

Propolis is a resinous substance of variable colour (green, red, golden or brown) made by honey bees (*Apis mellifera*) from material collected from leaves, flower buds, stems and crevices in the bark of many tree species, including poplar. Propolis is recognized worldwide as a natural product that in recent decades has gained the wide acceptance of people from many countries as a food supplement improving health and preventing diseases. The richness of its bioactive compounds determines the use of propolis in medicine and dentistry, as well as in the pharmaceuticals, cosmetics and food industries. Due to the wide range of propolis's applications, many studies on its biological activity have been conducted, but only on propolis from traditional sources. However, there is a lack of research on the activity of propolis from urban apiaries, although urban beekeeping has been developing rapidly in recent years. Due to the poor solubility of propolis in water, industry relies mostly on its ethanol extracts. Analysis of the mechanisms in which extracts of propolis act on microorganisms may allow for their selective use depending on the risks of contamination. Until now, very few scientific centres have focused on investigating the mechanisms of action of propolis on pathogenic microorganisms, in particular on fungi. There is a lack of research comparing several mechanisms of action of propolis, and researchers usually focus on just one or two of them. Importantly, the use of ethanol extracts of propolis is not always possible, for example because of their strong smell, as well as the fact that some people, such as children or pregnant women, cannot consume alcohol. Therefore, researchers are looking for solutions that allow for the use of propolis in the food industry without losing the biological properties of this substance. One such solution is the addition of EEP in edible film, in which it is physically retained in the polymer matrix, but active compounds can still diffuse to the food surface, where the risk of microbial contamination is highest, and provide antimicrobial protection to food, such as fruits or vegetables. In addition, the alcohol contained in the extract is removed from the film by drying.

The objective of the research project is to investigate the antimicrobial and antioxidant properties of ethanol extract of propolis from urban beekeeping, and the mechanisms of action of propolis from urban beekeeping on food-borne microorganisms. Another objective of the research is to determine the inhibitory effect of the pullulan film containing extracts of propolis, in particular those rich in phenolic compounds and flavonoids, on the growth of microorganisms representing typical saprophytic microflora, as well as pathogenic food-borne microflora. The final result of the research will be a report on the effects (mechanisms of action) of propolis on microorganisms, and the development of technology for the production of pullulan films with the addition of biologically active compounds derived from propolis.