A composition for treating an inorganic slurry, the composition comprising: (a) a tetrakis (hydroxyorgano) phosphonium salt; and (b) a dispersant selected from the group consisting of (i) a phosphonated compound containing at least one tertiary nitrogen atom, (ii) a phosphonated oligomer of an unsaturated acid, (iii) a homopolymer of an unsaturated acid, and (iv) a polyphosphate.
COMPOSITION FOR TREATING AN INORGANIC SLURRY

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional application of application Ser. No. 13/856,058 filed Apr. 3, 2013, which is a continuation application of application Ser. No. 13/586,012 filed Aug. 15, 2012 (abandoned), which is a continuation application of application Ser. No. 10/542,432 filed Nov. 16, 2005 (abandoned), which is the United States national phase application of International application PCT/GB2004/000056 filed Jan. 12, 2004. The entire contents of each of Ser. Nos. 13/856,058, 13/586,012 and International application PCT/GB2004/000056 are hereby incorporated by reference herein.

This invention relates to a composition for treating inorganic slurries and to a method of treating inorganic slurries with the aforesaid composition so as to maintain the slurries in a substantially homogeneous phase.

The present invention will be described herein with particular reference to calcium carbonate-based slurries, especially those used in paper-making processes, although it is not to be construed as being limited thereto.

Most inorganic slurries contain about 70% to 80% by weight of solids. Many inorganic slurries (particularly those based on calcium carbonate) are known to be susceptible to bacterial contamination and it has been the practice to add one or more biocidally-active materials to the slurries in order to minimise such contamination.

Phosphorus-containing compounds, in particular tetrakis(hydroxyorgano)phosphonium salts (THP⁺ salts) are known to be effective biocides. Experimental work carried out by the applicants has shown, for example, that the addition of a solution of tetrakis(hydroxymethyl)phosphonium sulphate (THPS) to a calcium carbonate-based slurry can give rise to a reduction in bacterial count of 10⁶ in 2 hours.

However, it is also known that addition of THPS alone to a slurry results in instantaneous heterogeneous thickening and aggregation of the slurry.

The applicants have found that the use of a composition comprising a THP⁺ salt and a dispersant will provide continuing preservation against bacterial contamination, while at the same time maintaining the slurry in a substantially homogeneous phase.

Accordingly, in a first aspect, the present invention provides a composition for treating an inorganic slurry, the composition comprising:

(a) a tetrakis(hydroxyorgano)phosphonium salt (hereinafter THP⁺ salt); and
(b) a dispersant selected from the group consisting of:

(i) phosphonated compounds containing at least one tertiary nitrogen atom;
(ii) phosphonated oligomers of unsaturated acids;
(iii) homopolymers of unsaturated acids;
(iv) polyphosphates.

In accordance with the present invention, the THP⁺ salt is preferably tetrakis(hydroxymethyl)phosphonium sulphate.

Alternatively, the THP⁺ salt may be tetrakis(hydroxyethyl)phosphonium chloride, phosphate, nitrate or oxalate.

A preferred example of a dispersant of the type (b)(i) is a compound having one tertiary nitrogen atom, such as a sodium salt of trimethylene phosphate, particularly the tetra-sodium salt.

Preferred examples of dispersants of the type (b)(ii) include a phosphonated oligomer of maleic acid having the general formula H(CH₂OM.CH₂OM)₅PO₄M₂, wherein M is a cationic species such that the oligomer is soluble in water and n is a number greater than 1.

Other suitable oligomers are disclosed in the applicant's European Patent Specification 0 491 391.

A preferred example of a dispersant of the type (b)(iii) is a homopolymer of acrylic acid, especially a homopolymer having a molecular weight in the range 2000 to 5000.

Preferred examples of dispersants of the type (b)(iv) include sodium tripolyphosphate.

In a second aspect, the present invention provides a method of treating an inorganic slurry to maintain the slurry in a substantially homogeneous phase, the method comprising the addition to the slurry of an effective amount of a composition according to the first aspect of the present invention.

The inorganic slurry may, for example, comprise a calcium carbonate-based slurry.

Alternatively, the inorganic slurry may comprise a pigment slurry, a clay slurry or a cement slurry.

Preferably, the ratio of THP⁺ salt to dispersant in the composition is about 2:1 (as active ingredients).

Suitably, the composition may be added to the slurry in an amount in the range 10 ppm to 1000 ppm (by weight of the slurry), for example about 750 ppm (by weight of the slurry).

The present invention will be illustrated by way of the following examples.

In the examples, a 75% calcium carbonate slurry (commercially known as Setacarb) was treated with:

Example 1: THP⁺ salt alone.
Example 2: THP⁺ salt and dispersant of type (b)(i).
Example 3: THP⁺ salt and dispersant of type (b)(ii).

The amounts of each additive used, and the results, are given in the TABLE below.

<table>
<thead>
<tr>
<th>Example No.</th>
<th>THP⁺ salt (ppm)</th>
<th>Dispersant (ppm)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(a) THPS</td>
<td>(b)(ii)</td>
<td>Instant heterogeneous thickening</td>
</tr>
<tr>
<td></td>
<td>750 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(a) THPS</td>
<td>(b)(i)</td>
<td>No thickening</td>
</tr>
<tr>
<td></td>
<td>750 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(a) THPS</td>
<td>(b)(ii)</td>
<td>No thickening</td>
</tr>
<tr>
<td></td>
<td>750 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes to TABLE:

(a) An aqueous solution of tetrakis(hydroxymethyl)phosphonium sulphate (75% w/w), available as TOLCELE 4-P575.
(b) A quarternary solution of the tetra sodium salt of tetrakis(trimethylene phosphonic acid), available as BRIQUEST 8 301-325.
(c) A homopolymer of polyacrylic acid, having a molecular weight in the range 2000-5000 and available as BEVALOYD 8311.

1. A composition for treating an inorganic slurry, the composition comprising:

(a) a tetrakis(hydroxyorgano)phosphonium salt; and
(b) a dispersant selected from the group consisting of:

(i) a phosphonated compound containing at least one tertiary nitrogen atom;
(ii) a phosphonated oligomer of an unsaturated acid.
(iii) a homopolymer of an unsaturated acid, and
(iv) a polyphosphate.

2. The composition according to claim 1, in which the
tetraakis (hydroxyorgano) phosphonium salt is tetrakis (hydroxyethyl) phosphonium sulphate.

3. The composition according to claim 1, in which the
tetraakis (hydroxyorgano) phosphonium salt is selected from
the group consisting of tetraakis (hydroxyethyl) phosphonium chloride, tetrakis (hydroxyethyl) phosphonium phosphate, tetrakis (hydroxyethyl) phosphonium nitrate and tetraakis (hydroxyethyl) phosphonium oxalate.

4. The composition according to claim 1, in which the dispersant is (b(i)) and is a phosphonated compound containing one tertiary nitrogen atom.

5. The composition according to claim 4, in which the dispersant is (b(i)) and is a sodium salt of nitrilo-tris (methylenephosphonate).

6. The composition according to claim 5, in which the sodium salt is a tetra-sodium salt.

7. The composition according to claim 1, in which the dispersant is (b(ii)) and is a phosphonated oligomer of maleic acid.

8. The composition according to claim 7, in which the oligomer has the formula H(CH₂OM₂CH₂OM₂)ₙPO₃M₂, wherein M is a cationic species such that the oligomer is soluble in water and n is a number greater than 1.

9. The composition according to claim 1, in which the dispersant is (b(iii)) and is a homopolymer of acrylic acid.

10. The composition according to claim 7, in which the homopolymer has a molecular weight of 2000 to 5000.

11. The composition according to claim 1, in which the dispersant is (b(iv)) and is sodium tripolyphosphate.

12. The composition according to claim 1, in which a ratio of the tetraakis (hydroxyorgano) phosphonium salt to the dispersant, as active ingredients, in the composition is about 2:1.

13. A composition for treating an inorganic slurry, the composition comprising:
(a) a tetraakis (hydroxyorgano) phosphonium salt selected from the group consisting of tetrakis (hydroxyethyl) phosphonium sulphate, tetrakis (hydroxyethyl) phosphonium chloride, tetrakis (hydroxyethyl) phosphonium nitrate, tetrakis (hydroxyethyl) phosphonium oxalate; and
(b) a dispersant which is the tetra sodium salt of nitrilo-tris (methylenephosphonate).

14. The composition according to claim 13, in which the tetrakis (hydroxyorgano) phosphonium salt is tetrakis (hydroxyethyl) phosphonium sulphate.

15. The composition according to claim 13, in which the tetrakis (hydroxyorgano) phosphonium salt is selected from the group consisting of tetrakis (hydroxyethyl) phosphonium chloride, tetrakis (hydroxyethyl) phosphonium phosphate, tetrakis (hydroxyethyl) phosphonium nitrate and tetrakis (hydroxyethyl) phosphonium oxalate.

16. The composition according to claim 13, in which a ratio of the tetrakis (hydroxyorgano) phosphonium salt to the dispersant, as active ingredients, in the composition is about 2:1.

17. A composition for treating an inorganic slurry, the composition comprising:
(a) a tetrakis (hydroxyorgano) phosphonium salt selected from the group consisting of tetrakis (hydroxyethyl) phosphonium sulphate, tetrakis (hydroxyethyl) phosphonium chloride, tetrakis (hydroxyethyl) phosphonium nitrate, tetrakis (hydroxyethyl) phosphonium oxalate; and
(b) a dispersant which is a homopolymer of acrylic acid, the homopolymer having a molecular weight in the range of 2,000 to 5,000.

18. The composition according to claim 17, in which the tetrakis (hydroxyorgano) phosphonium salt is tetrakis (hydroxyethyl) phosphonium sulphate.

19. The composition according to claim 17, in which the tetrakis (hydroxyorgano) phosphonium salt is selected from the group consisting of tetrakis (hydroxyethyl) phosphonium chloride, tetrakis (hydroxyethyl) phosphonium phosphate, tetrakis (hydroxyethyl) phosphonium nitrate and tetrakis (hydroxyethyl) phosphonium oxalate.

20. The composition according to claim 17, in which a ratio of the tetrakis (hydroxyorgano) phosphonium salt to the dispersant, as active ingredients, in the composition is about 2:1.