Methane conversion to fatty acid methyl esters by engineered methanotroph

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Recently, metabolic engineering of methanotroph has received attention as a sustainable strategy to convert methane to value added biochemicals such as lactate, succinate and 1,4-butanediol. In this study, Methylosinus trichosporium OB3b, a model methanotroph, has been engineered to convert methane to fatty acid methyl esters (FAMEs) as biodiesel. First of all, due to the lack of wax ester synthase / diacylglycerol: acyl-coenzyme A acyltransferase (WS / DGAT) activity in the wild-type methanotroph, we metabolically engineered M. trichosporium OB3b by expressing heterologous WS / DGAT. Chemical inhibitors were added to prevent methanol being converted to formaldehyde by the methanol dehydrogenase to supply methanol as an acyl acceptor of FAME synthesis in the batch fermentation, resulting in detectable peaks of FAMEs. The methyl ester of oleic acid (18:1) was the main FAME of M. trichosporium OB3b, followed by methyl ester of palmitoleic acid (16:1) and methyl ester of palmitic acid (16:0). This result is the first report of FAME production from methane in methanotroph.