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Engineering a mini-cellulosome in *Lactococcus lactis* for direct conversion of cellulose in lactic acid: Cloning and expression of recombinant scaffoldin proteins

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Lactic acid (LA) is an extensively employed chemical. Notably, one of its main current applications is for synthesizing biocompatible and biodegradable plastic biopolymers, i.e., polylactide (PLA), poly (lactic acid-co-lysine), poly (lactic acid-co-glycolic acid). The latter can be used for clinical application (i.e., tissue engineering) and especially PLA as packaging thus replacing traditional plastics. Lactic acid bacteria are the main natural LA producers. Both "green" property and cost-sustainability of LA-based polymers can be improved if LA is obtained by fermentation of abundant cellulose-based wastes produced by our society, such as municipal solid waste and agricultural by-products. In this light, the development of a microorganism able to both use cellulose as fermentation substrate and produce LA can achieve both environmentally and economically sustainable biopolymer production. The aim of this work was to obtain a recombinant *Lactococcus lactis* able to depolymerize cellulose by expressing heterologous proteins derived from the cellulolytic complex, i.e., the cellulosome of *Clostridium cellulovorans*. *C. cellulovorans* cellulosome consists of enzyme subunits attached to a non-catalytic scaffold protein. Such scaffoldin is anchored to *C. cellulovorans* cell surface and allows optimal overall enzyme spatial organization, close to both cellulosic substrate and cell surface thus leading to improved cellular intake of cellulose hydrolysis products. In this work four different recombinant scaffoldins were constructed by molecular assembling of different protein domains of *C. cellulovorans* cellulosome. Engineered scaffoldins were successfully expressed by *L. lactis.* Their presence in cytosolic, extracellular and cell-wall fractions of *L. lactis* and their interaction with cellulosomal enzymes were analyzed by multiple approaches.

Biography

Loredana Tarraran has obtained her MSc in Molecular Biology from Turin University. She is interested in environmental field and working on metabolic engineering of microorganisms for application in biorefinery since 2009. She is author of one national congress communication and Co-Author of other three national and three international congress communications. Furthermore she is Co-Inventor of one international patent.

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