Pseudomonas Phage Cocktail Powders for Respiratory Infections

Mengyu Li[1], Rachel Yoon Kyung Chang[1] & Hak-Kim Chan[1]

[1]Advanced Drug Delivery Group, School of Pharmacy, Faculty of Medicine and Health, University of Sydney, Sydney, NSW, Australia.

Respiratory infections caused by Pseudomonas aeruginosa are highly problematic due to intrinsic and acquired resistance to multiple antibiotics. Inhaled phage therapy is reconsidered as a promising supplement to antibiotics. Since phages are specific to the bacterial hosts, cocktails containing multiple types of phages are used to maximize the therapeutic outcome by broadening the host range. Inhalation dry powders provide a fast and convenient way to administer therapeutic agents directly to the lungs. This study aimed to produce phage cocktail powders for treatment of bacterial infections caused by P. aeruginosa. Spray-drying was used to produce a three-phage cocktail formulation targeting specific bacterial hosts. The formulation contained PEV20 and PEV1 (both long-tailed myovirus phages), PEV2 (a short-tailed podovirus phage), with leucine (20 wt. %) and lactose (80 wt.%) as excipients. The phages were reasonably robust to spray-drying, showing a titre reduction of 0.11-1.3 logs in the cocktail powder. The powder contained mostly small, spherical amorphous particles (volume median diameter of 1.9 µm) with weak crystallinity due to leucine as shown by the X-ray diffraction. Dispersion of the powder using the high- and low-resistance Osmohalers produced fine particle fraction (wt. % of particles < 5 µm in the aerosols related to the loaded dose) values of 62.7 ± 2.1% and 45.4 ± 0.27% at 60 and 100 L/min, respectively. To conclude, the inhalable cocktail formulation showed powder properties and in vitro phage activity suitable to combat drug resistant P. aeruginosa in respiratory infections.

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