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(54) Title: ANTIMICROBIAL COMPOSITIONS

(57) Abrégé/Abstract:
Compositions for generating antimicrobial activity are described. The compositions comprise an enzyme that is able to convert a substrate to release hydrogen peroxide, a substrate for the enzyme, and a solute in the form of a sugar or sugar derivative having a solubility of at least 100g/100g water at 20°C and 1 atm. The compositions may not comprise sufficient free water to allow the enzyme to convert the substrate.

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(54) Title: ANTIMICROBIAL COMPOSITIONS

(57) Abstract: Compositions for generating antimicrobial activity are described. The compositions comprise an enzyme that is able to convert a substrate to release hydrogen peroxide, a substrate for the enzyme, and a solute in the form of a sugar or sugar derivative having a solubility of at least 100g/100g water at 20°C and 1 atm. The compositions may not comprise sufficient free water to allow the enzyme to convert the substrate.

Claims

1. A composition for generating antimicrobial activity, which comprises:
a purified enzyme that is able to convert a substrate to release hydrogen peroxide;
a purified substrate for the enzyme; and
a solute in the form of a sugar or sugar derivative having a solubility of at least 100g/100g water at 20°C and 1 atm,
wherein the composition does not comprise sufficient free water to allow the enzyme to convert the substrate.

2. A composition according to claim 1, wherein the solute has a solubility of at least 300g/100g water.

3. A composition according to any preceding claim, wherein the solute is a monosaccharide.

4. A composition according to claim 4, wherein the monosaccharide is fructose.

5. A composition according to any preceding claim, wherein the solute is at least 60% by dry weight of the composition.

6. A composition according to any preceding claim, wherein the substrate is at least 30% by dry weight of the composition.

7. A composition according to any preceding claim, wherein the combined dry weight of the substrate and the solute is at least 90%, preferably at least 95% of the composition, or wherein the total amount of sugar or sugar derivative in the composition is at least 90%, by dry weight, preferably at least 95%, by dry weight.

8. A composition according to any preceding claim, comprising a buffer.

9. A composition according to any preceding claim which has a pH of 6 to 8.

10. A composition according to any preceding claim, which provides for sustained release of hydrogen peroxide at a level of less than 2 mmol/litre and/or at level of at least 0.1 mmol/litre for a period of at least twenty four hours, following dilution of the composition.

11. A composition according to any preceding claim, wherein the enzyme is a glucose oxidase and the substrate for the enzyme is D-glucose.

12. A composition according to any preceding claim which is sterile, optionally wherein the composition has been sterilised by exposure to irradiation, preferably gamma irradiation, more preferably 10-70 kGy, even more preferably 25-70 kGy, most preferably 35-70 kGy.

13. A composition according to any of claims 1 to 11 which is sterile and has been sterilised by exposure to electron beam irradiation, preferably 10 to 100 kGy, more preferably 35 to 80 kGy.

14. A composition according to any preceding claim comprising substantially no hydrogen peroxide.

15. A composition according to any preceding claim, wherein the substrate for the enzyme is the solute, or wherein the substrate for the enzyme is distinct from the solute.

16. A composition according to any preceding claim, comprising substantially no zinc oxide.

17. A composition according to any preceding claim, comprising substantially no catalase.

18. A composition according to any preceding claim comprising substantially no peroxidase.

19. A composition according to any preceding claim wherein the composition is a pharmaceutical grade composition.

20. A composition according to any preceding claim comprising 25 to 2000 ppm of the enzyme.

21. A composition according to claim 20, comprising 250 to 1500 ppm of the enzyme.

22. A composition according to any preceding claim which does not comprise honey.

23. A composition according to any of claims 1 to 22, for use as a medicament.

24. A composition according to any of claims 1 to 22, for use in prevention, treatment, or amelioration of a microbial infection.

25. A composition according to any of claims 1 to 22, for use in treatment of a wound.

26. A wound dressing comprising a dressing material for dressing a wound, and a composition according to any of claims 1 to 22.

27. A method for producing a composition for generating antimicrobial activity, which comprises: contacting a purified enzyme that is able to convert a substrate to release hydrogen peroxide with a purified substrate for the enzyme, and a solute in the form of at least one sugar or sugar derivative, the solute having a solubility greater than 100g/100g water at 20°C and 1 atm,

wherein the composition does not comprise sufficient free water to allow the enzyme to convert the substrate.

28. A method according to claim 27, wherein the enzyme, substrate and solute are contacted with each other in dry form, preferably in powder form.

29. A method according to claim 27, wherein the composition is in the form of a liquid or a solution, and the substrate, solute and enzyme are dissolved in water.

30. A method of sterilising a composition or wound dressing according to any of claims 1 to 26, which comprises exposing the composition or dressing to irradiation, preferably gamma irradiation or electron beam radtiation, preferably 10-70 kGy, more preferably 25-70 kGy, most preferably 35-70 kGy.

31. A method of forming an antimicrobial solution comprising diluting a composition as defined in any of claims 1 to 22 in an aqueous solution such that there is sufficient free water to allow the enzyme to convert the substrate.

32. A method according to claim 31, comprising diluting the composition to form a solution which contains 30 g/l to 150 g/l, 50 to 100 g/l or 65 to 75 g/l of the composition.

33. A solution obtained or obtainable by a method according to claim 31 or 32.

34. A solution according to claim 33 in which hydrogen peroxide is present at a concentration of at least 10 μM, preferably 10 to 50 μM, more preferably 20 to 30 μM.

35. A solution according to claim 34, wherein the concentration of hydrogen peroxide is maintained for at least 1 hour, preferably at least 2 hours, more preferably at least 10 hours, even more preferably at least 24 hours following formation.

36. A composition comprising: a purified enzyme that is able to convert a substrate to release hydrogen peroxide; a purified substrate for the enzyme; a solute in the form of a sugar or sugar derivative having a solubility of at least 100g/100g water at 20°C and 1 atm, and sufficient free water to allow the enzyme to convert the substrate, wherein hydrogen peroxide is present at a concentration of at least 10 μM, preferably 10 to 50 μM, more preferably 20 to 30 μM.

37. A composition according to claim 36, wherein the concentration of hydrogen peroxide is maintained for at least 1 hour, preferably at least 2 hours, more preferably at least 10 hours, even more preferably at least 24 hours, following formation.

38. A solution or composition according to any of claims 33 to 37, for use in the treatment of a microbial infection that comprises a biofilm.

39. A solution or composition for use according to claim 38, wherein the microbial infection comprises *Haemophilus influenza,* MRSA or MSSA.

40. A solution or composition according to any of claims 33 to 37 for use in treating chronic rhinosinusitis.

41. A solution or composition as defined in any of claims 1 to 22 or 33 to 37, for use in treating an infection that comprises a biofilm, wherein the composition is administered with an antibiotic, optionally wherein the antibiotic is co-amoxiclav and/or optionally wherein the infection comprises *Haemophilus influenza*.

42. A solution or composition for use according to claim 41, wherein the administration is combined, concurrent, or sequential.

43. A solution or composition according to any of claims 1 to 22 or 33 to 37, comprising an antibiotic, optionally wherein the antibiotic is co-amoxiclav.

44. A kit comprising a composition or solution according to any of claims 1 to 22 or 33 to 37, and separately, an antibiotic.

45. A solution or composition according to any of claims 1 to 22 or 33 to 37, for use in the treatment of aphthous ulcers or geographic tongue.