Exploiting the potential of gas fermentation

The use of gas fermentation for production of chemicals and fuels with lower environmental impact is a technology that is gaining increasing attention. Over 38 Gt of CO2 is annually being emitted from industrial processes, thereby contributing significantly to the concentration of greenhouse gases in the atmosphere. Together with the gasification of biomass and different waste streams, these gases have the potential for being utilized for production of chemicals through fermentation processes. Acetogens are among the most studied organisms capable of utilizing waste gases. Although engineering of heterologous production of higher value compounds has been successful for a number of acetogens, the processes are challenging due to the redox balance and the lack of efficient engineering tools. In this review, we address the availability of different gaseous feedstock and gasification processes, and we focus on the advantages of alternative fermentation scenarios, including thermophilic production strains, multi-stage fermentations, mixed cultures, as well as mixotrophy. Such processes have the potential to significantly broaden the product portfolio, increase the product concentrations and yields, while enabling the exploitation of alternative and mixed feedstocks. The reviewed processes also have the potential to address challenges associated with product inhibition and may contribute to reducing the costs of downstream processing. Given the widespread availability of gases, such processes will likely significantly impact the transition towards a more sustainable society.

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