Researchers from the UGR use a bacterium to obtain biopreservatives from food

The research group "Estudio de sustancias antagonistas producidas por microorganismos" (Antagonistic substances produced by microorganisms), part of the Microbiology Department of the University of Granada (Universidad de Granada [http://www.ugr.es]), has succeeded in isolating enterocin AS-48, which could have a medium-term use as food biopreservative. This represents a significant advance, given that biopreservation is an innovative method in food-preservation systems based on the use of microorganisms or their metabolic products to inhibit or destroy undesirable microorganisms.

Marina Sánchez Hidalgo, member of the research group and author of the doctoral thesis entitled 'Caracterización de variantes de la enterocina AS-48 obtenidas mediante mutagénesis dirigida' (Characterization of enterocin AS-48 variants via site-directed mutagenesis), explains that AS-48 is a bacteriocin (protein substance with antimicrobial activity) produced by Enterococcus faecalis S-48. "The bacteriocin is characterized by its circular structure —that is, because of the joining of its ends— contrary to most of proteins, which have a beginning and an end." AS-48 is very stable with respect to pH and temperature and has a broad action spectrum against numerous bacteria, including pathogenic bacteria transmitted by food, "which makes it a suitable molecule to use as a biopreservative."

The research carried out at the UGR will complete the information concerning the way that bacteriocins act on bacterial membranes and will also help in designing antimicrobial molecules with new characteristics. "Our work," states Marina Sánchez, "has determined which AS-48 amino acids are essential for membranestability and biological activity, and it has also helped us understand how this molecule permeabilizes bacterial membranes."

Competition for nutrients

Over the course of evolution, microorganisms have developed several strategies to compete for nutrients in their environment. One of these strategies is to produce antimicrobial compounds such as antibiotics, certain metabolism products, lytic agents, numerous types of protein exotoxins, and bacteriocins. It has become increasingly more necessary to find new antimicrobial agents because of the stronger resistance acquired by bacteria. Researcher Sánchez Hidalgo points out that natural antimicrobial cationic peptides such as bacteriocins "represent a good alternative."

Bacteriocins are proteins that are biologically active against members of the same species or species closely related to the producing bacterium. Some noteworthy

bacteriocins those produced by lactic-acid bacteria (LAB), as they have been used to prepare fermented food, improve quality, and extend the average duration of many foods for centuries.

The work presented in the doctoral thesis approaches the molecular aspects of the permeabilization that AS-48 exerts on bacterial membranes. "We designed a strategy to carry out site-directed mutagenesis on the as-48A gene, the one which generates enterocin AS-48", the researcher from Granada pointed out, "and we have studied the role of seven amino acids that could be involved in biological activity and in the hydrophobic nature and thermodynamic stability of the molecule. We made this study by changing the amino acids into others with different properties."

The results of this work made it possible to conclude that while some of the mutated amino acids are essential for biological activity, others improve AS-48 biotechnological characteristics. During the process of obtaining mutated amino acids, it was also determined that three out of the ten genes involved in the production of AS-48 express themselves together. The research also determined the way of that these genes are regulated and expressed as well.

Source : Universidad de Granada