I1. Environmental Microbiology and Biotechnology

P12. Production of propionate from carbon monoxide by a synthetic co-culture

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Syngas, mainly composed of carbon monoxide (CO) is a polluting gas produced by several industrial sectors as the end product of gasification process. Fermentation of syngas/CO by carboxidrotrophic microbes allows the production of compounds with high economical and industrial interest. The interest in expanding its production frame towards more complex products is increasing. Propionate is a value-added compound with numerous industrial applications, e.g. as an antifungal agent in foods and feeds, and as a building block to produce plastics and herbicides, among others. Propionate is currently produced by chemical reactions, though, its production from syngas/CO represents a new approach on microbial syngas conversion. Some propionogenic bacteria have the ability of producing propionate from alcohols and organic acids such as ethanol and acetate, and these compounds are the main products of CO fermentation by acetogens. Consequently, CO can be used as substrate for propionate production, using a co-cultivation approach. In this work different co-cultures of acetogens were established together with propionogenic bacteria. A novel isolated syngas- fermenting organism, *Acetobacterium* sp. strain JM, and the type strain, *Acetobacterium wieringae* DSM 1911, were tested together with the propiogenic bacteria *Pelobacter propionicus* and *Anaerobacterium neopropionicum.* The co-culture composed by *Acetobacterium* sp. strain JM and *Anaerobacterium neopropionicum* was able to produce up to 24.3 mM propionate from CO fermentation. A proteomic analysis was performed to get insights into the physiology of CO conversion to propionate, and into the biochemical mechanisms and microbial interactions within the consortium. Differential protein expression was found throughout different phases of growth. At an early stage, the co-culture shows an acetogenic behaviour, where *Acetobacterium* sp. strain JM is more active, converting CO into acetate. The concentration of 30 mM of acetate triggers *Acetobacterium* sp. strain JM to produce ethanol from CO and acetate. At this point, protein expression in *Anaerobacterium neopropionicum* is increased, resulting in ethanol conversion to propionate. This synthetic co-culture couples the Wood-Ljungdahl and acrylate pathways to produce propionate from carbon monoxide, which engages an interesting way of broadening the production scope of CO fermentation to more complex and valuable products.