LANTIBIOTICS: AN ANTIMICROBIAL PEPTIDE TO REPLACE COMMERCIAL ANTIBIOTICS IN AQUACULTURE

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Introduction

Over 1 trillion species of microbes are found extensively throughout the world. Of these, bacteria are the predominant microbes. To survive in a competitive environment and to fight with competitors, bacteria employs various strategies. One of these defence strategies is the production of an antimicrobial peptide called bacteriocins. There are various classes of bacteriocins based on their size, structure and mode of action. Class I bacteriocins are classified by the presence of unusual lanthionine containing amino acids with unique mode of action. These are called lantibiotics.

Mode of action of Lantibiotics

Lantibiotics are antimicrobial peptides, produced mostly by Gram-positive bacteria, that binds to the lipid membrane of the target pathogen. Lantibiotics have two modes of action. Some varieties of lantibiotics interrupt the outer membrane during its synthesis and inhibit the formation of the cell membrane. The second type of lantibiotics bind to the bacterial membrane and disrupt the cells by forming pores. Third type of lantibiotics function in both ways. They inhibit cell wall synthesis and also forms pores in the cell membrane of bacteria (Fig. 1).

Different methods for the production of lantibiotics

Lantibiotics are produced by different methods. Producer bacteria should be given competitive stress or challenge with other microorganisms to make it produce lantibiotics. The microorganism used to challenge lantibiotic producers must be less powerful.

Lantibiotics are produced on a laboratory scale using multilayers of agar, in which one layer contains weak bacteria and the other layer contains lantibiotic producing bacteria. On industrial-scale, lantibiotics can be produced by co-culturing both the bacterias.

Advantages of using lantibiotics

Lantibiotics are bacterial killing peptides produced naturally byGram-positive bacteria. They can tolerate salt and heat stresses. They are non-toxic and easily digestible. They have strong antibacterial activity hence very less amount will be required to use in aquaculture.

Lantibiotics can be sometimes combined with antibiotics to produce antibacterial activity against a wide range of bacterial pathogens. Some of the lantibiotics can be used against viral and fungal diseases.

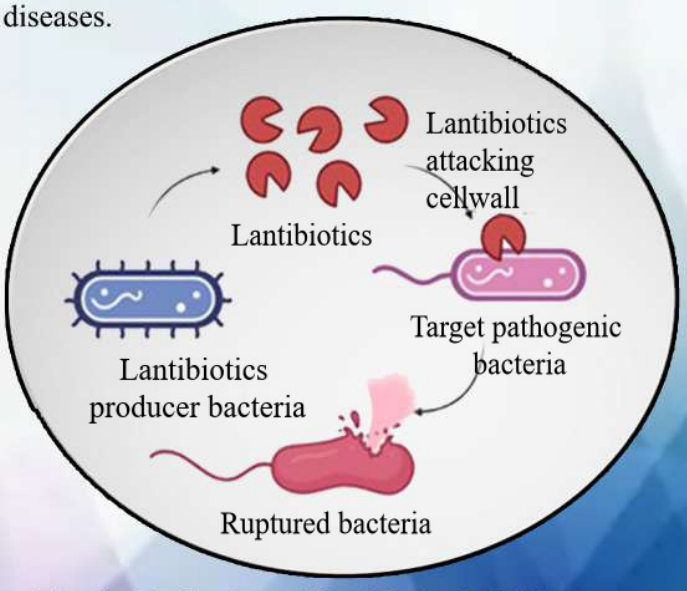

Fig. 1. Mechanism of lantibiotics in killing target pathogen

Commercially available lantibiotics

Nisin is a well-established FDA approved lantibiotic that is in commercial use for a long time. It is produced by lactococcus bacterium. Lantibiotics are commercially used in the food industry as a food preservative because it is tasteless, colourless, odourless and inhibit the growth of food spoilage microorganisms. Consumption of lantibiotics will not create harmful side effects like commercial antibiotics. Due to these advantages usage of lantibiotics are successful in the food industry. **Epidermin** is another lantibiotic used in dairy products. It is used as a preservative to inhibit cheese spoiling bacteria.

Lantibiotics for the aquaculture industry

Lantibiotics such as Nisin, and Epiderminare have been studied extensivelyin inhibiting aquatic pathogens and these lantibiotics showed strong antibacterial activity against aquatic pathogens. Application of these lantibiotics can also increase the water quality of aquaculture farms and can prevent disease-causing pathogens. Since lantibiotics are used to store food products, they can also be used as a preservative in aquaculture products. The implementation of lantibiotics in aquaculture could be a better replacement for commercial antibiotics. Lantibiotics can be used for aquaculture farms either in powdered or solution form.