

CHARACTERIZATION OF LYTIC BACTERIOPHAGE ISOLATED AGAINST MULTI-DRUG-RESISTANT *KLEBSIELLA PNEUMONIAE*

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Article received:20/04/2021, Revised:28/05/2021, Accepted: 31/05/2021

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ABSTRACT

Context: Multidrug-resistant strains of *Klebsiella pneumoniae* are ever emerging and creating a big challenge to healthcare worldwide. Therefore, there is a growing interest in potent lytic bacteriophages against multidrug-resistant *Klebsiella pneumoniae*.

Objectives: This study reports isolation and characterization of a potent, waterborne lytic phage of multidrug-resistant *Klebsiella pneumoniae* isolated from the hospital environment.

Methods: Pavana river water sample was used to isolate the phage against *Klebsiella pneumoniae*.

Results: Phage (vB_KpnM_KPP) isolated specific against *Klebsiella pneumoniae* from river water was identified as a member of the Myoviridae family, which is morphologically similar to the FC3 phage group. The adsorption rate constant was 4.7×10^{-10} . Latent and eclipsed periods were 15 and 20 min, respectively, with the burst size of 120 phage particles per infected cell. The phage DNA size was 54 kb, and a proteome of 9 bands in the gradient gel was obtained. It is stable within a range of pH (5 to 10) and temperature (4 to 50 °C) range. As KPP, phage showed infectivity from pH 6 to 9 and temperature from 28 to 42 °C.

Conclusion: KPP is stable over a wide range of pH and temperature, indicating its wide applications to control *Klebsiella pneumoniae* infections.

Keywords: *Klebsiella pneumoniae*, Myoviridae, multidrug resistance, burst size, stability, infectivity

INTRODUCTION

Klebsiella pneumoniae is a Gram-negative, opportunistic bacterial pathogen belonging to the Enterobacteriaceae family. It has been associated with various types of infections, viz., hospital-acquired urinary tract infections, pneumonia, septicemia, soft tissue infections.¹ The infections caused by *Klebsiella pneumoniae* have been well documented in United States² and India.³ Multidrug-resistant strains of *Klebsiella pneumoniae* are ever emerging. Recently, World Health Organization (WHO) has also warned regarding the emergence of multidrug-resistant bacteria worldwide and their big challenge to healthcare.⁴ These multidrug-resistant bacteria are very hard to eradicate using available antibiotics. The extensive use of antibiotics has led to the development of multidrug-resistant strains of *Klebsiella* spp. About 80 % of nosocomial infections in immune-compromised patients are caused by multidrug-resistant strains of *Klebsiella pneumoniae*.⁵ In one study, it has been found that over

60 % of strains of *Klebsiella pneumoniae* from the clinical cases were resistant to chloramphenicol and tetracycline.⁶ Cephalosporin resistant strains of *Klebsiella pneumoniae* have been associated with increased morbidity and mortality in hospitalized patients.⁷ Nosocomial infections caused by ESBL producing *Klebsiella pneumoniae* strains have been reported in Europe,⁸ United States, and South America.⁹ The study in France showed plasmid-mediated ESBL production in *K. pneumoniae*.¹⁰ The study carried out in the United States of America during 1998 - 2010 reported that the antimicrobial drug resistance in *K. pneumoniae* has increased for every antimicrobial class studied except tetracyclines and ciprofloxacin.¹¹ The biofilm formed by wild type *Klebsiella pneumoniae* resisted killing by ampicillin and ciprofloxacin was reported Anderl et al.¹²

From the above reports, it is clear that *Klebsiella pneumoniae* has now become resistant to almost all antibiotics available.

