Structure changes of lipopolysaccharide influence the membrane properties and biofilm formation of *Escherichia coli*

Zhou Wang, Ye Li, Feng Shi, Xiaoyuan Wang  
State Key Laboratory of Food Science and Technology, Jiangnan University, 1800 Lihu Avenue, Wuxi 214122, China.

Biofilms can be defined as communities of microorganisms attached to a surface. They have an important influence on microbial infections and industrial processes. As a permeability barrier, outer membranes of Gram-negative bacteria retard the entry of substrate into the cell and prevent the product secretion. Alteration of this barrier would change the efficiency of whole-cell catalyzed reactions and cell to cell communication in the biofilm. Lipopolysaccharides are major molecules in the outer membranes; therefore, their structure might influence the membrane permeability and surface hydrophobicity of cells. In this study, 11 mutants of *Escherichia coli* were constructed by deleting the relevant genes in the biosynthetic pathway of lipopolysaccharide, resulting in the altered structures of lipopolysaccharide, as judged by the SDS-PAGE and LC/MS analysis. The biofilm formation ability, outer membrane permeability and hydrophobicity of these mutants were different. Compared with wild-type strain *E. coli* W3110, the ability of biofilm formation of ΔwaaG, ΔwaaP, and ΔwaaFC mutants decreased by 30% to 50%, and their membrane permeability were 2-5 folds higher. Comparing with the wild type strain, surface hydrophobicity of seven mutants with altered core oligosaccharide increased by 10-30%. Apart from the variation of membrane properties, the secretion of extracellular polymeric substance (EPS) has an influence on the biofilm formation. The results demonstrate that the structure of lipopolysaccharide would influence the biofilm formation, cell membrane permeability and surface hydrophobicity of *E. coli* W3110.