**Microbial-based production of fatty acid–derived products**

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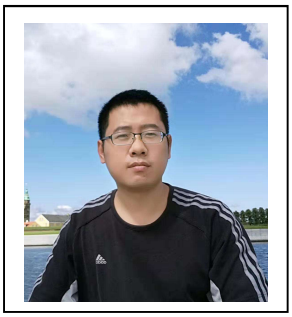

## Abstract

Free fatty acids (FFAs) and their derivatives are valuable products with many applications, such as biofuels, chemicals, flavor and fragrance intermediates, pharmaceuticals, cosmetics, plasticizers, coatings, and fuels. For example, fatty acid ethyl esters (FAEEs) exhibit fulfilled or improved properties compared to diesel fuel, and can perform as a replacement of currently applied biodiesel; triacylglyceride with odd-chain fatty acyl moieties (ocTAG) is a type of odd-chain fatty acid derivatives, and it is estimated to cost US$6000-8000 per ton and have a global value of US$6-8 billion per year.

The interest in microbial synthesis of fatty acid–derived products has increased substantially. In the past years, we have engineered the budding yeast *Saccharomyce cerevisiae* as a cell factory for production of FAEEs. In connection with this work we first evaluated different wax synthases that catalyze formation of the ester bond between fatty acids and ethanol, and further engineered lipid metabolism to improve the production of FAEEs. The FAEEs production reached 34 mg/L after several rounds of metabolic engineering cycles, which is still below the commercial level. In order to further increase the production of FAEE, we are trying to modify the key enzyme WS through protein evolution. Besides, an oleaginous yeast *Rhodosporidium toruloide* was also under development as an efficient cell factory for FAEEs.

## Brief Biography

Dr. Shuobo Shi is now a professor at Beijing University of Chemical Technology. He obtained his Ph.D. degree in Biochemical Engineering from Tianjin University in 2009. Then he did his postdoc research with one of the world-leading metabolic engineers, Prof. Jens Nielsen at the Chalmers University of Technology in Sweden. He joined Prof. Huimin Zhao's research laboratory in Agency for Science, Technology and Research (A*STAR) of Singapore as a research scientist in 2013. His main scientific interest focuses on metabolic engineering and synthetic biology, including metabolic engineering of microbial cell factories for biofuel productions, development of genome engineering and synthetic biology tools, and development of automation systems for synthetic biology. Until now he has been published more than 20 peer-reviewed papers, including two ESI highly cited papers.

**Brief CV**

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**Education:**

B.S. Biochemical Engineering, Hebei University of Technology, P.R. China, 2004

Ph.D. Biochemical Engineering, Tianjin University, P.R. China, 2009

**Professional Career:**

2009-2012 Chalmers University of Technology, Sweden, Postdoctoral Researcher
2013-2017 Agency for Science, Technology and Research, Singapore, Scientist
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**Research Interests:**

1. Metabolic Engineering
2. Microbial Systems and Synthetic Biology
3. Fatty Acid Derivatives
4. Microbial Cell Factories

**Selected publications**

1. Yueping Zhang, Juan Wang, Zibai Wang, Yiming Zhang, **Shuobo Shi**, Jens Nielsen, Zihe Liu* (2019). Nature Communications, 10:1053
2. **Shuobo Shi**, Ee Lui Ang, and Huimin Zhao (2018). Journal of Industrial Microbiology & Biotechnology, 45:491.
3. **Shuobo Shi**, Yook Wah Choi, Huimin Zhao, Tan Meng How, and Ee Lui Ang (2017). Bioresource Technology, 245: 1343-1351.
4. **Shuobo Shi**, and Huimin Zhao (2017). Frontiers in Microbiology, 8:2185.
5. **Shuobo Shi**, Tong Si, Zihe Liu, Hongfang Zhang, Ee Lui Ang, and Huimin Zhao (2016). Scientific Reports, 6:25675.
6. **Shuobo Shi**, Youyun Liang, Mingzi M Zhang, Ee Lui Ang, and Huimin Zhao (2016). Metabolic Engineering, 33:19-27. (ESI Highly Cited Papers)
7. **Shuobo Shi**, Haichuan Ji, Verena Siewers, and Jens Nielsen (2016). FEMS Yeast Research, 16(1): 108.
8. **Shuobo Shi**, Juan Octavio Valle-Rodríguez, Verena Siewers, and Jens Nielsen (2014). Biotechnology and Bioengineering, 111: 1740–1747.
9. **Shuobo Shi**, Yun Chen, Verena Siewers, and Jens Nielsen (2014). mBio, 5(3): e01130-14.
10. Juan Octavio Valle-Rodríguez[#], **Shuobo Shi[#],** Verena Siewers, and Jens Nielsen (2014). Applied Energy, 115: 226-232. (ESI Highly Cited Papers)