

TABLE 3

Structural formulae for pure smectites (<1 micron size fractions) used in the experiments, calculated from the data in Table 2. The first parentheses in the formulae below contain the octahedral cations, the second the tetrahedral cations. The first brackets contain the 2:1 layer atoms, with the net negative charge as the superscript. The second brackets contain the interlayer cations, with their balancing positive charge as the superscript. These clay minerals also contain loosely bound water molecules (nH₂O), which are not included in the formulae.

Clay mineral	Structural formula
Wyoming montmorillonite	$[(Al_{1.52}Fe_{0.07}^{3+}Fe_{0.14}^{2+}Mg_{0.26})^{-0.40}(Si_{3.93}Al_{0.07})^{-0.07}O_{10}(OH)_2]^{-0.47}[Ca_{0.21}Na_{0.05}K_{0.01}]^{+0.50}$
Kinney montmorillonite	$[(Al_{1.48}Fe_{0.06}^{3+}Mg_{0.46})^{-0.46}(Si_{3.93}Al_{0.07})^{-0.07}O_{10}(OH)_2]^{-0.53}[Na_{0.50}]^{+0.50}$

TABLE 4

Comparison between bacterial viability and oxidation-reduction potential (ORP) for various bacteria, for a variety of natural clays, and for pyrite-amended clays. Suspensions were 40 mg clay/mL water, unless otherwise noted, and experiments lasted for 24 h.

FIG. Ref.	Bacteria tested	Mineral used	Viable cells (% of total)	ORP (mV)
2A	<i>Streptococcus</i> sp.	Culture control	73.0	167.0
		Argiletz	84.9	81.1
		Wyoming	57.2	98.6
		Argicur (heated 200 C.)	16.6	-96.2
		Argicur	2.5	-101.0
2B	<i>Staphylococcus epidermidis</i>	Pyroclay	1.2	-48.1
		Culture control	93.0	126.0
		Miraculite	99.8	144.0
		Pyrite only (1 h grind)	7.4	-49.0
		Pyrite only (0.5 h grind)	1.1	-32.0
		North Sea sediment	0.17	-91.0
		Pyroclay	0.07	-115.0
2C	<i>Escherichia coli</i>	Argicur	0.03	-122.0
		Culture control	84.0	120.0
		Ormalite	63.3	53.7
		Pyrite only	3.5	-58.0
		Pyroclay	2.6	-113.0
3	<i>Escherichia coli</i>	North Sea sediment	1.2	-137.0
		Argicur	0.5	-175.0
		Pyroclay (0.4 mg/mL)	44.8	68.0
		Pyroclay (4 mg/mL)	28.7	62.0
		Pyroclay (20 mg/mL)	33.7	55.0
5A	<i>Staphylococcus epidermidis</i>	Pyroclay (40 mg/mL)	0.2 to 2.6	-113.0
		Wyoming with no pyrite	44.5	2.1
		Wyoming with pyrite ground 0.5 h	3.4	-35.1
		Wyoming with pyrite ground 1.0 h	1.6	-55.4
5B	<i>Escherichia coli</i>	Wyoming with no pyrite	19.1	-47.1
		Wyoming with 10% pyrite ground 0.5 h	7.8	-83.1
		Wyoming with 10% pyrite ground 1.0 h	2.8	-56.7
		Culture control	95.8	167.0
5C	<i>Escherichia coli</i>	Kinney only	60.6	2.3
		Kinney + 10% pyrite + 10% calcite	31.7	-78.4
		Kinney + 1% pyrite	22.6	-86.4
		Kinney + 10% pyrite	3.1	-91.9
		Weathered Blue clay	89.8	78.4
6	<i>Escherichia coli</i>	Blue clay	10.3	-27.9

1. (canceled)

2. A synthetic bactericidal composition, comprising a bactericidal effective amount of a particulate reducing agent selected from the group consisting of pyrite, marcasite, pyrrhotite, FeS₂, FeS, FeSO₄, and a combination thereof, and

a clay or clay mineral comprising a smectite clay, an illite clay, a rectorite clay, or a combination thereof.

3. (canceled)

4. The composition of claim 1, wherein said fine particulate reducing agent is present in said composition in an amount ranging from approximately 0.5% wt. to 10% wt. of said composition.

5. The composition of claim 2, wherein the particle size of said reducing agent is less than 1 micron.

6-7. (canceled)

8. The composition of claim 2, wherein said reducing agent is pyrite, and wherein said clay is a smectite clay.

9. The composition of claim 8, wherein said composition comprises 0.5% wt. to 10% wt. fine particulate pyrite; and wherein the particle size of said pyrite is less than one micron.

10. The composition of claim 8, wherein said composition comprises approximately 10% wt. pyrite and a Ca-saturated smectite clay.

11-18. (canceled)

19. A method of treating a bacterial skin infection, comprising topically applying to the site of said bacterial skin infection a composition as set forth in claim 2.

20. A method of treating a bacterial skin infection, comprising:

adding to a composition as set forth in claim 2 a suitable aqueous liquid in an amount so as to create a paste; and topically applying said hydrated composition to the site of said bacterial skin infection.

21. The method of claim 20, wherein said suitable aqueous liquid is water.

22. The method of claim 20, wherein said bacterial skin infection is caused by one or more bacteria selected from the group consisting of *Mycobacterium ulcerans*, *E. coli*, ESBL *E. coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Staphylococcus epidermidis*, *S. aureus*, MRSA, *M. smegmatis*, *Streptococcus* sp. and *M. marinum*.

23. A method of making a synthetic bactericidal composition comprising:

adding a bactericidal effective amount of a reducing agent in fine particulate form to a non-bactericidal clay or non-bactericidal clay mineral, wherein said reducing agent is pyrite, marcasite, pyrrhotite, FeS₂, FeSO₄, FeS; and

rendering said composition bactericidal.

24. (canceled)

25. The method of claim 23, wherein said fine particulate reducing agent is added to said clay or clay mineral so as to be present in said bactericidal composition in an amount ranging from 0.5% wt. to 10% wt.