

CLAIMS:

1. A capsule comprising one or more strains of strict obligate anaerobic bacteria, wherein the capsule has a porous wall comprising surface pores with a molecular weight cut off between 50 and 200 kDa, wherein the porous wall comprises a complex formed from sodium cellulose sulphate and poly[dimethyldiallyl-ammonium chloride].
2. The capsule of claim 1, wherein the one or more strains of strict obligate anaerobic bacteria encapsulated in the capsule have improved stability in the presence of oxygen relative to a corresponding one or more strains of the bacteria not encapsulated in the capsule.
3. The capsule of claim 1 or claim 2, which is freeze-dried.
4. The capsule of any one of claims 1-3, wherein at least one of the strains of strict obligate anaerobic bacteria is a lactic acid-utilising bacteria (LUB).
5. The capsule of any one of claims 1-3, wherein at least one of the strains of strict obligate anaerobic bacteria is a starch-utilising bacteria.
6. The capsule of claim 4 or claim 5, wherein at least one of the strains of strict obligate anaerobic bacteria is from a genus selected *Megasphaera* and/or *Ruminococcus*.
7. The capsule of claim 6, wherein at least one of the strains of strict obligate anaerobic bacteria is *Megasphaera elsdenii* or *Ruminococcus bromii*.
8. The capsule of any one of claims 1-7 comprising *Megasphaera elsdenii* and *Ruminococcus bromii*.
9. The capsule of any one of claims 1-8, wherein the capsule does not comprise bacteria from a genus selected from the group consisting of: *Bifidobacterium*, *Bacteroides*, *Fusobacterium*, *Propionibacterium*, *Enterococcus*, *Lactococcus*, *Peptostreptococcus*, *Pediococcus*, *Leuconostoc*, *Weissella*, *Geobacillus*, and *Lactobacillus*.
10. The capsule of any one of claims 1-9, wherein the porous capsule contains at least 0.2×10^6 CFU of the strict obligate anaerobic bacteria.

11. The capsule of any one of claims 1-10, wherein the bacteria are suspended in the log phase of growth within the capsule.
12. The capsule of any one of claims 1-11, wherein the one or more strains of strict obligate anaerobic bacteria remain viable within the capsule for at least 30 days when stored under anaerobic conditions at ambient temperatures.
13. The capsule of claim 12, wherein the porous capsule contains at least about 0.4×10^5 CFU of the strict obligate anaerobic bacteria one month after encapsulation following storage under anaerobic conditions at ambient temperature.
14. The capsule of claim 12, wherein the porous capsule contains at least about 0.4×10^5 CFU of the strict obligate anaerobic bacteria three months after encapsulation following storage under anaerobic conditions at ambient temperature.
15. The capsule of claim 12, wherein the porous capsule contains at least about 0.2×10^5 CFU of the strict obligate anaerobic bacteria eight months after encapsulation following storage under anaerobic conditions at ambient temperature.
16. The capsule of any one of claims 13-17, wherein the capsule has been stored at an ambient temperature of up to about 35°C.
17. A composition comprising one or more capsules of any one of claims 1-16.
18. The composition of claim 17, wherein the composition comprises one or more carriers with low oxygen diffusion rate.
19. The composition of claim 17 or claim 18 which is an animal feed additive.
20. The composition of any one of claims 17-19 provided in a dry form.
21. The composition of any one of claims 17-19 provided in a liquid form.
22. The composition of any one of claims 17-21, where said composition is provided in a dosage form comprising at least about 1×10^6 CFU of the at least one strict obligate anaerobic bacteria.

23. The composition of any one of claims 17-22 which is packaged in a container under anaerobic conditions.

24. A method of increasing a population of a strict obligate anaerobic bacteria in the gastrointestinal tract of an animal, comprising administering the capsule of any one of claims 1-16 or the composition of any one of claims 17-23 to the animal.

25. The method of claim 24, wherein increasing the population of the strict obligate anaerobic bacteria in the gastrointestinal tract of the animal achieves one or more of the following:

- (i) facilitates adaptation of the animal to a diet having a relatively higher amount of fermentable carbohydrates;
- (ii) reduces accumulation of organic acid in the gastrointestinal tract of the animal;
- (iii) improves starch utilisation in the gastrointestinal tract of the animal;
- (iv) prevents or treats lactic acidosis, or one or more associated conditions or clinical symptoms thereof, in the animal;
- (v) induces satiety in the animal;
- (vi) controls or modulates food intake by the animal;
- (vii) improves lactate utilization in the gastrointestinal tract of the animal;
- (viii) improves one or more production traits selected from milk production, feedlot performance, growth rate, rate of gain, finishing time and feed conversion efficiency;
- (ix) lowers the chance of digestive morbidity and/or mortality of the animal; and/or
- (x) improves tolerance of an animal to a diet which is relatively higher in fermentable carbohydrates and/or lower in structural carbohydrates, without development of lactic acidosis.

26. The method of claim 25, wherein the condition associated with lactic acidosis is selected from the group consisting of rumenitis, lactic acidosis induced laminitis, lactic acidosis induced bloat, polioencaphomelacia (PEM), colic, gastric ulcers, dehydration and liver abscesses.

27. The method of claim 25, wherein the one or more clinical symptoms of lactic acidosis are selected from reduced feed intake, reduced feed-conversion efficiency, weight loss, lameness, diarrhea, dehydration, reduced physical performance, slow recovery from exercise, crib-biting, wind-sucking and weaving behaviour.

28. The method of any one of claims 25-27, wherein the acidosis is acute acidosis or subacute acidosis.
29. The method of any one of claims 25-28, wherein administration of the capsule or composition comprising same to the gastrointestinal tract of the animal maintains a stable pH in the gastrointestinal tract of the animal.
30. The method of any one of claims 25-29, wherein the animal is a ruminant and administration of the capsule or composition comprising same to the gastrointestinal tract of the animal increases pH of the rumen and/or maintains pH of the rumen above about 5.5.
31. The method of claim 30, wherein the animal is a ruminant is selected from the group consisting of sheep, cattle, goats, buffaloes, deer and camels.
32. The method of any one of claims 25-29, wherein the animal is a hindgut fermenter and administration of the capsule or composition comprising same to the gastrointestinal tract of the animal increases pH of the hindgut and/or maintains pH of the hindgut above about 5.5.
33. The method of claim 32, wherein the animal is a hindgut fermenter, optionally wherein the hindgut fermenter is a horse.
34. The method of any one of claims 18-33, wherein at least about 1×10^6 CFU of the strict obligate anaerobic bacteria is administered to the gastrointestinal tract of the animal.
35. A method of improving the stability of a strict obligate anaerobic bacteria, said method comprising encapsulating the strict obligate anaerobic bacteria in a capsule having a porous wall comprising surface pores with a molecular weight cut off between 50 and 200 kDa, wherein the porous wall comprises a complex formed from sodium cellulose sulphate and poly[dimethyldiallyl-ammonium chloride].
36. The method of claim 35, wherein the capsule is a capsule of any one of claims 1-16 and the strict obligate anaerobic bacteria is a strict obligate anaerobic bacteria comprised in the capsule of any one of claims 1-16.

37. The method of claim 35 or 36, wherein the one or more strains of strict obligate anaerobic bacteria remain viable within the capsule at least about 30 days post encapsulation, or at least about 2 months post encapsulation, or at least about 3 months post encapsulation, or at least about 4 months post encapsulation, or at least about 5 months post encapsulation, or at least about 6 months post encapsulation, or at least about 7 months post encapsulation, or at least about 8 months post encapsulation, when the capsule is stored under anaerobic conditions at ambient temperatures.

38. The method of any one of claims 35-37, wherein the one or more strains of strict obligate anaerobic bacteria remain viable within the capsule for at least about 30 minutes, or at least about 1 hour, or at least about 90 minutes, or at least about 2 hours, or at least about 3 hours when exposed to atmospheric oxygen levels.

39. A method of producing a capsule of any one of claims 1-16, the method comprising:

- (i) culturing one or more strict obligate anaerobic bacteria in an anaerobic media;
- (ii) encapsulating the bacteria in a capsule having a porous wall comprising surface pores with a molecular weight cut off between 50 and 200 kDa, wherein the porous wall comprises a complex formed from sodium cellulose sulphate and poly[dimethyldiallyl-ammonium chloride]; and
- (iii) performing one or more step which suspend growth of bacteria; and optionally cultivating the encapsulated bacteria in an anaerobic media prior to performing step (iii).

40. The method of claim 39, wherein:

- the strict obligate anaerobic bacteria is a lactic acid utilising bacteria and the anaerobic media is a MRS media; or
- the strict obligate anaerobic bacteria is a starch utilising bacteria and the anaerobic media is a maltose media, optionally containing rumen fluid.

41. The method of claim 39 or 40, wherein the one or more step which suspend the growth of bacteria comprises any one of freeze-drying, spray-drying or extrusion.