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Publication date:
2011

Document Version
Publisher's PDF, also known as Version of record

USE OF EXTREMOPHILIC BACTERIA FOR SECOND GENERATION BIOETHANOL PRODUCTION

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The pursuit of ways to obtain viable alternatives to fossil fuels has been one of the main subjects in microbial biotechnology research in the last decade. Of all the possible fuel candidates, bioethanol is one of the most relevant, especially when considered for the transport sector. Its production from food crops, such as corn (starch) or sugar cane (sucrose) is already an established process, with the USA and Brazil supplying 86% of the market. The major challenge remains in the use of different waste sources – agricultural, forestry, animal and household waste - as a feedstock. The recalcitrance of these materials and their diverse sugar composition make the industrial yeast strains currently used unsuitable for a second generation bioethanol production process.

One of the alternative strategies is the use of extreme thermophilic microorganisms. Currently, selected members from the genera *Clostridium*, *Thermoanaerobacter*, *Geobacillus* and *Thermoanaerobacterium* are among the best candidates. A new strain of *Thermoanaerobacter,* closely related to *T. italicus and T. mathranii*, has achieved 0.43 $g_{ethanol}/g_{xylose,}$ which is 83% of the theoretical yield of ethanol based on xylose and the highest value for a wild type strain reported so far. However, productivity and titer values comparable to a first generation process are yet to be achieved. Metabolic engineering to redirect the metabolism from mixed-product fermentation to ethanol production is one of the solutions proposed to improve the performance of extreme thermophilic bacteria.