SHORT ACADEMIC ABSTRACT

The chronic and progressive *Pseudomonas aeruginosa* infection in cystic fibrosis (CF) patients' lungs starts with the bacterial lectins-mediated binding to certain sugars on the respiratory tract. Blocking this binding with competitive sugars offers a promising treatment to the infection. Due to the diverse living microenvironment of *P. aeruginosa* in the lungs, the bacteria isolated from CF patients often have very different colony morphologies and physiological phenotypes, which are directly related to their unusually high antibiotic-resistance. Therefore, we asked whether *P. aeruginosa* with different morphologies also have different carbohydrate-binding profiles, and what monosaccharides can be bound by the bacteria on a cellular level. To answer these questions, a group of *P. aeruginosa* laboratory strains and clinical isolates with various morphologies were tested against a panel of synthesized and commercial fluorescent glycopolymers possessing distinct pendant monosaccharides. Our attempt to synthesize glycopolymers through pre-activated poly(*p*-nitrophenyl acrylate) reacting with primary-amine-containing side chains failed. However, using reversible addition fragmentation chain-transfer (RAFT) polymerizations, a group of fluorescent glycopolymers containing different pendant sugars were successfully prepared. In the *P. aeruginosa* binding tests in which commercial glycopolymers were mainly used, α-D-galactose, β-D-*N*-acetylgalactosamine, or β-D-galactose-3-sulfate demonstrated strong binding with all the strains and clinical isolates tested. But within an isogenic population, only ~1% of the bacteria showed observable binding. These findings provide new perspectives for the pathogenesis of the *P. aeruginosa* infection in CF lungs and the sugar-inhalation anti-adhesion treatment.