1. Objective of the project

The aim of the project is to develop an innovative method of supporting the adsorption processes of heavy metals from aqueous solutions, using a strong external electromagnetic field.

2. Basic research carried out during the project

Heavy metals are one of the most important environmental hazards, mainly due to their high toxicity to almost all living organisms. On the other hand, many different branches of industry feedstock or products is based on these compounds. Therefore, one of the major challenges currently facing scientists and engineers is to find a new and more efficient treatment methods of wastewater rich in heavy metals. Among the many methods and processes relating to the removal of heavy metals from aqueous solutions, such as chemical precipitation, membrane separation or capacitive deionization, for a special attention deserve adsorption techniques. They allow to obtain a very high yield of the purification process and during the use of the adsorbents of natural origin such as straw, does not carry the risk of introducing the additional environmentally hazardous chemicals to purified water. Adsorption processes based on the natural origin adsorbents are generally called as a biosorption processes and they are one of dynamically developing branches of knowledge in contemporary environmental engineering. Therefore a new methods and ways of appropriately modifying of the biosorption processes are developing all the time, in order to enhance the attractiveness of this methods. One of the most investigated ways of increasing the efficiency of the biosorption properties is a chemical modification of sorbents, but it often requires a use of aggressive environmentally hazardous chemicals that are necessary to modify the surface of biosorbents. Thus, the process involves the generation of additional amounts of waste water which are often toxic to many aquatic organisms and microorganisms. Therefore, it is important to find a modification methods of adsorption processes that will not require the introduction into the reaction system any additional components or substances. The modification methods by placing the reactors in a strong electromagnetic field, proposed in the application, are a highly innovative proposals that carry a novelty solutions on the world scale. It should also be noted that literature studies and results of preliminary tests confirm the validity of the assumptions presented in the project.

3. Present reasons for choosing the research topic

The basic research, provided in project aimed at testing the possibility of intensification and modification of heavy metal adsorption process, by using strong electromagnetic (EM) field. This impact will be examined separately for both components of the EM field, both for electric and magnetic field. Adsorbents used in the project will be activated carbon as adsorbent having a known technical characteristics provided by the manufacturer, vermiculite and barley straw, as a representative of biosorbents. Choice of the barley straw was dictated by the fact that it occupies an important place in the sowing structure in Poland, and its biosorption properties, compared with corn, wheat or rice straw, are very poorly understood. Analysis of the EM field influence will be carried out in a periodically reactor in which the solution and the adsorbent are mixed for a sufficiently long period of time and then filtered to separate the phases. Obtained during the experiments results, will be used to propose a model of adsorption process that best describes the analyzed system, and changes caused by applying different types of EM fields. This differentiated approach to the problem, should allow to obtain a full picture of the analyzed phenomena and thereby to fill a significant gap in current knowledge related with the adsorption processes. In addition, the project's undoubted advantage is that during the period between March and August 2018, research will be continued during an internship at the Massachusetts Institute of Technology *(Boston, USA*), which is the best technical university in the world. This fact, according to the principal investigator, confirms an innovativeness and future nature of the project, which was noted not only by the experts from the American Fulbright Foundation's but also by a very prominent expert on the topic, prof. T. Alan Hatton, who a tutor of this research internship.