- providing an elastomeric film comprising one or more film layers, the elastomeric film including first and second opposing surfaces;
- introducing an antimicrobial agent onto or into the first opposing surface; and
- introducing a skin-protective agent selected from a probiotic, a prebiotic, or a combination thereof onto or into the second opposing surface.

To ensure that the antimicrobial agent does not appear in any appreciable amount on the inner surface of the film (i.e. to ensure that the inner surface is free of an antimicrobially effective amount of antimicrobial agent that is effective against both beneficial and harmful microorganisms), the step of introducing an antimicrobial agent onto or into the first opposing surface should be performed in a manner so as to avoid the antimicrobial agent from being introduced onto the second opposing surface. Examples of techniques for ensuring this occurs are described in the detailed description.

In preferred examples, the applicant found that unexpected benefits come from including a layer that is free of both the antimicrobial agent and the skin-protective agent between the external and internal surfaces that contain those agents. This layer functions as a barrier layer, and aids in preserving the efficacy of the skin-protective agent.

Therefore, according to a one aspect, there is provided an elastomeric article comprising:

- an elastomeric film comprising one or more film layers, and including an external surface and an internal surface,
- an antimicrobial agent that is effective against both beneficial and harmful microorganisms on the external surface of the elastomeric film,
- a skin-protective agent selected from a probiotic, a prebiotic, or a combination thereof on the internal surface of the elastomeric film, and
- a barrier film layer that provides separation between the antimicrobial agent and the skin-protective agent;

wherein the inner surface of the film is free of an antimicrobially-effective amount of an antimicrobial agent that is effective against both beneficial and harmful microorganisms.

In another aspect, there is provided an elastomeric article comprising:

- an elastomeric film comprising one or more film layers, and including an external surface and an internal surface,

- an antimicrobial agent that is effective against both beneficial and harmful microorganisms on the external surface of the elastomeric film or incorporated into an outermost film layer of said one or more film layers which forms the external surface of the elastomeric film,
- a skin-protective agent selected from a probiotic, a prebiotic, or a combination thereof, on the internal surface of the elastomeric film, and
- a barrier layer that provides separation between the antimicrobial agent and the skin-protective agent and substantially prevents migration of the antimicrobial agent to the internal surface of the elastomeric film,

wherein the internal surface of the film is free of an antimicrobially-effective amount of an antimicrobial agent that is effective against both beneficial and harmful microorganisms.

In another aspect, there is provided a method for the manufacture of an elastomeric article, the method comprising:

- providing an elastomeric film comprising one or more film layers, the elastomeric film including first and second opposing surfaces;
- introducing an antimicrobial agent that is effective against both beneficial and harmful microorganisms onto or into the first opposing surface in a manner so as to avoid the antimicrobial agent from being introduced onto or into the second opposing surface;
- introducing a skin-protective agent selected from a probiotic, a prebiotic, or a combination thereof onto or into the second opposing surface; and
- providing a barrier layer in the elastomeric film that provides separation between the antimicrobial agent and the skin-protective agent and substantially prevents migration of the antimicrobial agent to the second opposing surface of the elastomeric film,
- wherein the second opposing surface of the elastomeric article produced by the method is free of an antimicrobially-effective amount of antimicrobial agent.

In another aspect, there is provided a method for the manufacture of an elastomeric article, the method comprising:

- providing an elastomeric film comprising one or more film layers, the elastomeric film including first and second opposing surfaces;

- introducing an antimicrobial agent that is effective against both beneficial and harmful microorganisms onto or into the first opposing surface in a manner so as to avoid the antimicrobial agent from being introduced onto or into the second opposing surface; and

- providing a barrier layer between the antimicrobial agent on or in the first opposing surface of the elastomeric film and the second opposing surface of the film that substantially prevents migration of the antimicrobial agent to the second opposing surface of the elastomeric film, to prevent contact between the antimicrobial agent on or in the first opposing surface of the elastomeric film and skin that comes into contact with the second opposing surface of the article,

- wherein the second opposing surface of the elastomeric article produced by the method is free of an antimicrobially-effective amount of an antimicrobial agent.

According to another preferred example, there is provided a method for the manufacture of an elastomeric article, the method comprising:

- providing an elastomeric film comprising one or more film layers, the elastomeric film including first and second opposing surfaces;
- introducing an antimicrobial agent that is effective against both beneficial and harmful microorganisms onto or into the first opposing surface in a manner so as to avoid the antimicrobial agent from being introduced onto or into the second opposing surface;
- introducing a skin-protective agent selected from a probiotic, a prebiotic, or a combination thereof onto or into the second opposing surface; and
- providing a barrier film layer in the elastomeric film that provides separation between the antimicrobial agent and the skin-protective agent.

In the course of preparing the above films, the applicant has additionally found that very effective articles that are antimicrobial while avoiding excessive irritation to the skin can be prepared without any skin-protective agent on the inner surface. In such instances, care must be taken to ensure that the antimicrobial agent is applied to the external surface of the article, and a barrier layer is also required. In another aspect, there is accordingly provided an elastomeric article comprising:

- an elastomeric film comprising one or more film layers, and including an external surface and an internal surface;
- an antimicrobial agent that is effective against both beneficial and harmful microorganisms on the external surface of the elastomeric film; and
- a barrier film layer between the antimicrobial agent on the external surface of the elastomeric film and the internal surface, to prevent or minimise contact between the antimicrobial agent on the external surface of the elastomeric film and skin that comes into contact with the internal surface of the article, wherein the internal surface of the film is free of an antimicrobially-effective amount of an antimicrobial agent that is effective against both beneficial and harmful microorganisms.

In another aspect, there is provided an elastomeric article comprising:

- an elastomeric film comprising one or more film layers, and including an external surface and an internal surface;
- an antimicrobial agent that is effective against both beneficial and harmful microorganisms on the external surface of the elastomeric film or incorporated into

- an outermost film layer of said one or more film layers which forms the external surface of the elastomeric film; and

- a barrier layer between the antimicrobial agent on the external surface of the elastomeric film and the internal surface, or between the outermost film layer containing the antimicrobial agent and the internal surface, wherein said barrier layer substantially prevents migration of the antimicrobial agent to the internal surface of the elastomeric film, to prevent contact between the antimicrobial agent and skin that comes into contact with the internal surface of the article,

- wherein the internal surface of the film is free of an antimicrobially-effective amount of an antimicrobial agent that is effective against both beneficial and harmful microorganisms.

The reference to skin that comes into contact with the internal surface of the article refers to skin that, in use, comes into contact with the inner surface of the article.

According to the present disclosure, there is provided an elastomeric glove produced by the methods described above.

CLAIMS:

1. An elastomeric article comprising:

- an elastomeric film comprising one or more film layers, and including an external surface and an internal surface,
- an antimicrobial agent that is effective against both beneficial and harmful microorganisms on the external surface of the elastomeric film or incorporated into an outermost film layer of said one or more film layers which forms the external surface of the elastomeric film,
- a skin-protective agent selected from a probiotic, a prebiotic, or a combination thereof, on the internal surface of the elastomeric film, and
- a barrier layer that provides separation between the antimicrobial agent and the skin-protective agent and substantially prevents migration of the antimicrobial agent to the internal surface of the elastomeric film,

wherein the internal surface of the film is free of an antimicrobially-effective amount of an antimicrobial agent that is effective against both beneficial and harmful microorganisms.

2. The elastomeric article of claim 1, wherein the barrier layer is a barrier film layer.

3. The elastomeric article of any one of claims 1 to 2, wherein the elastomeric film is a single layer film.

4. The elastomeric article of any one of claims 1 to 2, wherein the elastomeric film is a multilayer film comprising a first film layer that defines the external surface of the article and a second film layer that defines the internal surface of the article.

5. The elastomeric article of claim 4, wherein the antimicrobial agent is present within the first film layer.

6. The elastomeric article of claim 5, wherein the antimicrobial agent is present in the first film layer through incorporation into a coagulant used in the production of the elastomeric article, or through incorporation into an elastomeric film-forming composition used to produce the first film layer.

7. The elastomeric article of claim 6, wherein the amount of antimicrobial agent in the first film layer is 0.01 to 20 phr.

8. The elastomeric article of claim 7, wherein the amount of antimicrobial agent in the first film layer is 0.1 to 10 phr.

9. The elastomeric article of any one of claims 1 to 4, wherein the article comprises a coating layer on the external surface of the article, and the coating layer on the external surface comprises the antimicrobial agent.

10. The elastomeric article of any one of claims 1 to 9, wherein the skin-protective agent is present in a coating on the internal surface of the elastomeric film.

11. The elastomeric article of any one of claims 1 to 10, wherein the article comprises a dry, dehydrated coating layer on the internal surface of the article, and the coating layer on the internal surface comprises the skin-protective agent.

12. The elastomeric article of claim 11, wherein the coating layer constitutes 0.001% to 30% by weight of the total weight of the article.

13. The elastomeric article of claim 11 or claim 12, wherein the total amount of the skin-protective agent in the coating layer is at least 5% by weight of the coating layer.

14. The elastomeric article of any one of claims 1 to 13, wherein the antimicrobial agent is selected from the group consisting of pyrithiones, phenolic compounds, heterocyclic compounds, quaternary ammonium salts, biguanide compounds, parabens, antibiotics, antivirals, antifungals, antimicrobial peptides and combinations of one or more thereof.

15. The elastomeric article of claim 14, wherein the antimicrobial agent is selected from the group consisting of pyrithiones, phenolic compounds, and combinations thereof.

16. The elastomeric article of any one of claims 1 to 15, wherein the skin-protective agent comprises a probiotic selected from the group consisting of *Lactobacillus*, *Lactococcus*, *Bifidobacterium*, and combinations thereof.

17. The elastomeric article of any one of claims 1 to 15, wherein the skin-protective agent comprises a prebiotic selected from the group consisting of saccharides, phytosphingosine and derivatives or salts thereof, lactic acid, glycomacropeptide, amino acids, peptides and combinations or salts thereof.

18. The elastomeric article of claim 17, wherein the prebiotic comprises a saccharide selected from the group consisting of alpha-glucan, beta-glucan, fructooligosaccharides, inulin, and combinations thereof.

19. The elastomeric article of any one of claims 1 to 18, wherein the skin-protective agent comprises both the probiotic and the prebiotic.

20. The elastomeric article of any one of claims 1 to 19, wherein the elastomeric film comprises an elastomer selected from the group consisting of natural rubber, nitrile rubber, silicone rubber, polyvinyl chloride, polyethylene, polypropylene, polyurethane, polyisoprene, polychloroprene, polystyrene, acrylic polymers, polybutadienes, fluoroelastomers, copolymers or blends of these polymers or their monomers, and derivatives or blends thereof.

21. The elastomeric article of any one of claims 1 to 20, wherein the elastomeric film comprises an elastomer selected from the group consisting of natural rubber, nitrile rubber, polyisoprene, polychloroprene, polyurethane, copolymers or blends of these polymers or their monomers, and derivatives or blends thereof.

22. The elastomeric article of any one of claims 1 to 21, in the form of a glove, finger cot or footwear.

23. The elastomeric article of any one of claims 1 to 22, wherein the article has an average thickness of between 0.01 and 3.0 mm.

24. The elastomeric article of any one of claims 1 to 23, with:

- a modulus at 500% stretch of less than 15 MPa,
- a modulus at 300% stretch of less than 10 MPa,
- a tensile strength of at least 8 MPa; and/or
- an elongation to break of at least 200%.

25. The elastomeric article of any one of claims 1 to 24, wherein the probiotic is in the form of a ferment lysate or extract.

26. A method for the manufacture of an elastomeric article, the method comprising:

- providing an elastomeric film comprising one or more film layers, the elastomeric film including first and second opposing surfaces;
- introducing an antimicrobial agent that is effective against both beneficial and harmful microorganisms onto or into the first opposing surface in a manner so as to

avoid the antimicrobial agent from being introduced onto or into the second opposing surface;

- introducing a skin-protective agent selected from a probiotic, a prebiotic, or a combination thereof, onto or into the second opposing surface; and
- providing a barrier layer in the elastomeric film that provides separation between the antimicrobial agent and the skin-protective agent and substantially prevents migration of the antimicrobial agent to the second opposing surface of the elastomeric film,
- wherein the second opposing surface of the elastomeric article produced by the method is free of an antimicrobially-effective amount of antimicrobial agent.

27. The method of claim 26, comprising incorporating the barrier layer into the elastomeric article as a barrier film layer.

28. The method of claim 27, the method comprising producing a first film layer from a first elastomeric film-forming composition which comprises the antimicrobial agent so as to result in the introduction of the antimicrobial agent into the first opposing surface of the article, and producing the barrier film layer as a separate layer of the elastomeric film.

29. The method of claim 28, comprising dipping a mould into the first elastomeric film-forming composition to produce the first film layer, and dipping the mould into a second elastomeric film-forming composition to form the barrier film layer.

30. The method of claim 28 or claim 29, comprising incorporating the antimicrobial agent into the first elastomeric film-forming composition in an amount of from 0.01 to 20 phr.

31. The method of claim 27, the method comprising:

- dipping a mould into a coagulant composition comprising the antimicrobial agent and dipping the coagulant-dipped mould into a first elastomeric film-forming composition to produce a first film layer of the elastomeric film, the dipping steps resulting in incorporation of the antimicrobial agent into the first film layer; and
- dipping the mould with the first film layer into a second elastomeric film-forming composition to form the barrier film layer.

32. The method of claim 31, comprising incorporating the antimicrobial agent into the coagulant composition in an amount of from 0.01% to 50% by weight of the coagulant composition.

33. The method of any one of claims 26 to 32, comprising coating a coating composition comprising the antimicrobial agent onto the first opposing surface of the elastomeric film.

34. The method of claim 33, comprising spray coating or tumble coating the coating composition onto the first opposing surface of the elastomeric film.

35. The method of any one of claims 26 to 34, comprising coating a coating composition comprising the skin-protective agent onto the second opposing surface of the elastomeric film, and drying the coating composition comprising the skin-protective agent to form a dry, dehydrated coating layer comprising the skin-protective agent.

36. The method of claim 35, comprising coating a coating composition comprising a skin-protective agent in an amount of between 0.01% and 50% by weight of the coating composition onto the second opposing surface of the elastomeric film.

37. The method of claim 35, comprising coating a coating composition comprising a skin-protective agent in an amount of between 0.01% and 30% by weight of the coating composition onto the second opposing surface of the elastomeric film.

38. The method of claim 36 or claim 37, comprising dip coating, spray coating or tumble coating the coating composition onto the second opposing surface of the elastomeric film.

39. The method of any one of claims 35 to 38, wherein the coating composition coated onto the second opposing surface of the elastomeric film comprises:

- 0.01 – 20% by weight of the skin-protective agent;
- optionally one or more of a dispersing agent, an emulsifier, a solubiliser, a rheology modifier, a wetting agent, an emollient, a skin conditioning agent, a humectant, a preservative, silicone, fragrance and a pH adjustor; and
- water.

40. The method of any one of claims 35 to 39, comprising applying the coating composition comprising the skin-protective agent onto the elastomeric film by dipping or spray coating in an online process prior to curing of the elastomeric film.

41. The method of any one of claims 29 to 32, comprising dipping the mould with the first elastomeric film layer comprising the antimicrobial agent and the barrier layer into a third elastomeric film-forming composition comprising the skin-protective agent, to produce a third film layer comprising the skin-protective agent.

42. The method of claim 41, wherein the step of dipping the mould into the third elastomeric film-forming composition comprises dipping into a third elastomeric film-forming composition comprising 0.01 – 50 phr of skin-protective agent.

43. The method of claim 26, comprising applying a coating composition comprising the antimicrobial agent onto the first surface of the elastomeric film, and applying a coating composition comprising the skin-protective agent onto the second opposing surface of the elastomeric film.

44. The method of any one of claims 26 to 43, wherein the skin-protective agent comprises a probiotic in the form of a ferment lysate or extract.

45. The method of any one of claims 26 to 44, wherein the skin-protective agent comprises both the probiotic and the prebiotic.

46. An elastomeric article comprising:

- an elastomeric film comprising one or more film layers, and including an external surface and an internal surface;
- an antimicrobial agent that is effective against both beneficial and harmful microorganisms on the external surface of the elastomeric film or incorporated into an outermost film layer of said one or more film layers which forms the external surface of the elastomeric film; and
- a barrier layer between the antimicrobial agent on the external surface of the elastomeric film and the internal surface, or between the outermost film layer containing the antimicrobial agent and the internal surface, wherein said barrier layer substantially prevents migration of the antimicrobial agent to the internal surface of the elastomeric film, to prevent contact between the antimicrobial agent and skin that comes into contact with the internal surface of the article,
- wherein the internal surface of the film is free of an antimicrobially-effective amount of an antimicrobial agent that is effective against both beneficial and harmful microorganisms.

47. A method for the manufacture of an elastomeric article, the method comprising:

- providing an elastomeric film comprising one or more film layers, the elastomeric film including first and second opposing surfaces;
- introducing an antimicrobial agent that is effective against both beneficial and harmful microorganisms onto or into the first opposing surface in a manner so as to avoid the antimicrobial agent from being introduced onto or into the second opposing surface; and
- providing a barrier layer between the antimicrobial agent on or in the first opposing surface of the elastomeric film and the second opposing surface of the film that substantially prevents migration of the antimicrobial agent to the second opposing surface of the elastomeric film, to prevent contact between the antimicrobial agent on or in the first opposing surface of the elastomeric film and skin that comes into contact with the second opposing surface of the article;
- wherein the second opposing surface of the elastomeric article produced by the method is free of an antimicrobially-effective amount of an antimicrobial agent.