CLAIMS:

1. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA and less than 0.1 mg of colanic acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes colanic acid wherein the colanic acid has been removed from the plasmid composition by an enzymatic process, wherein the toxicity of the purified gram negative bacterial plasmid composition when administered to live mammalian subjects is reduced.

2. The composition of claim 1, wherein the composition comprises less than 0.05 mg of colanic acid per mg of gram negative bacterial plasmid DNA and more preferably no detectable colanic acid by ethidium bromide staining.

~~3. The composition of claim 1 or 2, wherein the composition further comprises less than 0.1 mg uronic acid per mg of gram negative bacterial plasmid DNA, and more preferably less than 0.05 mg uronic acid per mg and more preferably no detectable uronic acid by spectrometric absorbance at 520 nm.~~

4. The composition of any one of claims 1 to 3 wherein the composition further comprises less than 0.1 mg fucose per mg of gram negative bacterial plasmid DNA, and more preferably less than 0.05 mg fucose per mg and more preferably no detectable fucose by fluorometry with a 360 nm excitation filter and a 465 nm emission filter.

~~5. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA, less than 0.1 mg of colanic acid per mg of gram negative bacterial plasmid DNA, and less than 0.1 mg uronic acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes~~

~~colanic acid.~~

6. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA, less than 0.05 mg of colanic acid per mg of gram negative bacterial plasmid DNA, and less than 0.05 mg fucose acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes colanic acid wherein an injection of the purified gram negative bacterial plasmid composition is nontoxic in a mouse.

~~7. A process for the purification of plasmid DNA, the process comprising treating an aqueous composition containing a high-copy number plasmid DNA isolated from a bacterium that makes colanic acid with a polypeptide to digest colanic acid and separating the plasmid DNA from the treated aqueous composition.~~

~~8. The process of claim 7, wherein the aqueous composition is pre-treated to partially remove endotoxin from the aqueous composition prior to treatment with the polypeptide, the pretreatment comprising combining the aqueous composition with a chromatographic material; combined with an affinity chromatography resin after treatment with the polypeptide, and thereafter combined with a hydrophobic interaction chromatography resin; and filtered to further separate endotoxin from the plasmid DNA after eluting the plasmid DNA from the hydrophobic interaction chromatography resin.~~

~~9. The process of any one of claims 7-8 wherein the polypeptide comprises an amino acid sequence having at least 90% homology to SEQ ID NO: 1 or SEQ ID NO: 2, and conservative amino acid substitutions thereof.~~

10. A process for the purification of a high-copy number plasmid DNA, the process comprising:

(a) pre-treating an aqueous composition containing the high-copy number plasmid DNA isolated from a bacterium that makes colanic acid by combining the aqueous composition with an anion-exchange resin;

(b) treating the pre-treated aqueous composition with a polypeptide to digest colanic acid;

(c) separating the plasmid DNA from the treated aqueous composition, the separation comprising combining the treated aqueous composition with an affinity chromatography resin, and thereafter combining the treated aqueous composition with a hydrophobic interaction chromatography resin; and

(d) filtering the plasmid DNA.

11. A polypeptide comprising an amino acid sequence having at least 90% homology to SEQ ID NO: 1 or SEQ ID NO: 2, and conservative amino acid substitutions thereof.

12. An isolated polynucleotide comprising a nucleic acid sequence that shares at least 90% sequence identity with SEQ ID NO: 7 or SEQ ID NO:8, or the complement thereof.

13. A vector comprising the polynucleotide of claim 12, wherein the vector is selected from the group consisting of a plasmid, a virus, and a bacteriophage.

14. A process for digesting colanic acid in a nucleic acid sample, the process comprising contacting the nucleic acid sample with a polypeptide capable of digesting

~~colanic acid selected from an amino acid sequence having at least 90% homology to SEQ ID NO: 1 or SEQ ID NO: 2, and conservative amino acid substitutions thereof.~~

15. ~~A process for the removal of colanic acid from an aqueous composition containing a high-copy number plasmid DNA, the process comprising digesting colanic acid in the aqueous composition and thereafter combining the aqueous composition with a chromatographic material to separate colanic acid from the bacterial high copy number plasmid DNA.~~

WHAT IS CLAIMED IS:

1. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA and less than 0.1 mg of colanic acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes colanic acid wherein the colanic acid has been removed from the plasmid composition by an enzymatic process.

2. The composition of claim 1, wherein the composition comprises less than 0.05 mg of colanic acid per mg of gram negative bacterial plasmid DNA and more preferably no detectable colanic acid by ethidium bromide staining.

3. The composition of claim 1 or 2, wherein the composition further comprises less than 0.1 mg uronic acid per mg of gram negative bacterial plasmid DNA, and more preferably less than 0.05 mg uronic acid per mg and more preferably no detectable uronic acid by spectrometric absorbance at 520 nm.

4. The composition of any one of claims 1 to 3 wherein the composition further comprises less than 0.1 mg fucose per mg of gram negative bacterial plasmid DNA, and more preferably less than 0.05 mg fucose per mg and more preferably no detectable fucose by fluorometry with a 360 nm excitation filter and a 465 nm emission filter.

5. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA, less than 0.1 mg of colanic acid per mg of gram negative bacterial plasmid DNA, and less than 0.1 mg uronic acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes colanic acid.

6. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA, less than 0.05 mg of colanic acid per mg of gram negative bacterial plasmid DNA, and less than 0.05 mg fucose acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes colanic acid wherein an injection of the purified gram negative bacterial plasmid composition is nontoxic in a mouse.

7. A process for the purification of plasmid DNA, the process comprising treating an aqueous composition containing a high-copy number plasmid DNA isolated from a bacterium that makes colanic acid with a polypeptide to digest colanic acid and separating the plasmid DNA from the treated aqueous composition.

8. The process of claim 7, wherein the aqueous composition is pre-treated to partially remove endotoxin from the aqueous composition prior to treatment with the polypeptide, the pretreatment comprising combining the aqueous composition with a chromatographic material; combined with an affinity chromatography resin after treatment with the polypeptide, and thereafter combined with a hydrophobic interaction chromatography resin; and filtered to further separate endotoxin from the plasmid DNA after eluting the plasmid DNA from the hydrophobic interaction chromatography resin.

9. The process of any one of claims 7-8 wherein the polypeptide comprises an amino acid sequence having at least 90% homology to SEQ ID NO: 1 or SEQ ID NO: 2, and conservative amino acid substitutions thereof.

10. A process for the purification of a high-copy number plasmid DNA, the process comprising:

(a) pre-treating an aqueous composition containing the high-copy number plasmid DNA isolated from a bacterium that makes colanic acid by combining the aqueous composition with an anion exchange resin;

(b) treating the pre-treated aqueous composition with a polypeptide to digest colanic acid;

(c) separating the plasmid DNA from the treated aqueous composition, the separation comprising combining the treated aqueous composition with an affinity chromatography resin, and thereafter combining the treated aqueous composition with a hydrophobic interaction chromatography resin; and

(d) filtering the plasmid DNA.

11. A polypeptide comprising an amino acid sequence having at least 90% homology to SEQ ID NO: 1 or SEQ ID NO: 2, and conservative amino acid substitutions thereof.

12. An isolated polynucleotide comprising a nucleic acid sequence that shares at least 90% sequence identity with SEQ ID NO: 7 or SEQ ID NO:8, or the complement thereof.

13. A vector comprising the polynucleotide of claim 12, wherein the vector is selected from the group consisting of a plasmid, a virus, and a bacteriophage.

14. A process for digesting colanic acid in a nucleic acid sample, the process comprising contacting the nucleic acid sample with a polypeptide capable of digesting colanic acid selected from an amino acid sequence having at least 90% homology to SEQ ID NO: 1 or SEQ ID NO: 2, and conservative amino acid substitutions thereof.

15. A process for the removal of colanic acid from an aqueous composition containing a high-copy number plasmid DNA, the process comprising digesting colanic acid in the aqueous composition and thereafter combining the aqueous composition with a chromatographic material to separate colanic acid from the bacterial high-copy number plasmid DNA.

CLAIMS:

1. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA and less than 0.1 mg of colanic acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes colanic acid wherein the colanic acid has been removed from the plasmid composition by an enzymatic process, wherein the toxicity of the purified gram negative bacterial plasmid composition when administered to live mammalian subjects is reduced.

2. The composition of claim 1, wherein the composition comprises less than 0.05 mg of colanic acid per mg of gram negative bacterial plasmid DNA and more preferably no detectable colanic acid by ethidium bromide staining.

3. The composition of any one of claims 1 to 3 wherein the composition further comprises less than 0.1 mg fucose per mg of gram negative bacterial plasmid DNA, and more preferably less than 0.05 mg fucose per mg and more preferably no detectable fucose by fluorometry with a 360 nm excitation filter and a 465 nm emission filter.

4. A purified gram negative bacterial plasmid composition comprising a gram negative, high-copy number bacterial plasmid DNA, less than 0.05 mg of colanic acid per mg of gram negative bacterial plasmid DNA, and less than 0.05 mg fucose acid per mg of gram negative bacterial plasmid DNA isolated from a bacterium that makes colanic acid wherein an injection of the purified gram negative bacterial plasmid composition is nontoxic in a mouse.