## Claims

1. A recombinant endolysin comprising

(i) a N-terminal catalytic domain,

(ii) a C-terminal cell-wall binding region, wherein the C-terminal cell-wall binding region comprises one or more cell-wall binding domains, and

(iii) a linker region between the N-terminal catalytic domain and the C-terminal cell-wall binding region,

wherein the N-terminal catalytic domain is from a first natural endolysin, and at least one cell wall binding domain is from a second natural endolysin, and wherein the first and the second natural endolysins are encoded by different genomes from different prophages,

wherein said recombinant endolysin has a killing activity against *Gardnerella*; and

wherein

(I) the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of any one of SEQ ID NOs: 1 to 3, 5, 7, 10 and 11, and

the one or more cell-wall binding domains are independently selected from the group consisting of the polypeptides comprising the amino acid sequence of SEQ ID NOs: 19 to 24 and 26 to 33, respectively; or

(II) the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of any one of SEQ ID NOs: 2, 3, 5, 7, 10 and 11, and

the one or more cell-wall binding domains are independently selected from the group consisting of the polypeptides comprising the amino acid sequence of SEQ ID NOs: 15, 16, 19 to 24 and 26 to 33, respectively; or

(III) the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of SEQ ID NO: 2 and the C-terminal cell-wall binding region comprises a first cell-wall binding domain and a second cell-wall binding domain, wherein said first cell-wall binding domain comprises an amino acid sequence having at least 90% identity with the amino acid sequence of any one of SEQ ID NOs: 28, 30 and 32, and said second cell-wall binding domain comprises an amino acid sequence having at least 95% identity with the amino acid sequence of any one of SEQ ID Nos: 29, 31 and 33.

2. A recombinant endolysin comprising

(i) a N-terminal catalytic domain,

(ii) a C-terminal cell-wall binding region, wherein the C-terminal cell-wall binding region comprises one or more cell-wall binding domains, and

(iii) a linker region between the N-terminal catalytic domain and the C-terminal cell-wall binding region,

wherein the N-terminal catalytic domain is from a first natural endolysin and at least one cell wall binding domain is from a second natural endolysin, and wherein the first and the second natural endolysins are encoded by different genomes from different prophages,

wherein said recombinant endolysin has a genus-selective killing activity against *Gardnerella*; and

wherein

(I) the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of any one of SEQ ID NOs: 1 to 3, 5, 7, 10 and 11, and

the one or more cell-wall binding domains are independently selected from the group consisting of the polypeptides comprising the amino acid sequence of SEQ ID NOs: 19 to 24 and 26 to 33, respectively; or

(II) the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of any one of SEQ ID NOs: 2, 3 5, 7, 10 and 11, and

the one or more cell-wall binding domains are independently selected from the group consisting of the polypeptides comprising the amino acid sequence of SEQ ID NOs: 15, 16, 19 to 24 and 26 to 33, respectively; or

(III) the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of SEQ ID NO: 2 and the C-terminal cell-wall binding region comprises a first cell-wall binding domain and a second cell-wall binding domain, wherein said first cell-wall binding domain comprises an amino acid sequence having at least 90% identity with the amino acid sequence of any one of SEQ ID NOs: 28, 30 and 32, and said second cell-wall binding domain comprises an amino acid sequence having at least 95% identity with the amino acid sequence of any one of SEQ ID Nos: 29, 31 and 33.

3. The recombinant endolysin of claim 1 or claim 2, wherein the C-terminal cell-wall binding region comprises a first cell-wall binding domain and a second cell-wall binding domain, wherein

in said option (I), said first cell-wall binding domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 19, 21, 23, 26, 28, 30 and 32 and said second cell-wall binding domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 20, 22, 24, 27, 29, 31 and 33,
in said option (II), said first cell-wall binding domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 15, 19, 21, 23, 26, 28, 30 and 32 and said second cell-wall binding domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 16, 20, 22, 24, 27, 29, 31 and 33.

4. The recombinant endolysin of claim 1 or claim 2, wherein the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of SEQ ID NO: 2 and the one or more cell-wall binding domains are independently selected from the group consisting of the polypeptides comprising the amino acid sequence of SEQ ID NOs: 28 to 33, respectively.

5. The recombinant endolysin of claim 1 or claim 2, wherein the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of SEQ ID NO: 7 and the one or more cell-wall binding domains are independently selected from the group consisting of the polypeptides comprising the amino acid sequence of SEQ ID NOs: 19 and 20, respectively.

6. The recombinant endolysin of claim 1 or claim 2, wherein in said option (III), said first and second cell-wall binding domains are functional and the function comprises the ability to bind to the cell wall of *Gardnerella.*

7. The recombinant endolysin of claim 1 or claim 2, wherein the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of SEQ ID NO: 2 and the C-terminal cell-wall binding region comprises a first cell-wall binding domain and a second cell-wall binding domain, wherein said first cell-wall binding domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 28, 30 and 32, and said second cell-wall binding domain comprises and amino acid sequence selected from the group consisting of SEQ ID NOs: 29, 31 and 33.

8. The recombinant endolysin of claim 1 or claim 2, wherein the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of SEQ ID NO: 2 and the C-terminal cell-wall binding region comprises a first cell-wall binding domain and a second cell-wall

binding domain, wherein said first cell-wall binding domain is defined by SEQ ID NO: 28 and said second cell-wall binding domain is defined by SEQ ID NO: 29.

9. The recombinant endolysin of claim 1 or claim 2, wherein the N-terminal catalytic domain is a polypeptide comprising the amino acid sequence of SEQ ID NO: 2 and the C-terminal cell-wall binding region comprises a first cell-wall binding domain and a second cell-wall binding domain, wherein said first cell-wall binding domain is defined by SEQ ID NO: 28 and said second cell-wall binding domain is defined by SEQ ID NO: 31.

10. The recombinant endolysin of any one of claims 1 to 3 and 6 to 9, wherein said first cell-wall binding domain is N-terminally located of said second cell-wall binding domain.

11. The recombinant endolysin of any one of the precedent claims wherein the linker region is a polypeptide comprising the amino acid sequence:
(i) (XXX)n, wherein each X is independently G, A or S, preferably wherein the amino acid sequence (XXX)n is (GGS)n, wherein n corresponds to the number of repetitions of the sequence XXX, preferably wherein n is 2, 3, 4, 5 or 6; or
(ii) $X_1X_2$GLNG$X_3X_4$NGGS, wherein $X_1$ is N or K, $X_2$ is A or V, $X_3$ is Y or C and $X_4$ is K or Q.

12. The recombinant endolysin of claim 1, wherein said endolysin has a genus-selective killing activity against *Gardnerella*.

13. The recombinant endolysin of any one of the precedent claims wherein said endolysin has a killing activity against *Gardnerella vaginalis sensu stricto, Gardnerella leopoldii, Gardnerella piotii* and/or *Gardnerella swidsinskii,* or any other species in the genus *Gardnerella*.

14. The recombinant endolysin of any one of the precedent claims, wherein said endolysin has no killing activity against *Lactobacilli crispatus*, *Lactobacilli gasseri*, and/or *Lactobacilli jensenii*.

15. A polynucleotide which encodes the recombinant endolysin of any one of claims 1 to 14.

16. A pharmaceutical composition comprising the recombinant endolysin of any one of claims 1 to 14 or the polynucleotide of claim 15 and further comprising a pharmaceutically acceptable carrier and/or diluent.

17. A recombinant endolysin as defined in any one of claims 1 to 14, a polynucleotide as defined in claim 15 or a pharmaceutical composition as defined in claim 16 for use in treating a disease or disorder.

18. Use of a recombinant endolysin as defined in any one of claims 1 to 14, a polynucleotide as defined in claim 15 or a pharmaceutical composition as defined in claim 16 in the manufacture of a medicament for treating a bacterial infection caused by at least one strain of the *Gardnerella* genus.

19. The use according to claim 18 wherein said bacterial infection is bacterial vaginosis.

20. The use according to claim 19 wherein said bacterial vaginosis is caused by *Gardnerella vaginalis sensu stricto, Gardnerella leopoldii, Gardnerella piotii* and/or *Gardnerella swidsinskii*.

21. The use according to any one of claims 18 to 20, wherein said medicament is to be administered locally, preferably wherein said medicament is to be administered locally into the vagina of a female subject and/or into or on the glans penis, prepuce or urethral entry of a male subject.

22. The use according to any one of claims 18 to 21, wherein said medicament is to be administered into the vagina of a female subject and/or into or on the glans penis, prepuce or urethral entry of a male subject.

23. The use according to any one of claims 18 to 22, wherein said medicament is to be co-administered with a compound or composition which adjusts the pH of the vagina to 4.0 – 6.0.

24. A plasmid comprising the polynucleotide of claim 15.

25. A bacterial host cell comprising the plasmid of claim 24, preferably wherein the bacterial host cell is an *E. coli* cell.

26. An *in vitro* method for the diagnosis of a disease or condition which can be treated with the endolysin according to any one of claims 1 to 14, the method comprising the steps of:

(i) contacting a sample obtained from a subject with a polypeptide comprising the C-terminal cell-wall binding region of the endolysin according to any one of claims 1 to 14, and optionally the N-terminal catalytic domain of the endolysin according to any one of claims 1 to 14, wherein the sample comprises microbial cells, and wherein the C-terminal cell-wall binding region of said endolysin is optionally labelled;

(ii) testing whether the polypeptide binds to, and/or lyses, the microbial cells of the sample; and

(iii) determining that a disease or condition can be treated with the endolysin according to any one of claims 1 to 14 if the polypeptide binds to, and/or lyses, the microbial cells.