Claims

1. A method for adaptation of anaerobic microorganisms and selection of more oxygen tolerant anaerobic microorganisms, said method comprising the steps of culturing said microorganisms with a stepwise dual induction of oxidative stress via a stepwise increase of applied voltage and oxygen diffusion, and a stepwise reduction in the concentration of antioxidant combined with a stepwise increase in the concentration of oxidized counterpart to change the anti-oxidant/oxidized counterpart concentration ratio to adjust the redox state, wherein the dissolved oxygen concentration in the culture medium is maintained at a sub-lethal concentration at which some but not all the of microorganisms are killed.

2. The method of claim 1, wherein the antioxidant/oxidised counterpart is selected from the group consisting of cysteine/cystine, glutathione/glutathione-oxidized state, ascorbic acid/dehydroascorbate, dithiothreitol/oxidized dithiothreitol, and gallic acid/oxidized gallic acid.

3. The method of any one of claims 1 to 2, wherein the starting conditions for said method are selected from one or more, or all, of: low or zero oxygen flux, low applied voltage, high concentration of anti-oxidant and low concentration or zero concentration of the oxidized counterpart, and a culture medium from which oxygen has been removed.

4. The method of claim 3, wherein the starting conditions are selected from one or more, or all, of: 8mM cysteine, 0mM cystine, an applied voltage of 0.1V, and zero or low oxygen flux.

5. The method of claim 4, wherein the stepwise changes are continued until one or more, or all, of: a minimum cysteine concentration of 3mM, a maximum cystine concentration of 5mM, a maximum applied voltage of 0.6 V, and a high oxygen flux.

6. The method of any one of claims 1 to 4, wherein the applied voltage does not exceed 0.6 V, and/or the cysteine concentration is no lower than 3mM, and/or the cystine concentration is no higher than 5mM.

7. The method of any one of claims 1 to 6, wherein once the stepwise changes have been completed, the method comprises one or more further steps of culturing said microorganisms under the final conditions of applied voltage, oxygen diffusion and anti-oxidant/oxidized counterpart concentration ratio reached after the stepwise changes, optionally further comprising steps in which further stepwise changes are carried out.

8. The method of any one of claims 1 to 7, wherein said method or further steps involve reinoculations of the anaerobic microorganisms into new culture media preferably wherein said reinoculations involve said stepwise changes in the culture conditions.

9. The method of any one of claims 1 to 8, wherein the microorganisms are *Faecalibacterium prausnitzii.*

10. The method of any one of claims 1 to 9, wherein said method involves a further step wherein the adapted strains are screened for oxygen tolerance, and optionally butyrate production and assessment of growth kinetics, in order to select the best adapted strain, with maintained metabolic characteristics.

11. A method for enhanced production of anaerobic microorganisms, comprising adapting anaerobic microorganisms and selecting more oxygen tolerant anaerobic microorganisms by the method of any one of claims 1 to 10, and further culturing the microorganisms with a combination of constant oxidizing potential/applied voltage, oxygen diffusion, and anti-oxidant/oxidized counterpart concentration ratio, which has been optimized for production of the oxygen adapted microorganisms, wherein the dissolved oxygen concentration thus enabling a selective pressure and resulting in a high yield of certain strains of microorganisms.

12. The method of claim 11, wherein said culture conditions comprise 3mM cysteine, 5mM cystine, an applied voltage of 0.6 V and oxygen flux of 0.2nmoles$ml^{-1}min^{-1}$; and/or (ii) said microorganism is *Faecalibacterium prausnitzii*.

13. An oxygen adapted microorganism strain obtained by the method of any one of claims 1 to 10, wherein said microorganism is a *Faecalibacterium prausnitzii* strain, and wherein said microorganism strain shows an increased level of tolerance to ambient air, compared to a starting or parent strain which has not been made oxygen adapted.

14. An oxygen adapted microorganism strain obtained by the method of any one of claims 1 to 10, wherein said microorganism is a *Faecalibacterium prausnitzii* strain, and wherein said microorganism strain shows an increased level of tolerance to ambient air, compared to a starting or parent strain which has not been made oxygen adapted by said method.

15. An oxygen adapted microorganism strain according to claim 14, wherein said adapted bacterial strain is stable for longer periods of storage compared to said starting or parent strain.

16. The method of claim 11, wherein said microorganism is a Faecalibacterium prausntizii bacterial strain.

17. The method of claim 12, wherein said microorganism is a *Faecalibacterium prausnitzii* bacterial strain selected from the group consisting of DSM 32380, DSM 32378 and DSM 32379.