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Metabolic Engineering of Industrial Applications

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Introduction

Its physiological, metabolic and genomic characteristics have made it a superior host for metabolic engineering. The results of optimizing internal pathways and introducing new pathways have demonstrated that *Y. lipolytica* can be a platform cell factory for cost-effective production of chemicals and fuels derived from fatty acids, lipids and acetyl-CoA. Two products have been commercialized from metabolically engineered *Y. lipolytica* strains producing high amounts of omega-3 eicosapentaenoic acid, and more products are on the way to be produced at industrial scale. Here we review recent progress in metabolic engineering of *Y. lipolytica* for production of biodiesel fuel, functional fatty acids and carotenoids.

Description

Metabolic engineering is a process of optimizing native metabolic pathways and regulatory networks or assembling heterologous metabolic pathways for production of targeted molecules using molecular, genetic and combinatorial approaches. The purpose of the metabolic engineering is to generate a cell factory that produces cost-effective molecules at industrial scale. In order to carry out a successful metabolic engineering project, the following factors should be considered: first, use of a safe and robust host organism with genetic and physiological advantages for the target product; second, understanding of the metabolic pathways, co-factor balances, and regulatory networks; third, selection of effective enzymes and genetic elements; fourth, analysis of stoichiometry and thermodynamics; fifth, availability of efficient transformation technology; and sixth, approaches to reduce potential toxic intermediates and products. Since its inception microbial metabolic engineering has mainly focused on traditional model.

The paper is structured as follows. Section presents main existing methodologies for developing ontologies. Section describes the methodological level of the LOT framework which includes the proposed activities to be performed in any ontology development process, while Section presents the software support recommended to carry out such activities. Section focuses on the validation of the methodology based on its application and comparison with existing approaches. Finally, Section concludes and presents future lines of work. Although numerous ontology development methodologies have been proposed since the 1990s, existing methodologies should be reviewed and adapted to support ontology development in the Linked Data and agile context, which are currently popular scenarios. This section provides an overview of ontology development methodologies mainly oriented to OWL ontologies.

Specifically, METHONTOLOGY defined a set of life cycle models and a development process that provided an overview of how an ontology should be developed. Moreover, it provided detailed guidelines to carry out the ontology conceptualization. The life cycle models that it proposed were waterfall, incremental (which ensures that each version is compatible with the previous ones) and one based on evolving prototypes (with essential similarities to agile development). However, from a current perspective it has some drawbacks: There are activities that are not defined in a precise way; it was focused on developing application-independent ontologies, however, currently it is usual to develop ontologies as part of a bigger software project;some of the premises associated with METHONTOLOGY are no longer valid, for instance, that the ontologies that you reuse will be stable and available forever; and there was not so much experience as now developing ontologies. [1-5].

Conclusion

Third, capital investment for manufacturing assets must be reduced. Creative innovation in fermentation engineering and downstream processing will be required for industrial applications of biological manufacturing with using *Yarrowia* and (or other microorganisms) to become widely used. For example, a continuous fermentation process which performs with the same yield and titer as the fed batch fermentation will significantly increase the volumetric productivity of the process, and thereby decrease the capital investment in both fermentation and downstream process equipment. *Y. lipolytica* shows considerable promise to meet the challenges in each of these three areas. With further advances in our knowledge and tools, metabolic engineering of Y. lipolytica will play a more important role for industrial applications, and will help to provide more sustainable and renewable products to society in the future.

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