One of the most interesting research areas of materials science deals with the development of biomaterials such as bioactive ceramics, **bioceramics**. Among them, **Hydroxyapatite (HA)**, and **bioglass (BG)** are promising alternatives in the bone tissue engineering (**BTE**) approach. Although HA and BG exhibit good bioactive indexes and present osteogenic properties, the biological application of these materials is limited due to their low mechanical properties to the development of scaffolds. To try to overcome the limitations some **composite** materials are developed from two or more materials that can integrate the advantageous attributes and compensate for the disadvantages of their single components and get the properties of interest in a single material.

Following this research line the synergistic effects, novel potentialities and more functionality of two bioactive materials such as **hydroxyapatite** (**HA**) and **bioglass** (**BG**) want to be achieved in the presented project by means of a synthesis of **3 types of nanocomposites**. The first two are **MOF** composites: **MOF@HA**, **MOF@BG** and **MOF@Fe_3O_4@HA**, **MOF@Fe_3O_4@BG**. Metal-Organic Frameworks (MOFs) are characterized by excellent properties, e.g. large surface area, adjustable structure, and high porosity. This allows various important compounds to be incorporated in pores, depending on their intended use and application. The third type of composites proposed to be obtained within the framework of the presented project are composites with **metal oxide (MO) type MO@HA** and **MO@BG**, for which we will present an innovative approach to the synthesis from MOF composites**.**

Despite the unique properties in terms of **bone tissue engineering (BTE)** and **agriculture** MOFs are still undiscovered, especially their composites based on **bioceramics.**

Therefore the synthesis of this **sophisticated material** is planning in order to *(i) enhance the mechanical properties of BG or HA and overcome their current limitations and weakness, (ii) to impart their bioactivity/biocompatibility and (iii) providing new functionality by introducing various compounds into pores, e.g. vitamin C, ferulic acid, fulvic acid, urease inhibitors or nitrification inhibitors*. In order to determine the properties of the materials received, to verify the assumptions and to select the material with the best properties, the following parameters characterizing the materials will be determined: chemical composition, crystal structure, particle size, aggregation degree, porosity and specific surface area, mechanical and magnetic properties (for F_3O_4 composites), etc.

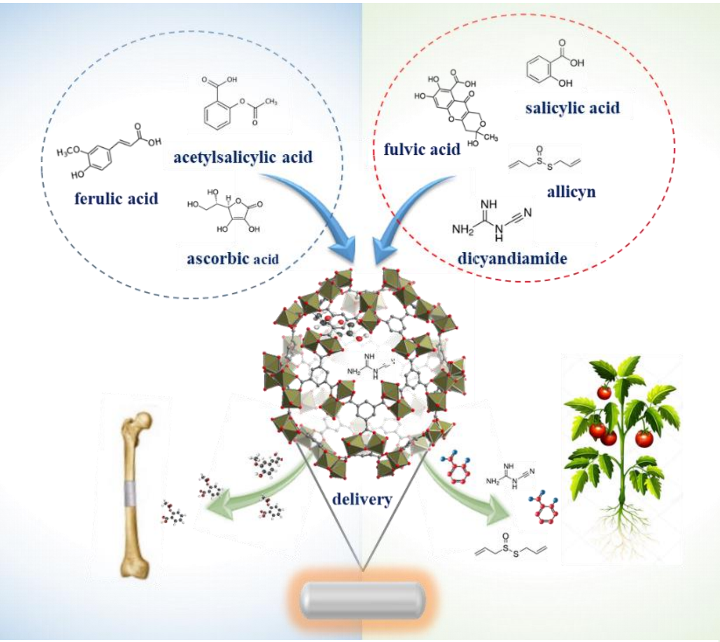

Figure 1. Scheme of using the proposed composites.

Biological research will be carried out in two stages. In the first step, the growth of hydroxyapatite (an inorganic component of bones and teeth) on the resulting materials in the presence of simulated body fluid (SBF) will be tested. In the second stage, cell cultures (*in vitro* tests) and selected strains of bacteria will be used.

The second aspect of the research concerns their potential use in agriculture as intelligent fertilizers. It is planned to determine the kinetics releasing of macro- and microelements as well as plant nutrients from composites in different pH ranges and evaluation of their ability to inhibit urease.

The final goal of the project is to select promising materials with high biological activity that could be further tested *in vivo* as an attractive alternative to the commercial Bioglass® and offering new perspectives for bioactive glass as third-generation biomaterials for tissue regeneration. We believe that the project will also lead to the preparation and characterization of a very interesting group of advanced materials with new functionalities - to be used in agriculture as environmentally friendly fertilizers. As a result, the implementation of the planned research will contribute to the improvement of human health in both cases.