increase the yield in the conversion of glucose/xylose mixtures to ethanol. These strains feature PEP-independent glucose uptake with both the EMPP and the PPP operative.

Chinen (loc. cit.) and US Patent 7,785,858 disclose a recombinant bacterium selected from the group consisting of the Enterobacteriaceae familiy, Coryneform bacterium, and Bacillus bacterium comprising increased phosphoketolase activity for the conversion of glucose to target molecules which are produced via the intermediate acetyl-CoA, including the group consisting of L-glutamic acid, L-glutamine, L-proline, L-arginine, L-leucine, L-cysteine, succinate and polyhydroxybutyrate. These strains feature PEP-dependent glucose uptake with the EMPP operative. Notably, the activity of phosphofructokinase in the bacterium of US Patent 7,785,858 is reduced compared to that of a wild-type or non-modified strain (see page 33).

Whether a particular microorganism utilizes PEP-independent glucose uptake or PEP-dependent glucose uptake impacts the overall energetic balance of a process. For example, S. cerevisiae strains naturally employ PEP-independent glucose uptake while Escherichia coli strains naturally employ PEP-dependent glucose uptake. E. coli strains have been disclosed where PEP-dependent glucose uptake has been replaced with PEP-independent glucose uptake. Flores et al. (Metabolic Engineering (2005) 7, 70-87) and US Patent 7,371,558. In particular, US Patent 7,371,558 discloses the glucose uptake modification to increase the yield in the conversion of glucose to 1,3-propanediol. The strains feature PEP-independent glucose uptake with both the EMPP and the PPP operative, notably with no phosphoketolase activity present.

There is a need to develop recombinant microorganisms, comprising central carbon and product specific pathways that maximize the conversion of feedstock to product by best accommodating the redox and energetic constraints of enzyme reactions. Applicants have addressed this need by providing the embodiments as defined in the claims.

Summary

In one aspect, there is provided a recombinant microorganism characterized by: a) having phosphoketolase activity; b) (i) a diminished or inactivated Embden-Meyerhof-Parnas pathway (EMPP) by inactivation of the gene(s) encoding phosphofructokinase or by being genetically modified so as to reduce phosphofructokinase activity as compared to a non-genetically modified microorganism; or (ii) not possessing phosphofructokinase activity; and c) (i) having a diminished or inactivated oxidative branch of the pentose phosphate pathway (PPP) by inactivation of the gene(s) encoding glucose-6-phosphate dehydrogenase or by being genetically modified so as to reduce glucose-6-phosphate dehydrogenase activity as compared to a non-genetically modified microorganism; or (ii) not possessing glucose-6-phosphate dehydrogenase activity.

In another aspect, there is provided the use of the recombinant microorganism as defined herein for the conversion of glucose into acetyl-CoA.

In yet another aspect, there is provided the use of the recombinant microorganism as defined herein for the conversion of glucose into acetone.

In yet another aspect, there is provided the use of the recombinant microorganism as defined herein for the conversion of glucose into isobutene.

In yet another aspect, there is provided the use of the recombinant microorganism as defined herein for the conversion of glucose into propene.

In yet another aspect, there is provided a method for producing acetone from glucose comprising the steps of: culturing the microorganism as defined herein in a suitable medium; and optionally recovering said acetone from the culture medium.

In yet another aspect, there is provided a method for producing isobutene from glucose comprising the steps of: culturing the microorganism as defined herein in a suitable medium; and optionally recovering said isobutene.

In yet another aspect, there is provided a method for producing propene from glucose comprising the steps of: culturing the microorganism as defined herein in a suitable medium; and optionally recovering said propene.

Description

Thus, the present invention relates to a recombinant microorganism characterized by:

a) having phosphoketolase activity;

b) (i) having a diminished or inactivated Embden-Meyerhof-Parnas pathway (EMPP) by inactivation of the gene(s) encoding phosphofructokinase or by

6. The recombinant microorganism of any one of claims 1 to 4, wherein said microorganism is a bacterium.

7. The recombinant microorganism of claim 6, wherein the gene(s) encoding the PEP-dependent PTS transporter has/have been inactivated.

8. The recombinant microorganism of any one of claims 1 to 7 further characterized in that it:
e) is capable of converting acetyl-CoA into acetone.

9. The recombinant microorganism of claim 8 further characterized in that it:
f) is capable of converting acetone into isobutene.

10. The recombinant microorganism of claim 8 further characterized in that it:
g) is capable of converting acetone into propene.

11. Use of the recombinant microorganism of any one of claims 1 to 10 for the conversion of glucose into acetyl-CoA.

12. Use of the recombinant microorganism of any one of claims 8 to 10 for the conversion of glucose into acetone.

13. Use of the recombinant microorganism of claim 9 for the conversion of glucose into isobutene.

14. Use of the recombinant microorganism of claim 10 for the conversion of glucose into propene.

15~~14~~. A method for producing acetone from glucose comprising the steps of:
culturing the microorganism of any one of claims 8 to 10 in a suitable medium; and
optionally recovering said acetone from the culture medium.

16~~15~~. A method for producing isobutene from glucose comprising the steps of:
culturing the microorganism of claim 9 in a suitable medium; and
optionally recovering said isobutene.

17~~16~~. A method for producing propene from glucose comprising the steps of:
culturing the microorganism of claim 10 in a suitable medium; and
optionally recovering said propene.