

Research on the causes of the increase in the antioxidant properties of natural compounds contained in food. The search for effective antioxidants in food technology

Oxygen is an indispensable element for life. Each oxygen atom has an even number of electrons in the last orbit, however in the process of oxygen respiration which takes place on the inner membrane of the mitochondrial cell, one of the electrons can detach which results in a gap in the oxygen atom, or one of the electronic pairs in oxygen molecule may be unpaired (triplet oxygen). Such forms are called reactive oxygen species. They are unstable forms that seek other atoms to bond to them. In the case of a matching an appropriate atom the reactive species abstracts electron from it, and generate new free radical, that will react with an another molecule (radical or atom) to complete its electron pair, etc.

The abovementioned process of free radicals formation is a chain reaction that may continue endlessly. Unfortunately, the disrupted balance of free radicals in the body negatively affects its biological functions. Free radicals having high energy can cause damage to the body's cells leading to several diseases. They may impair the structure of collagen-building the skin and muscles, and cause their flaccidity, contribute to the formation of eye cataracts, accelerate atherosclerotic processes in the blood vessels, and destroy the structure of the genetic code by causing DNA mutations. Living cells with mutated DNA intensively divide without control mechanisms, resulting in cancer. Currently, free radicals are considered to be the risk factors of neurodegenerative diseases such as senile dementia, Alzheimer's, and Parkinson's diseases. The formation of free radicals is favored by i.e. tobacco smoke, UV radiation, highly processed food containing artificial coloring and preservatives.

The abovementioned issue has become the main motivation of the scientists from the Bialystok University of Technology, Institute of Agricultural and Food Biotechnology in Warsaw, Oncology Center MD Andersen in the USA, University of Hebrew in Israel, Jagiellonian University in Krakow, and Institute of Nuclear Chemistry and Technology in Warsaw, who combine their scientific experience to counteract the free radicals problems. Foods with excess of free radicals is undesirable.

To find more effective and natural antioxidants that will scavenge the free radicals, many efforts have been made. Our preliminary research (which we intend to verify in the present grant, using extensive experimental material) shows that metal complexation of selected phenolic acids and other biologically active ligands significantly improves their antioxidant properties. Innovative research on a global scale will answer the questions of how the molecular structure of the ligand affects its antioxidant properties and what metal parameters, e.g. oxidation state, ionic potential, degree of atomic orbitals delocalization, lead to an increase in the antioxidant properties of ligand complexes. This study will allow the synthesis of new, effective antioxidants used in food technology and human nutrition, which throughout deactivating the free radicals will act preventively against cancer, neurodegenerative diseases, and many other diseases of our times.