Metallic bone implants made of austenitic stainless steel and titanium biomaterials are frequently used as important therapeutic devices in the clinical treatment of numerous orthopaedic and dental diseases. However, infections in patients with implanted devices are a very common and challenging global problem. The progress of infection is related to the adhesion of bacteria and the formation of a biofilm on the implant surface. Moreover, this situation is difficult to control in clinical practice today due to the increase in the number of antibiotic-resistant bacterial strains. This inconvenience leads to an increase in patient morbidity and frequent revision operations.

With the increasing number of infections, even in short-term implants, and the ability of pathogens to develop resistance to current treatment strategies, there is a great need to find new safe strategies to combat them. One of the most promising strategies is to coat metallic implants with natural coatings reducing bacterial adhesion and inhibiting the formation of biofilms. The use of coating materials based on natural components, separately or in the form of composites, can remove harmful chemicals and provide new promising antimicrobial properties of biomaterials. Natural compounds derived from plants have attracted significant interest because of their safety, specific antimicrobial activity, low toxicity, and high bioavailability. Among the numerous potential antimicrobial agents, essential oils (EOs) show exceptional antibacterial properties against both Gram-negative and Gram-positive bacterial strains. The other very promising antimicrobial compounds are derived from herbs, such as cardamom and curcumin. The crucial challenge is obtaining coatings with favourable antimicrobial properties, low cytotoxicity and chemical stability suitable for the release of the active substances. **Therefore, in this project, we intend to develop a new family of totally natural coatings based on marine biopolymers** (chitosan and alginate separately as well as enhanced with cellulose nanocrystals) **with balanced antimicrobial capability and low cytotoxicity for metallic biomaterials, which is very important for society and worth advanced scientific research.**

Electrophoretic deposition (EPD) is a versatile technique for the co-deposition of natural antimicrobial compounds and natural polymeric particles. This technique will be used in the project to deposit the following innovative coatings on commercially pure titanium and austenitic stainless steel substrates:

- *marine biopolymers chitosan- and alginate-based coatings with EOs or their major components*. Various EO components, such as thymol, carvacrol, cinnamaldehyde, citronellol, and terpinen-4-ol, will be used. For comparison purposes, coatings with natural EOs (thyme oil, cinnamon oil, citronella oil, and tea tree oil) will be deposited and investigated.
- *multicomponent cellulose nanocrystals CNs/chitosan and CNs/alginate-based coatings with cardamom and curcumin.*

The critical issue of the project will be the elaboration of deposition conditions to obtain homogeneous and robust coatings with a tailored microstructure, phase composition and properties. Therefore, a systematic investigation of EPD kinetics and mechanisms will be conducted. The metallic substrates with homogeneous coatings exhibiting good adhesion to the substrate will be submitted for the characterisation of electrochemical corrosion resistance, antimicrobial activity and cytotoxicity. It is expected that the proposed advanced interdisciplinary approach will contribute to the development of new knowledge in the field of natural coatings with antimicrobial capability for metallic biomaterials. This new knowledge can be valuable for the further development of safe metallic implants used in orthopaedics and dental applications. Accordingly, the proposed research will contribute to reducing the use of antibiotics and revision surgery as well as support the comfort and quality of life of patients.