

DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Microbiological deterioration of fresh or minimally processed food is a great problem for both consumers and food producers. The problem particularly affects the industry processing and distribution of fish and fish products. From the scientific reports of many researchers it results that spoilage of fish products is mainly caused by bacteria from *Pseudomonas* spp. Despite the reported cases of microbial spoilage, many market forecasts point to a continuous increase in sales of these products, especially obtained according to the recipes of oriental cuisine (i.e., the sushi and sashimi). Propagation of eating of such products connects to their beneficial impact on human health because of high concern of omega-3 fatty acids. Since the human body cannot make significant amounts of these essential nutrients, fish products start to be an important part of the diet.

In foods, *Pseudomonas* spp. prefer to lie „dormant” and defer their virulent and spoilage activities until their populations size has grown large enough to overwhelm food preservation treatment. This newly discovered phenomenon termed as bacterial *quorum sensing* operates through signals such as: N-acylhomoserine lactones (AHLs). Phenotypes that are regulated by *quorum sensing* in bacteria are highly diverse, and notably include the production of traits that are directly involved in food spoilage reactions (e. g., mucus onto the surface, change in taste, aroma and texture of foods). Because *quorum sensing* plays an important role in food spoilage, the identification of mechanisms that disrupt *quorum sensing* in saprotrophic/pathogenic *Pseudomonas* spp. currently is a hot topic in microbiology and food technology and plant essential oils have been claimed to be able to inhibit *quorum sensing* in *Pseudomonas* spp. bacteria. In the project we will investigate in depth anti-*quorum sensing* activity of essential oils from St. Jones wort, mirth, pepper, juniper, tarragon, and rosemary. In the project the wild strains of *Pseudomonas* spp. obtained from food products and digestive track of fish will be used. That work is just one of the few describing the true impact of essential oils and their selected compounds on *quorum sensing*-controlled gene expression in wild-type strains. In that project the whole genome sequencing is planned, which help to estimate genetic variation developed through evolution process and precisely designs starters to quantitative polymerase chain reaction (RT-qPCR). Despite the transcriptomic analyzes of the level of expression of genes playing key roles in exopolysaccharides biosynthesis and proteolytic enzymes production in investigated *Pseudomonas* spp. strains, also the analyzes *in silico* of real anti-*quorum sensing* and thus anti-bacterial of bioactive compounds through molecular docking of ligands autoinductors and bioactive compounds from essential oils) to *quorum sensing* receptors (LasR, RhlR and PqsR) in *Pseudomonas* spp. will be carried out. Moreover, the model cytotoxic and genotoxic analyzes of essential oils are scheduled. The cytotoxic and genotoxic activity of tested essential oils will be analyzed with respect to the cells of the gastrointestinal tract, including the gastric mucosa, intestinal epithelium and liver. The results obtained in this task will allow estimating the doses required to elicit a specific biological response while maintaining the safety of the preparations in terms of their cytotoxicity and genotoxicity to the cells of the gastrointestinal tract. The aim of the final task of that project is to estimate the level of expression of selected genes after supplemented of model product by investigated microflora and selected concentrations of essential oils.

In that project the scientific hypotheses will be verified:

- If disturbing of autoinductors of *quorum sensing* synthesis can selectively influence on microorganisms` metabolism? What kind of molecular mechanisms regulate that process?
- Does the set of genes that are affected by examined *quorum sensing* inhibitors match the set of genes that are under *quorum sensing* control?
- If disturbing of AHL synthesis can be an alternative way to improve the quality and safety of food products vulnerable to spoilage?
- If the essential oils from St. John wort, mirth, pepper, juniper, tarragon, and rosemary in food products have cytotoxic and genotoxic activity to human normal cells of gastrointestinal tract? If the addition of essential oils into food products positively influenced on their extended durability?

Strong and innovative side of the planned research is also:

- Whole genome sequencing of investigated strains, the use of wild strains and development of primers with software to target the most conserved sequence region;
- Development of research scheme to assignation of antimicrobial activity of essential oils and their bioactive compounds. Despite of classical MIC method, the flow cytometry, microscopic diagnostic and fatty acid analyzes by GC-FID will be done;
- Interdisciplinary analyzes (biological, bioinformatics, chemical, and technological experiments) help to estimate the real influence of mechanism of *quorum sensing* inhibition on physiological properties of microorganisms carried by foods but also the importance of that phenomenon in food products.