A Rapid Lysostaphin Production Approach and a Convenient Novel Lysostaphin Loaded Nano-emulgel; As a Sustainable Low-Cost Methicillin-Resistant Staphylococcus aureus Combating Platform

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Abstract

Staphylococcus aureus is a Gram-positive pathogen that is capable of infecting almost every organ in the human body. Alarmingly, the rapid emergence of methicillin-resistant S. aureus strains (MRSA) jeopardizes the available treatment options. Herein, we propose sustainable, low-cost production of recombinant lysostaphin (rLST), which is a native bacteriocin destroying the staphylococcal cell wall through its endopeptidase activity. We combined the use of E. coli BL21(DE3)/pET15b, factorial design, and simple Ni-NTA affinity chromatography to optimize rLST production. The enzyme yield was up to 50 mg/L culture, surpassing reported systems. Our rLST demonstrated superlative biofilm combating ability by inhibiting staphylococcal biofilms formation and detachment of already formed biofilms, compared to vancomycin and linezolid. Furthermore, we aimed at developing a novel rLST topical formula targeting staphylococcal skin infections. The phase inversion composition (PIC) method fulfilled this aim with its simple preparatory steps and affordable components. LST nano-emulgel (LNEG) was able to extend active LST release up to 8 h and cure skin infections in a murine skin model. We are introducing a rapid, convenient rLST production platform with an outcome of pure, active rLST incorporated into an effective LNEG formula with scaling-up potential to satisfy the needs of both research and therapeutic purposes

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