Extended Abstract
Volume 5:4, 2021

Journal of Genetics and DNA Research

Open Access

Modification of silicone surfaces with carbohydrates to promote formation of nonpathogenic biofilms against pathogenic colonization

Chengzhi Cai

University of Houston, USA

Abstract

Device-associated infections, such as catheter-associated urinary tract infection (CAUTI), are due to formation of pathogenic biofilms on the devices. In these biofilms, pathogens are embarked in their secreted extracellular polymeric substances (EPS) that shield them from antimicrobial agents and host defense and facilitate their development of drug resistance. Despite extensive research, long-term prevention of pathogenic colonization and biofilm formation in a high nutrient environment remains a great challenge. Since biofouling and the subsequent pathogen colonization is eventually inevitable, a new strategy based on bacterial interference using non-pathogenic bacteria to guard against pathogens has attracted increasing interest. Crucial to the success of this strategy is to establish a high coverage and stable biofilm of non-pathogenic bacteria on the surface. We have been using a non-pathogenic E. coli strain with type I fimbriae to interfere the colonization of uropathogenic bacteria on silicone as the most common biomedical material. To promote the formation of stable and densely packed benign E. coli biofilms on silicone surfaces, we developed an efficient method for modification of the surface with mannoside ligands.

The resultant biofilms prevented the colonization of several strains of antibioticresistant uropathogenic isolates at a concentration thousand times higher than the diagnostic threshold for CAUTI.

Using the well-defined model systems, we are also studying the initial bacterial adhesion and biofilm formation on surfaces presenting mannosides and polysaccharides, poly(N-acetylglucosamine). Our work indicated that the strong binding between the immobilized carbohydrates and the bacteria promoted the production and secretion of EPS consisting of proteins and polysaccharides that are crucial to the biofilm coverage and stability. The work will be discussed in this talk.

Biofilm-related infections have been a major clinical problem and include chronic infections, device-related infections and malfunction of medical devices. Since biofilms are not fully available for the human immune system and antibiotics, they are difficult to eradicate and control; therefore, imposing a global threat to human health. There have been avenues to tackle biofilms largely based on the disruption of their adhesion and maturation. Nowadays, the use of probiotics and their derivatives has gained a growing interest in battling against pathogenic biofilms. In the present review, we have a close look at probiotics with the ultimate objective of inhibiting biofilm formation and maturation. Overall, insights into the mechanisms by which probiotics and their derivatives can be used in the management of biofilm infections would be warranted.

This work is partly presented at International Conference on Glycobiology