7. Summary

Pure silver is very rare in the natural environment and probably due to this fact it got known by ancient people much later than gold. According to the Greek Chronicles, its discovery around 1300 BC is attributed to Ajakos. The antimicrobial properties of silver were experimentally confirmed only in the 19th century, but nowadays this metal and its compounds are widely used in many areas of human life, including medicine. It was Hippocrates who had already observed that this remarkable metal has biological properties in the treatment and prevention of diseases. The Phoenicians kept water, wine, and vinegar in silver pots to prevent them from spoilage. Why silver has bactericidal properties is still not entirely clear, although there are some theories. During World War I, silver compounds were used to prevent infection as antibiotics were not known then. The standard solution was silver nitrate which was later replaced with sulfadiazine ointment. With the discovery of antibiotics and sulfonamides, the interest in silver-containing drugs has decreased , but is now gaining new momentum. The silver (I) cation has a bactericidal, antiseptic, anti-inflammatory and astringent effect, it is a natural bactericidal metal that is effective against 650 species of bacteria, and its extremely important feature is the low resistance of bacteria to its compounds, contrary to almost all antibiotics to which more and more bacterial strains are not sensitive.

Because of the aforementioned resistance of bacteria to the most modern antimicrobial agents, we are returning to solutions that could remedy problems caused by inappropriate prescription, abuse or inappropriate use of antibiotics, which is a worldwide misfortune. Chemists, pharmacists, biologists and physicians, joining forces with engineers, physicists, biotechnologists and other scientists whose areas of expertise it is not feasible to mention here, are still looking for new chemical compounds with desired biological properties by modifying the structures of molecules known for a long time or creating new adducts from substances with well-documented performance. A lot of past studies have determined the chemical and biological properties of coordination compounds - imidazole derivatives and transition metals, including silver.

This work focuses on the synthesis of a new silver (I) coordination compound of the formula $[Ag(MTZ)_2]_2SO_4$ and the modification of the synthesis of the complex of the formula $[Ag(MTZ)_2NO_3]$. Both compounds were tested to confirm their composition (elemental analysis, ^1H NMR, IR), stability under various storage conditions (daylight, darkness, UV-A radiation), cytotoxic properties (determined with the use of 5 cell lines) and antibacterial

properties (conducted for a dozen or so types of bacteria, both gram-negative and gram-positive). I also determined the basic physicochemical properties, such as melting points, water solubility, taking into account the possibilities of practical application in pharmaceutical preparation. For the novel synthesized complex, its structural formula was presented based on X-ray structure studies.

The presented new simplified route of $[Ag(MTZ)_2NO_3]$ synthesis allowed for developing a formulation of 4 drug forms: external ointment, external gel, eye ointment and eye drops. The last form of the drug has also undergone a process of refinement, which made it possible to improve the comfort of use for the patient. Prescription medicinal products made in the operating conditions of a real pharmacy, constituting an individual approach in patient therapy, have been tested for pharmacological effects in several patients. Each of the drug forms was also subjected to an assessment of behavior during both appropriate storage and improper storage (in conditions conducive to decomposition), taking into account the pharmaceutical standards recommended by Polish Pharmacopoeia. My dissertation presents the results I obtained, which bring high hopes, among others, for dermatology and ophthalmology. Undoubtedly, the research I have started should be developed further.