Authors of the project aim to obtain new fillers based on aluminosilicate which will be applied to:
a) abrasive tools,
b) dental fillings,
c) novel sorbents.
It is planned to use new fillers as catalysts for resins cross-linking, phenol-formaldehyde resins, which are used as a binder for abrasive articles. Such a composite will be used as the building blocks of modern abrasive tools. This aspect of the project should be considered as a fully innovative. An important objective of the project is to investigate the curing mechanism of the above-mentioned resins in the presence of active new fillers and determining physicochemical properties of the new composite resin-new filler such as chemical structure, structural resins adhesion to the abrasive, mechanical properties and thermo-mechanical properties.
The received new materials will be used also as the inorganic components of new biomaterials for dental fillings. The main task of filler in such composites is to improve the mechanical properties. Addition to such composition modified aluminosilicate can also affect their potential to improve cariostatic potential.
It is also planned to use of obtained aluminosilicates as sorbents in a new analytical procedure for the designation of compounds secreted from dental biomaterials in contact with body fluids.
Implementation of the project will contribute to increasing knowledge of aluminosilicate modification methods and expand knowledge on new application possibilities for these materials.
New fillers will be obtained during realization of the project. These will be mesoporous aluminosilicates and they will be modified to obtain the active form for the intended applications. It will be taken advantage of the zeolites negative charge of aluminosilicate networks. Collected materials will be examined in detail using a variety of techniques. Production of dental composites will be carried out by mixing the mechanical components of the organic matrix of the aluminosilicate filler. The new material will be cured by photopolymerization (by UV light) and its properties (biocompatibility, stability) will be examined by chromatographic techniques, spectroscopy, microscopy, and others. Similarly, composites of the phenolic resin and aluminosilicates for abrasive tools will be prepared by mechanical mixing. Then the properties of new composites will be evaluated on the basis of the following instrumental techniques: inverse gas chromatography and liquid chromatography, infrared spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, atomic force microscopy (AFM), nanointender.
Carried out the synthesis of aluminosilicates and their modifications will let obtain materials with modified properties, for example an active filler which will catalyze the cross-linking reaction of phenol-formaldehyde resins. It will be possible to control the process of resins curing at a lower temperature and through this obtained resin with the appropriate hardness. This will reduce the processing costs of preparation of these resins as well as the preparation of abrasive tools and eliminate/reduce the use of hardening agent used for these resins which emit of harmful compounds into the environment during the decomposition, ie. ammonia, formaldehyde. Thus, implementation of the project will be a measurable positive impact on the environment. On the basis of the collected results a mechanism of the curing reaction of the resin in the presence of an active filler will be proposed.
Obtaining and characterization of new aluminosilicate fillers for potential use in dental composites can contribute to the obtaining of promising new materials. Because the only form of prevention of caries is, so far, the removal and replacement of infected tissue with artificial material, thus, production the material with cariostatic potential create new opportunities that contribute to improvement the health and quality of people life.