fermentation rates, and high ethanol production, high tolerance to ethanol, sugars and fermentation inhibitors.

[0008] While rational metabolic engineering has been effective in improving phenotypes of *S. cerevisiae* strains for xylose fermentation, it typically involves the constitutive expression of multiple genes followed by mutagenesis and post-evolutionary engineering. It is therefore tedious, labour intensive and time-consuming.

[0009] On the other hand, the whole genome engineering approach, such as genome shuffling, offers the advantage of simultaneous changes at different positions throughout the entire genome without the necessity for genome sequence data or network information. It therefore has advanced the field of constructing phenotypes at a more rapid pace as compared with the conventional tools.

[0010] Considering the complexity of pathway design for rational metabolic engineering, genome shuffling uses recursive genetic recombination analogous to DNA shuffling. This strategy has been successfully applied in rapid strain improvement of both prokaryotic and eukaryotic cells. However, this method largely depends on the efficiency of the traditional protoplast fusion techniques. Although protoplast fusion has been regarded as a traditional and effective way to accelerate strain evolution and has been applied in many studies, the technique has the disadvantages of low efficiency of fusion induced by polyethylene glycol (PEG), being labour intensive and time-consuming due to protoplast preparation and fusant regeneration, and fusant instability.

[0011] In view of the problems mentioned above, there is a need to provide a method of providing a recombinant microorganism that ameliorates at least one of the disadvantages mentioned above. There is a need to provide a method of producing recombinant yeast strains that is rapid and reliable. In particular, there is a need to provide recombinant yeast strains with enhanced xylose-fermentation capability and which have enhanced ethanol tolerance.

SUMMARY

[0012] In one aspect, there is provided a method of providing a recombinant microorganism, said method may comprising the steps of (a) providing a hybrid microorganism comprising whole genomic DNA from a host microorganism and a donor microorganism, wherein the hybrid microorganism is thus a microorganism having genomes from two different parent microorganism, the hybrid microorganism is produced by transferring the whole genome of the donor microorganism to the host microorganism by whole genome transformation; and the hybrid microorganism exhibits an enhanced activity as compared to its host microorganism and/or donor microorganism individually; and (b) fusing whole genomic DNA extracted from a second microorganism into the hybrid microorganism to form the recombinant microorganism.