A K47 Klebsiella pneumoniae Phage and Its Capsule Depolymerase in Therapeutic Applications

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Klebsiella pneumoniae (KP) has been raging around the world recently, posing a threat to public health and also becoming a significant burden on healthcare systems. Although antibiotics were initially used in medicine, their effectiveness has been decreasing due to the antibiotic resistance of KP. In particular, capsular-type K47 KP, which is one kind of carbapenem-resistant KP (CRKP), has risen as a predominant type associated with nosocomial infection. Hence, finding alternative treatments against it is urgent. Among these, phages and their derivative enzymes are considered promising in the development of antibiotic alternatives. In this study, we aimed to isolate phages from natural environments. As a result, we purified phage K47_1 and phage K47_3 from sewage, both of which potentially carry capsule polysaccharide depolymerases (CPDs). Their bactericidal effects against capsular-type K47 KP were both around 99% when the multiplicity of infection (MOI) equals 10,000. Through whole genome sequencing, we found a putative CPD 003 from phage K47_1. Afterwards, the recombinant protein (of CPD003) was expressed and purified. Digestion of CPS (from a K47 strain) suggested it's a K47 capsule depolymerase. In summary, we isolated two lytic phages against K47 KP strains. These phages and a depolymerase from one of them can help in CRKP treatments. The depolymerase can be further used in development of a capsule conjugate vaccine against K47 KP strains.

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