

Algae are among the most widespread organisms on Earth, thriving in a remarkable variety of environments. They can colonize almost any surface, from natural rocks and soils to man-made materials such as concrete, brick, and glass. This adaptability means that algae are commonly found on both new and old buildings, where they often form visible green biofilms, especially those belonging to the Chlorophyta group. Their presence can lead to discoloration, making buildings look neglected, and can cause physical and chemical changes that weaken the materials over time. This not only reduces the functional lifespan of buildings and increases maintenance costs for property owners, but is also especially detrimental to cultural heritage. To address these challenges, a range of protective strategies has been developed. These include special coatings that prevent initial biofouling, as well as treatments for materials that are already affected. Recent advances in science and technology have introduced new methods, such as surface hydrophobization (making surfaces water-repellent), the use of quaternary ammonium salts, photoactive compounds, and nanoparticles of metals like silver and copper, all of which can help control microbial growth. Despite these innovations, chemical biocides are still the most commonly used solution, as they are highly effective and relatively affordable. However, the use of these chemicals comes with significant drawbacks. Many biocides are toxic to the environment and can pose risks to human health. In response, the European Union has implemented strict regulations to limit the use of harmful substances, leading to a significant reduction in the number of approved antialgal products. This shift in policy has created an urgent need for new, environmentally friendly alternatives. Recent scientific studies suggest that plant-derived substances, such as essential oils, may offer a promising solution. Natural compounds have shown antimicrobial properties in laboratory tests and in the conservation of historic buildings. However, most of these studies have been limited in scope, have never been widely tested against terrestrial algae and much remains to be explored regarding the full potential of isolates from different plant species and regions.

The main aim of this project is to explore the antialgal properties of plant-derived isolates and to evaluate their effectiveness in protecting building materials. The proposed research will involve the isolation of essential oils and hydrolates from a broad spectrum of raw plant materials typical of the geographic area of Poland. The obtained compounds will be analyzed for their chemical composition and screened for antialgal activity under model conditions. Finally, following simple hydrogel immobilization, selected isolates will be used to treat colonized building materials, including substrates of historic value.