hydraulic powder). The amount of a fine aggregate was 338 parts by mass per 100 parts by mass of the hydraulic powder. Components used were as follows.

- W: water (tap water containing dispersants)
- C: a normal portland cement (manufactured by Taiheiyo Cement Corp., density: 3.16 g/cm³, gypsum content: 4.5% by mass)
- S: a fine aggregate (a pit sand from Joyo, density: 2.56 g/cm³)

[0153]

<Preparation and evaluation of mortars>

(1) Preparation of mortars

The hydraulic powder (C) and the fine aggregate (S) under the blending condition shown in Table 1 were placed in a mortar mixer (manufactured by Dalton Corp., type of universal mixing stirrer: 5DM-03-γ), and dry kneaded for 10 sec, and then, the water (W) containing component (A) and component (B1) in Table was added. At this time, a defoaming agent (silicone-based defoaming agent, manufactured by Dow Corning Toray Co., Ltd.) was added so that the amount of air entrained became 2% or smaller. The resultants were kneaded at a low-speed rotation (63 rpm) of the mortar mixer for 120 sec to thereby prepare mortars.

[0154]

(2) Evaluation of flowability

The flow of the prepared mortars was measured according to the test method of JIS R 5201. However, no operation to give falling motion was carried out. Results are shown in Table 2.

[0155]

[Table 2]

		Component (A)		Component (B1)		(A)+(B1) parts by mass	Mass ratio (A)/(B1)	Molar ratio (A)/(B1)	Mortar flow (mm)
		Kind	Parts by mass	Kind	Parts by mass				
Examples	1a-1	alkyl polyglycoside	0.1	polyoxyethylene (3) lauryl ether	0.3	0.4	0.33	0.33	220
	1a-2	alkyl polyglycoside	0.1	polyoxyethylene (4) lauryl ether	0.3	0.4	0.33	0.38	221
	1a-3	alkyl polyglycoside	0.1	polyoxyethylene (5) lauryl ether	0.3	0.4	0.33	0.42	211
	1a-4	alkyl polyglycoside	0.1	polyoxyethylene (6) lauryl ether	0.3	0.4	0.33	0.47	211
	1a-5	alkyl polyglycoside	0.1	polyoxyethylene (23) lauryl ether	0.3	0.4	0.33	1.25	213
	1a-6	alkyl polyglycoside	0.2	polyoxyethylene (47) lauryl ether	0.2	0.4	1	7.04	255
	1a-7	alkyl polyglycoside	0.1	polyoxyethylene (47) lauryl ether	0.3	0.4	0.33	2.35	216
	1a-8	alkyl polyglycoside	0.05	polyoxyethylene (47) lauryl ether	0.35	0.4	0.14	1.01	175
	1a-9	alkyl polyglycoside	0.02	polyoxyethylene (47) lauryl ether	0.38	0.4	0.053	0.37	150
	1a-10	alkyl polyglycoside	0.1	polyoxyethylene (47) lauryl ether	0.2	0.3	0.5	3.52	213
	1a-11	alkyl polyglycoside	0.15	polyoxyethylene (47) lauryl ether	0.15	0.3	1	7.04	240
	1a-12	alkyl polyglycoside	0.1	polyoxyethylene (47) lauryl ether	0.1	0.2	1	7.04	194
	1a-13	alkyl polyglycoside	0.05	polyoxyethylene (47) lauryl ether	0.15	0.2	0.33	2.35	193
	1a-14	alkyl polyglycoside	0.1	polyoxyethylene (9) oleyl ether	0.3	0.4	0.33	0.69	207
	1a-15	alkyl polyglycoside	0.1	polyoxyethylene (50) stearyl ether	0.3	0.4	0.33	2.57	215
	1a-16	alkyl polyglycoside	0.1	palm kernel oil fatty acid diethanolamide	0.3	0.4	0.33	0.31	245
	1a-17	alkyl polyglycoside	0.1	coconut oil fatty acid methylethanolamide	0.2	0.3	0.5	0.42	203
	1a-18	alkyl polyglycoside	0.1	coconut oil fatty acid methylethanolamide	0.3	0.4	0.33	0.28	256
	1a-19	alkyl polyglycoside	0.1	coconut oil fatty acid methylethanolamide	0.5	0.6	0.2	0.17	251
	1a-20	alkyl polyglycoside	0.02	coconut oil fatty acid methylethanolamide	0.3	0.32	0.067	0.06	184
	1a-21	alkyl polyglycoside	0.05	coconut oil fatty acid methylethanolamide	0.3	0.35	0.17	0.14	235
	1a-22	alkyl polyglycoside	0.1	polyoxyethylene (2) laurylamine	0.3	0.4	0.33	0.28	257
	1a-23	alkyl polyglycoside	0.1	polyoxyethylene (5) laurylamine	0.3	0.4	0.33	0.42	224
	1a-24	alkyl polyglycoside	0.1	polyoxyethylene (11) distyrenated phenyl ether	0.3	0.4	0.33	0.82	200
Comparative Examples	1a-1	alkyl polyglycoside	0.1	-	-	-	-	-	128
	1a-2	-	-	coconut oil fatty acid methylethanolamide	0.3	-	0	-	136
	1a-3	-	-	-	-	-	-	-	129

[0156]

In Table 2, numbers in parts by mass of component (A) and component (B1) are, respectively, amounts added of component (A) and component (B1) per 100 parts by mass of the hydraulic powder.

[0157]

<Examples 2a and Comparative Example 2a>

20 g of each mortar containing component (A) and component (B1) as shown in Table 3 was placed in a constant-temperature calorimeter (TAM Air, manufactured by TA Instruments Inc.), and the change in the hydration heat generation rate over time was determined under the constant temperature condition of 20°C. The time point when the differential value with respect to time of the heat generation rate, d^2Q/dt^2 , became a positive value was defined as a hydration reaction initiation time for evaluation. The results are shown in Table 3. The each mortar was obtained by kneading in the same manner as in (1) of Examples 1a. The mortars of Examples 2a-1 and 2a-2 and Comparative Example 2a-1 in Table 3 corresponded to the mortars of Examples 1a-7 and 1a-6 and Comparative Example 1a-3, respectively.

[0158]

[Table 3]

		Component (A)		Component (B1)		(A)+(B1) parts by mass	Mass ratio (A)/(B1)	Molar ratio (A)/(B1)	Mortar flow (mm)	Initiation time of hydration reaction (hr)
		Kind	Parts by mass	Kind	Parts by mass					
Examples	2a-1 (1a-7)	alkyl polyglycoside	0.1	polyoxyethylene (47) lauryl ether	0.3	0.4	0.33	2.35	216	1.95
	2a-2 (1a-6)	alkyl polyglycoside	0.2	polyoxyethylene (47) lauryl ether	0.2	0.4	1	7.04	255	3.36
	2a-3	alkyl polyglycoside	0.3	polyoxyethylene (47) lauryl ether	0.1	0.4	3	21.11	214	8.23
	2a-4	alkyl polyglycoside	0.35	polyoxyethylene (47) lauryl ether	0.05	0.4	7	49.25	196	12.10
Comparative Example	2a-1 (1a-3)	-	-	-	-	-	-	-	129	1.70

[0159]

<Example 1b and Comparative Example 1b>

A mortar blend is shown in Table 4, and evaluation results are shown in Table 5. Compounds in Table were as follows.

Component (A)

- An alkyl polyglycoside: the number of carbons of the alkyl chain of 8 to 16, an average number of carbons of the alkyl chain of 10, a degree of sugar condensation of 1.1, a higher alcohol adduct of glucose

[0160]

Components (B2)

- Polyoxyethylene (1) lauryl ether: an average number of added moles of ethylene oxide of 1, a numeral in parentheses is an average number of added moles of

ethylene oxide (the same applies hereinafter), an HLB of 5.2

- Polyoxyethylene (2) lauryl ether: an average number of added moles of ethylene oxide of 2, an HLB of 6.3
- Polyoxyethylene (3) lauryl ether: an average number of added moles of ethylene oxide of 3, an HLB of 8.1
- Polyoxyethylene (4) lauryl ether: an average number of added moles of ethylene oxide of 4, an HLB of 9.6
- Polyoxyethylene (5) lauryl ether: an average number of added moles of ethylene oxide of 5, an HLB of 10.5
- Polyoxyethylene (4) nonylphenyl ether: an average number of added moles of ethylene oxide of 4, an HLB of 8.9
- Palm kernel oil fatty acid diethanolamide: a mixture of an alkyldiethanolamide having the number of carbons of alkyl/alkenyl chains of 8 to 18 and an average number of molecules of the alkyl/alkenyl chains of 13.5 with glycerol, an HLB of 5.5 (the content of glycerol was 10% by mass; in Table 5, the amount in parts by mass of the mixture is indicated)
- Coconut oil fatty acid methylethanolamide: a mixture of an alkyldiethanolamide having the number of carbons of alkyl/alkenyl chains of 8 to 18 and an average number of molecules of the alkyl/alkenyl chains of 13.0 with glycerol, an HLB of 3.3 (the content of glycerol was 10% by mass, in Table 5, the amount in parts by mass of the mixture is indicated)

- Polyoxyethylene (2) laurylamine: an average number of added moles of ethylene oxide of 2, an HLB of 6.3

- Polyoxyethylene (6) monooleate: an HLB of 9.2

[0161]

Component (A') (comparative component of component (A))

- Phenyl glycoside: a reagent manufactured by Tokyo

Chemical Industry Co., Ltd., product code: P0178

(indicated in the column of component (A) in Table 5 for convenience).

[0162]

Dispersant

- A polycarboxylic acid-based copolymer: a complex of a ligninsulfonic acid compound with a polycarboxylic acid ether

[0163]

[Table 4]

W/C	Amount blended (g)		
	W	C	S
50%	200	400	1350

[0164]

The mass ratio of water and a hydraulic powder, W/C, was 50% (50 parts by mass of water per 100 parts by mass of the hydraulic powder). The amount of a fine aggregate was 338 parts by mass per 100 parts by mass of the hydraulic powder. Components used were as follows.

- W: water (tap water containing dispersants)

- C: a blast furnace cement type B (manufactured by Taiheiyo Cement Corp., density: 3.04 g/cm³, gypsum content: 4.0% by mass)
- S: a fine aggregate (manufactured by Japan Cement Association, a standard sand for cement strength test, density: 2.64 g/cm³)

[0165]

<Preparation and evaluation of mortars>

(1) Preparation of mortars

The hydraulic powder (C) and the fine aggregate (S) under the blending condition shown in Table 4 were placed in a mortar mixer (manufactured by Dalton Corp., type of universal mixing stirrer: 5DM-03-γ), and dry kneaded for 10 sec, and then, the kneading water (W) containing component (A) or component (A'), component (B2) and the dispersant (in the case of using it) was added. At this time, a defoaming agent (silicone-based defoaming agent, manufactured by Dow Corning Toray Co., Ltd.) was added so that the amount of air entrained became 2% or smaller. The resultants were kneaded at a low-speed rotation (63 rpm) of the mortar mixer for 120 sec to thereby prepare mortars.

[0166]

(2) Evaluation of the adiabatic temperature rise due to hydration heat of the hydraulic powder

Each of the kneaded mortars was filled in a 1-L volume polypropylene-made disposable cup; a thermocouple

was inserted to the central portion of the mortar; thereafter, the cup was placed in a 1-L Dewar flask, which was then sealed with a cork stopper. The Dewar flask was allowed to stand in a foamed styrol container (thickness: 140 mm) packed with foamed beads made of polystyrene; and the change in the temperature of the mortar was observed with time using a data logger. A schematic diagram of the measurement method is illustrated in Figure 1.

The temperature rise from a temperature when the hydraulic powder contacted with water to the maximum temperature was taken as an adiabatic temperature rise. Results are shown in Table 5. In Table 5, Comparative Example 1b-1 was taken as the reference, and the adiabatic temperature rise was indicated in terms of the difference in the adiabatic temperature rise between each of Examples and Comparative Examples and the reference. It can be said that as the difference in the adiabatic temperature rise was a larger positive number, the temperature rise due to hydration heat of the hydraulic powder was highly suppressed.

[0167]

[Table 5]

		Component (A)		Component (B2)			(A)+(B2) parts by mass	Mass ratio (A)/(B2)	Molar ratio (A)/(B2)	Dispersant		Adiabatic temperature rise (°C)	
		Kind	Parts by mass	Kind	HLB	Parts by mass				Kind	Parts by mass	Found value	Difference
Examples	1b-1	alkyl polyglycoside	0.1	polyoxyethylene (1) lauryl ether	5.2	0.3	0.4	0.33	0.24	-	-	35.3	6.0
	1b-2	alkyl polyglycoside	0.1	polyoxyethylene (2) lauryl ether	6.3	0.3	0.4	0.33	0.29	-	-	32.9	8.4
	1b-3	alkyl polyglycoside	0.1	polyoxyethylene (3) lauryl ether	8.1	0.3	0.4	0.33	0.33	-	-	34.5	6.8
	1b-4	alkyl polyglycoside	0.1	polyoxyethylene (4) lauryl ether	9.6	0.3	0.4	0.33	0.38	-	-	35.5	5.8
	1b-5	alkyl polyglycoside	0.1	polyoxyethylene (5) lauryl ether	10.5	0.3	0.4	0.33	0.42	-	-	38.5	2.8
	1b-6	alkyl polyglycoside	0.1	polyoxyethylene (4) nonylphenyl ether	8.9	0.3	0.4	0.33	0.41	-	-	35.3	6.0
	1b-7	alkyl polyglycoside	0.1	palm kernel oil fatty acid diethanolamide	5.5	0.3	0.4	0.33	0.31	-	-	36.5	4.8
	1b-8	alkyl polyglycoside	0.02	coconut oil fatty acid methylethanolamide	3.3	0.38	0.4	0.053	0.04	-	-	37.9	3.4
	1b-9	alkyl polyglycoside	0.05	coconut oil fatty acid methylethanolamide	3.3	0.35	0.4	0.14	0.12	-	-	36.3	5.0
	1b-10	alkyl polyglycoside	0.1	coconut oil fatty acid methylethanolamide	3.3	0.3	0.4	0.33	0.28	-	-	34.0	7.3
	1b-11	alkyl polyglycoside	0.2	coconut oil fatty acid methylethanolamide	3.3	0.2	0.4	1	0.84	-	-	34.8	6.5
	1b-12	alkyl polyglycoside	0.3	coconut oil fatty acid methylethanolamide	3.3	0.1	0.4	3	2.52	-	-	36.1	5.2
	1b-13	alkyl polyglycoside	0.2	coconut oil fatty acid methylethanolamide	3.3	0.6	0.8	0.33	0.28	-	-	34.1	7.2
	1b-14	alkyl polyglycoside	0.1	polyoxyethylene (2) laurylamine	6.3	0.3	0.4	0.33	0.28	-	-	32.9	8.4
	1b-15	alkyl polyglycoside	0.1	polyoxyethylene (6) monooleate	9.2	0.3	0.4	0.33	0.55	-	-	37.3	4.0
Comparative Examples	1b-1	-	-	-	-	-	-	-	-	polycarboxylic acid-based polymer	1.0	41.3	0
	1b-2	alkyl polyglycoside	0.1	-	-	-	0.1	-	-	-	-	40.3	1
	1b-3	-	-	coconut oil fatty acid methylethanolamide	3.3	0.3	0.3	0	-	-	-	43.3	-2
	1b-4	phenyl glycoside	0.1	coconut oil fatty acid methylethanolamide	3.3	0.3	0.4	0.33	-	-	-	44.3	-3

[0168]

In Table 5, numbers in parts by mass of component

(A) and component (B2) are amounts of component (A) and

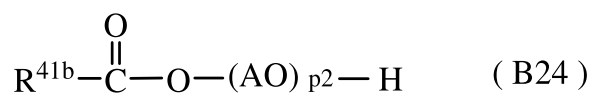
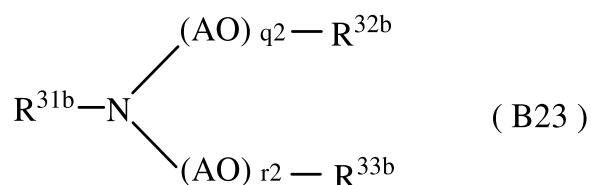
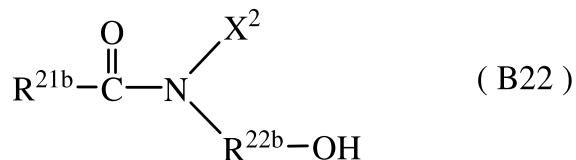
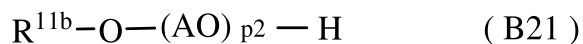
component (B2) added, respectively, per 100 parts by mass of the hydraulic powder. Further, a number in part by mass of the dispersant in Table is an amount of the dispersant added per 100 parts by mass of the hydraulic powder.

CLAIMS

1. A hydration heat suppressant for a hydraulic composition, the hydration heat suppressant comprising:

(A) at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less (hereinafter, referred to as a component (A)); and

(B2) at least one type of nonionic surfactant having an HLB value of 2 or higher and 11 or lower and selected from nonionic surfactants represented by the following general formula (B21), nonionic surfactants represented by the following general formula (B22), nonionic surfactants represented by the following general formula (B23) and nonionic surfactants represented by the following general formula (B24) (hereinafter, referred to as a component (B2)):



wherein R^{11b} and R^{31b} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21b} and R^{41b} are each a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22b} is an alkylene group having 2 or more and 4 or less carbons;

X^2 is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by $-R^{22b}-OH$; R^{32b} and R^{33b} are each a hydrogen atom or an alkyl group having 1 or more and 3 or less carbons;

A0 is an alkyleneoxy group having 2 or more and 4 or less carbons;

p2 is a number of 0.5 or more and 20 or less; and

q2 and r2 are each a number of 0 or more, and the sum of q2 and r2 is a number of 0.5 or more and 20 or less.

2. The hydration heat suppressant for a hydraulic composition according to claim 1, further comprising a defoaming agent (C).

3. The hydration heat suppressant for a hydraulic composition according to claim 1 or 2, wherein a molar ratio between the component (A) and the component (B2), $(A)/(B2)$, is 0.10 or higher and 10.0 or lower.

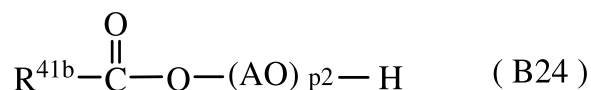
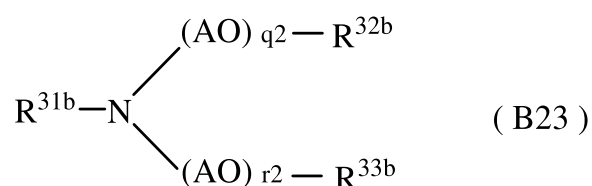
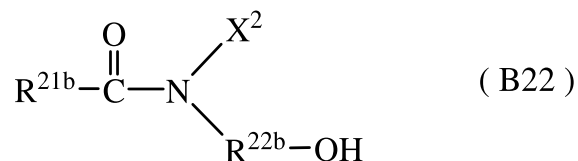
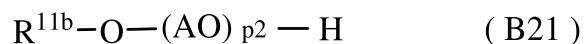
4. The hydration heat suppressant for a hydraulic composition according to any one of claims 1 to 3, wherein a mass ratio between the component (A) and the component (B2), $(A)/(B2)$, is 0.05 or higher and 4.0 or lower.

5. A hydraulic composition, comprising:
a hydraulic powder;

water;

(A) at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less (referred to as a component (A)); and

(B2) at least one type of nonionic surfactant having an HLB value of 2 or higher and 11 or lower and selected from nonionic surfactants represented by the following general formula (B21), nonionic surfactants represented by the following general formula (B22), nonionic surfactants represented by the following general formula (B23) and nonionic surfactants represented by the following general formula (B24) (hereinafter, referred to as a component (B2)):



wherein R^{11b} and R^{31b} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21b} and R^{41b} are each a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22b} is an alkylene group having 2 or more and 4 or less carbons;

X^2 is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by $-R^{22b}-OH$; R^{32b} and R^{33b} are each a hydrogen atom or an alkyl group having 1 or more and 3 or less carbons;

A0 is an alkyleneoxy group having 2 or more and 4 or less carbons;

p2 is a number of 0.5 or more and 20 or less; and

q2 and r2 are each a number of 0 or more, and the sum of q2 and r2 is a number of 0.5 or more and 20 or less,

wherein a total content of the component (A) and the component (B1) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

6. The hydraulic composition according to claim 5, further comprising a defoaming agent (C).

7. The hydraulic composition according to claim 5 or 6, further comprising a dispersant (D).

8. The hydraulic composition according to claim 7, wherein (D) is one or more dispersants selected from polycarboxylic acid-based copolymers, ligninsulfonic acid-based copolymers and naphthalenesulfonic acid-based copolymers.

9. The hydraulic composition according to any one of claims 5 to 8, wherein a molar ratio between the component (A) and the component (B2), $(A)/(B2)$, is 0.1 or higher and 10.0 or lower.

10. The hydraulic composition according to any one of claims 5 to 9, wherein a mass ratio between the component (A) and the component (B2), $(A)/(B2)$, is 0.05 or higher and 4.0 or lower.

11. The hydraulic composition according to any one of claims 5 to 10, wherein the hydraulic powder is a hydraulic powder having a content of a gypsum of 20% by mass or lower.

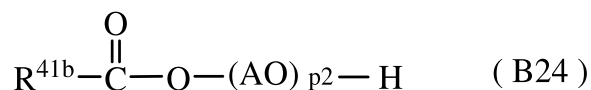
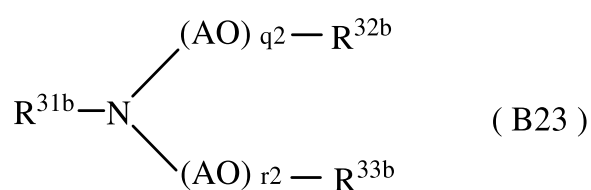
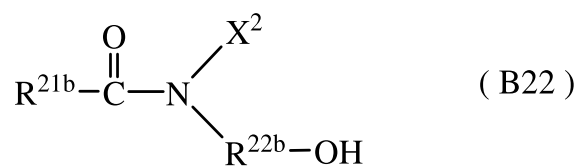
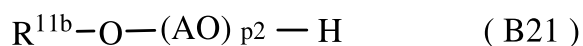
12. The hydraulic composition according to any one of claims 5 to 11, wherein a total content of the component (A) and the component (B2) is 0.1 parts by mass or higher and 2.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

13. A method for producing a hydraulic composition, the method comprising mixing a hydraulic powder, water, the following component (A) and the following component (B2):

component (A): at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less

carbons, and having a degree of sugar condensation of 1 or more and 5 or less; and

component (B2): at least one type of nonionic surfactant having an HLB value of 2 or higher and 11 or lower and selected from nonionic surfactants represented by the following general formula (B21), nonionic surfactants represented by the following general formula (B22), nonionic surfactants represented by the following general formula (B23) and nonionic surfactants represented by the following general formula (B24):



wherein R^{11b} and R^{31b} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl

groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21b} and R^{41b} are each a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22b} is an alkylene group having 2 or more and 4 or less carbons;

X^2 is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by $-R^{22b}-OH$;

R^{32b} and R^{33b} are each a hydrogen atom or an alkyl group having 1 or more and 3 or less carbons;

AO is an alkyleneoxy group having 2 or more and 4 or less carbons;

p_2 is a number of 0.5 or more and 20 or less; and

q_2 and r_2 are each a number of 0 or more, and the sum of q_2 and r_2 is a number of 0.5 or more and 20 or less,

wherein the component (A) and the component (B2) are mixed so that a total content of the component (A) and the component (B2) is 0.05 parts by mass or higher and 4.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

14. The method for producing a hydraulic composition according to claim 13, wherein a defoaming agent (C) is further mixed.

15. The method for producing a hydraulic composition according to claim 13 or 14, wherein the component (A) and the component (B2) are mixed so that a molar ratio between the component (A) and the component (B2), $(A)/(B2)$, is 0.1 or higher and 10.0 or lower.

16. The method for producing a hydraulic composition according to any one of claims 13 to 15, wherein the component (A) and the component (B2) are mixed so that a mass ratio between the component (A) and the component (B2), $(A)/(B2)$, is 0.05 or higher and 4.0 or lower.

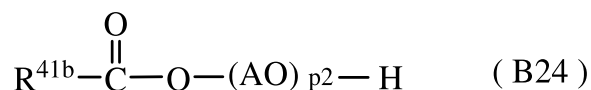
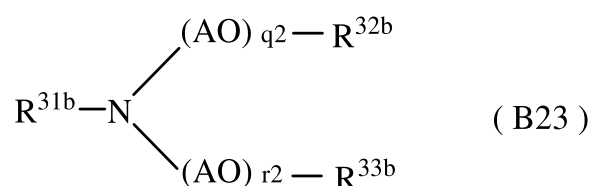
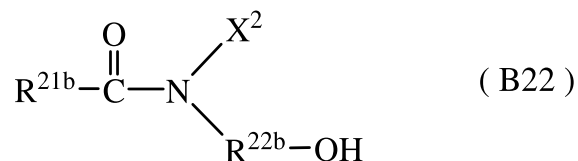
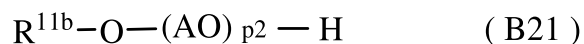
17. The method for producing a hydraulic composition according to any one of claims 13 to 16, wherein the hydraulic powder is a hydraulic powder having a content of a gypsum of 20% by mass or lower.

18. The method for producing a hydraulic composition according to any one of claims 13 to 17, wherein the component (A) and the component (B2) are mixed so that a total content of the component (A) and the component (B2) is 0.1 parts by mass or higher and 2.0 parts by mass or lower per 100 parts by mass of the hydraulic powder.

19. A method for suppressing hydration heat of a hydraulic composition, the method comprising adding, to a hydraulic composition comprising water and a hydraulic powder, the following component (A) and the following component (B2) in a total amount of the component (A) and the component (B2) of 0.05 parts by mass or more and 4.0 parts by mass or less per 100 parts by mass of the hydraulic powder:

component (A): at least one type of (poly)glycoside having an alkyl group with 8 or more and 20 or less carbons or an alkenyl group with 8 or more and 20 or less carbons, and having a degree of sugar condensation of 1 or more and 5 or less; and

component (B2): at least one type of nonionic surfactant having an HLB value of 2 or higher and 11 or lower and selected from nonionic surfactants represented by the following general formula (B21), nonionic surfactants represented by the following general formula (B22), nonionic surfactants represented by the following general formula (B23) and nonionic surfactants represented by the following general formula (B24):



wherein R^{11b} and R^{31b} are each a group selected from alkyl groups having 8 or more and 22 or less carbons, alkenyl groups having 8 or more and 22 or less carbons, aralkyl groups having 8 or more and 22 or less carbons, and substituted aryl groups having 8 or more and 22 or less carbons;

R^{21b} and R^{41b} are each a group selected from alkyl groups having 7 or more and 21 or less carbons, alkenyl groups having 7 or more and 21 or less carbons, aralkyl groups having 7 or more and 21 or less carbons, and substituted aryl groups having 7 or more and 21 or less carbons;

R^{22b} is an alkylene group having 2 or more and 4 or less carbons;

X^2 is a group selected from alkyl groups having 1 or more and 3 or less carbons and groups represented by $-R^{22b}-OH$; R^{32b} and R^{33b} are each a hydrogen atom or an alkyl group having 1 or more and 3 or less carbons;

A0 is an alkyleneoxy group having 2 or more and 4 or less carbons;

p2 is a number of 0.5 or more and 20 or less; and

q2 and r2 are each a number of 0 or more, and the sum of q2 and r2 is a number of 0.5 or more and 20 or less.

20. The method for suppressing hydration heat of a hydraulic composition according to claim 19, wherein at least one of the component (A) and the component (B2) is used in a liquid state.

21. The method for suppressing hydration heat of a hydraulic composition according to claim 19 or 20, wherein at least one of the component (A) and the component (B2) is dissolved in water or an organic solvent and then used.

22. The method for suppressing hydration heat of a hydraulic composition according to any one of claims 19 to 21, wherein the component (A) and the component (B2) are used in a molar ratio (A)/(B2) of 0.1 or higher and 10.0 or lower.

23. The method for suppressing hydration heat of a hydraulic composition according to any one of claims 19 to 22, wherein the component (A) and the component (B2) are used in a mass ratio (A)/(B2) of 0.05 or higher and 4.0 or lower.

24. The method for suppressing hydration heat of a hydraulic composition according to any one of claims 19 to 23, wherein the hydraulic powder is a hydraulic powder having a content of a gypsum of 20% by mass or lower.

25. The method for suppressing hydration heat of a hydraulic composition according to any one of claims 19 to 24, wherein the component (A) and the component (B2) are added in a total amount of the component (A) and the component (B2) of 0.1 parts by mass or more and 2.0 parts by mass or less per 100 parts by mass of the hydraulic powder.