CLAIMS

1. A method of producing phytoene comprising culturing a recombinant *Deinococcus* bacterium under conditions suitable to produce phytoene, and optionally recovering said phytoene, wherein said recombinant *Deinococcus* bacterium is genetically modified to exhibit increased phytoene synthase activity by overexpressing a native gene encoding phytoene synthase or expressing a heterologous gene encoding phytoene synthase, and is genetically modified to exhibit decreased phytoene desaturase activity by inactivating a gene encoding a phytoene desaturase.

2. The method of claim 1, wherein the recombinant *Deinococcus* bacterium does not exhibit any phytoene desaturase activity.

3. The method of claim 1 or 2, wherein, the recombinant *Deinococcus* bacterium is genetically modified by deleting all or part of a gene encoding a phytoene desaturase or introducing a nonsense codon, a cassette, a gene or a mutation inducing a frameshift in said gene.

4. The method of claim 3, wherein the recombinant *Deinococcus* bacterium is genetically modified by deleting all or part of the gene encoding a phytoene desaturase.

5. The method of any of claims 1 to 4, wherein the recombinant *Deinococcus* bacterium is genetically modified to overexpress a native gene encoding phytoene synthase.

6. The method of any of claims 1 to 4, wherein the recombinant *Deinococcus* bacterium is genetically modified to express a heterologous gene encoding phytoene synthase or a native gene encoding phytoene synthase and comprising a mutation improving phytoene synthase activity of the encoded enzyme.

7. The method of any of claims 1 to 6, wherein the recombinant *Deinococcus* bacterium is genetically modified to express a gene encoding a feedback resistant phytoene synthase.

8. The method of any of claims 1 to 7, wherein the recombinant *Deinococcus* bacterium further exhibits increased farnesyl diphosphate (FPP) synthase activity by

overexpressing an endogenous gene encoding FPP synthase or expressing a heterologous gene encoding FPP synthase.

9. The method of any of claims 1 to 8, wherein the recombinant *Deinococcus* bacterium further exhibits increased 1-deoxy-D-xylulose 5- phosphate (DXP) synthase and/or isopentenyl pyrophosphate (IPP) isomerase activities, preferably increased DXP synthase and IPP isomerase activities, wherein increased DXP synthase activity is obtained by overexpression of an endogenous gene encoding DXP synthase or expression of a heterologous gene encoding DXP synthase, and increased IPP isomerase activity is obtained by overexpression of an endogenous gene encoding IPP isomerase or expression of a heterologous gene encoding IPP isomerase.

10. The method of any of claims 1 to 9, wherein the recombinant *Deinococcus* bacterium is a *Deinococcus* bacterium selected from *D. geothermalis, D. murrayi, D. grandis, D. aquaticus, D. indicus, D. cellulosilyticus, D. depolymerans, D. maricopensis.*

11. The method of any of claims 1 to 10, wherein the recombinant *Deinococcus* bacterium is a *Deinococcus geothermalis* bacterium.

12. The method of any of claims 1 to 11, wherein the recombinant *Deinococcus* bacterium is able to produce at least 20 mg/g DCW (dry cell weight) of phytoene.

13. The method of claim 12, wherein the recombinant *Deinococcus* bacterium is able to produce at least 20 mg/g DCW (dry cell weight) of phytoene when cultured in aerobiosis and in the presence of glucose as carbon source.

14. The method of any of claims 1 to 13, wherein the recombinant *Deinococcus* bacterium produces only one isomer of phytoene which is 15-cis phytoene, and does not produce phytofluene, ζ-carotene, neurosporene or lycopene.

15. The method of any of claims 1 to 14, wherein the recombinant *Deinococcus* bacterium is a thermophilic *Deinococcus*, preferably *D. geothermalis*, and the culture of the recombinant *Deinococcus* bacterium under conditions suitable to produce phytoene is performed at a temperature comprised between 40 and 50°C, preferably between 45 and 48°C.

16. A recombinant *Deinococcus* bacterium as defined in any one of claims 1 to 15.

17. Use of a recombinant *Deinococcus* bacterium of claim 16 to produce phytoene.