

3. Scope and Objectives

The scope and overall objectives of the project are as follows:

- Development of a novel method for zeolite modification with cation active polymers (CAP)
- Development of a WWT method and industrial technology based on the application of zeolite modified with CAP
- Increase of the decomposition rate of organic compounds at biological WTPs
- Improvement of the nitrification and denitrification activities of activated sludge
- Improvement of the quality of wastewaters biologically treated
- Improvement of the settling characteristics of surplus sludge
- Decrease of the investment and operation costs of WTPs

Within the lifetime of the project, between 1999 and 2004, the following objectives were accomplished:

- Collection of available data and determination of the missing physical-chemical properties of Hungarian zeolitic rocks; mineral composition, cation exchange capacity, Si/Al ratio
- Based on the physical-chemical properties, selection of natural zeolites for further experiments
- Mechanical and chemical pre-treatment of the selected zeolitic rocks
- Modification of the pre-treated zeolites with CAP containing quaternary ammonium or amino groups applying different CAP/zeolite ratio, molecular weight of CAP
- Determination of the total organic carbon and the chemically bound CAP content of zeolites modified
- Characterization of the bond-strength between CAP molecules and zeolite surface
- Determination of the effect of modified zeolite on the decomposition rate of wastewaters and the quality of effluent waters
- Determination the relationship between the CAP content of modified zeolite and the effluent water quality
- Classification of modified zeolites by respirometric experiments
- Development of a combined, one-step zeolite modification method
- Determination of the properties of zeolites modified in one-step
- Development of a semi-industrial method for zeolite modification
- Preparation of the documentation of the WWTT applying modified zeolites
- Implementation of pilot- and industrial-scale biological degradability experiments using modified zeolite at the WTPs of Dunakeszi, Dorog, Jánossomorja, Kiser, Mezőszilas, Mosonmagyaróvár, Pilisszentkereszt, Tét, Szob, Szilasnémeti and Veresegyháza in Hungary
- Evaluation of the water and sludge quality data of the pilot- and industrial-scale experiments
- Economic assessment of the ZeoRap[®] WWTT
- Development of a mathematical model forecasting the water and sludge quality, as well as economical effects of ZeoRap[®] WWTT on biological WWT
- Hungarian patent (patent No. 1788/04) and PCT patent application (file number: P0004740) for the methods of zeolite modification and WWT using modified zeolite

Collaborating Institutions

- Budapest Technical University (BTU), Hungary
- Central Chemical Research Institute

Major Hungarian end-users

- Danube-valley Regional Waterworks, Inc.
- North-Transdanubian Water and Sewerage Works, Inc.

- Water and Sewerage Works of Dombóvár and its Environs, Ltd.
- Richter Gedeon Chemical Factory, Inc.
- Zeotrade Mining and Processing, Inc.
- KOMPLEX Assembly and Constructing Ltd.
- Bioteam Environmental and Constructing, Corp.
- ENGEL Environmental and Foreign Trade Ltd.
- Chematech Trading, Ltd.
- Unichem Chemical Manufacturer, Ltd.

Major end-users and collaborators in other countries

- Uwatech International Water Environmental Consultant Ltd., Germany, USA, Hungary
- GeoExplorer, Inc., USA
- Boulder Innovative Technologies, Inc., USA
- Zeotech, Inc., USA
- Rota Mining, Ltd., Turkey
- Zeocem, Ltd., Slovakia
- Wastewater Treatment Plant of Beszterce, Romania
- Zeolite Australia, Ltd., Australia

The project had a NATO consultant, Prof. Dr. Etienne Vansant who visited the projects sites in Hungary 3 times and participated in the project co-directors' meeting at he University of Florida in 2002.

Two zeolite experts were invited to Hungary and involved in the project implementation: (1) Prof. Dr. Robert Bowman, New Mexico Technology, USA and (2) Prof. Dr. Etienne Vansant, University of Antwerp, Belgium.

The key equipment and software were procured using NATO funds and considerably enhanced the scientific infrastructure in Hungary are as follows:

- Laboratory dissolved oxygen meter
- Laboratory COD meter
- Laboratory BOD meter
- Laboratory and portable temperature, pH, DO and mV meters
- Total organic carbon analyzer
- Wastewater sludge activity meter
- Computers with system software and CD writer
- Notebook
- Digital camera
- Portable automatic samplers
- Industrial dissolved oxygen monitors
- Colorimetric water test kit