Università degli Studi di Napoli Federico II

PhD in Biotechnology - 35th cycle

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Syngas fermentation for chemicals production

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The main current resources to satisfy the world's demand of energy/chemicals are fossil sources. However, the economic-political-environmental issues related to the use of fossil resources are pressing the modern societies. Numerous studies have been carried out to produce energy/chemicals from renewable sources: dedicated biomasses, wastes/residues to be used as feedstock. However, proposed solutions have several drawbacks.

An innovative solution towards a new generation of commodities is the syngas fermentation integrated in value-added chains. Autotrophic bacteria can produce biofuels/chemicals from greenhouse gases - GHG (CO_2, CO) - and may contribute to decrease GHG concentration in the atmosphere. Exploitation of syngas obtained by gasification of C-based streams – e.g. recyclable and non-recyclable wastes, by-products of industrial processes - via gas fermentation would open up ecologically, economically, scientifically, and technologically completely new dimensions.

Syngas fermentation has several advantages: high specificity, it does not require a strict specific H_2/CO ratio, biocatalysts are not particularly susceptible to metal poisoning. This process occurs under mild temperature and pressure and does not require any costly pre-treatment of the feed gas. Altogether, the biotechnological route may be definitively superior respect to the conventional chemical catalytic conversion processes of the syngas. The main challenges faced for commercializing this technology is the low aqueous solubility of gaseous substrates (mainly CO and H_2) and the low cell specific productivity.

References

Fernández et al., Efficient butanol-ethanol (B-E) production from carbon monoxide fermentation in *Clostridium carboxidivorans*. Appl Microbiol Biotechnol 100:4231–4240 (2016)