Molecular and functional aspects of bacteriophage endolysins

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Following infection and replication, phages depend on host lysis to release their progeny in the environment. This is accomplished by the regulated expression of lysis proteins at the end of the lytic cycle. One of these proteins is the endolysin, an enzyme that specifically degrades the bacterial peptidoglycan layer, consisting of alternating residues of β-(1,4) linked N-acetylglicosamine and N-acetylmuramic acid, linked by a peptide chain of three to five amino acids.

From the moment their genetic identity became known, endolysins have sparked the interest as alternatives for existing antibiotics, to control bacteria in vitro and in vivo. Owing to the omics era, which has resulted in the sequencing of over a thousand bacteriophage genomes, numerous endolysins have been identified. Several of them have been heterologously produced (e.g. in E. coli) and characterized. Based on their amino acid sequence and their mode of activity they have been classified into several groups. Roughly divided, endolysins display their activity on the sugar polymer (muramidase), the peptide chain (peptidase) or the N-acetylmuramoyl residue-amino acid linkage (amidase). Despite their conserved biological function, phage endolysins are enzymatically and architecturally extremely diverse and vary hugely in length and size. Many of them have a modular (in contrast to globular) structure, containing different cell binding domains and signal sequences. This structural modularity implies that endolysins are malleable and, to a certain extent, can be genetically altered.

This work will give an overview of the different molecular aspects of bacteriophage endolysins, their production and characterization, and how they can serve as alternatives for existing antibiotics when applied on foodborne pathogens.

Mutagenesis of Pseudomonas sp. for enhanced production of organophosphate hydrolase

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Organophosphate chlorpyrifos has been of great interest for its effectiveness against a wide range of insects. There are several consequences related to the over and inappropriate use of chlorpyrifos, which lead to chlorpyrifos toxicity and ultimately death. For enzymatic removal of chlorpyrifos, organophosphate hydrolase has been a subject of interest for many years. The bacterial strain Pseudomonas sp. has been isolated and purified from soil. The strain was subjected to chemical mutagenesis (Ethidium bromide 10μg L⁻¹) for enhanced production of organophosphate hydrolase. Kill curve formulation resulted in 71.9% killing of cells with survival of 28.1%. The screening by growth inhibitors resulted in more resistant bacterial strain with greater ability to remove chlorpyrifos. The activities of parental strain SRcps and mutant strains SR-EB10c, SR-EB10d, SR-EB10e, SR-EB10f, and SR-EB10g were 14.5, 22.65, 20.64, 17.3, 19.6 and 21.5 U mL⁻¹, respectively. The mutant strain SR-EB10c presented 156% higher activity as compared to parental strain; which is a significantly higher value. So it is recommended to use mutant derived strain SR-EB10c for frequent and safe removal of chlorpyrifos from soil and water samples.