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ZEOLITES AND THEIR USE AT ENVIRONMENT PROTECTION WITH A FOCUS ON THE AUTOMOTIVE INDUSTRY

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The objective of the monograph is to review literature on the use of zeolites in the environmental field as well as to present the experimental results on natural clinoptilolite zeolite application. This publication intends to address researchers involved in the use of sorption materials in the environmental area as well as university teachers interested in new trends in the area.

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Iveta PANDOVÁ, Anton PANDA:

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Abstract:

Phenomenon of industrial production development and automobile transportation is the formation of gaseous emissions and waste water. Air pollutants accrue mainly in energy production as well as technology and transportation. Combustion engines produce exhaust gases containing carbon monoxide, nitrogen oxides and various types of hydrocarbons. All of these ingredients are toxic to living organisms. Moreover, nitrogen oxides are a group of gases and contribute to climate changes as well as greenhouse effect. In order to reduce pollutants in exhaust gases, zeolites that have a crystalline porous structure, ion exchange and catalytic properties, can be used. The nature provides us with a material which after suitable chemical treatment as a selective effect on certain molecules, cations and anions as well as catalytic properties useful for the conversion of toxic components in exhaust gases into nontoxic. This material is natural zeolite. The peculiarity of its structure is of great interest nowadays. Due to its chemical and physical properties it has a wide range of applications in ecology, industry and technology as well as in agricultural production. In Slovakia, there are significant deposits of zeolites in Nižný Hrabovec and Majerovce, where the main rock-forming mineral is clinoptilolite. Natural zeolite clinoptilolite is ranked among the most widely used zeolite minerals. In addition to the significant physical and chemical properties such as adsorption, on exchange and catalytic properties, its non-toxicity and affordability is very important for environmental and industrial purposes. In the following sections, the authors characterize zeolites in general. The results of the research on the use of natural clinoptilolite zeolite for reducing toxic components of exhaust gases produced by internal combustion engines as well as the results of the research on the reduction of the content of some heavy metals in aqueous solutions are being presented in this publication.

CONTENTS

1 INTRODUCTION, BASIC TERMS, INTENTION AND THE OBJECTIVES OF THE MONOGRAPH

Accompanying phenomenon of industrial production development and automobile transportation is the formation of gaseous emissions and waste water. Air pollutants accrue mainly in energy production as well as technology and transportation. Combustion engines produce exhaust gases containing carbon monoxide, nitrogen oxidesand various types of hydrocarbons. All of these ingredients are toxic to living organisms. Moreover, nitrogen oxides are a group of gases and contribute to climate changes as well as greenhouse effect. In order to reduce pollutants in exhaust gases, zeolites that have a crystalline porous structure, ion exchangeand catalytic properties, can be used. The nature provides us with a material which after suitable chemical treatment has a selective effect on certain molecules, cations and anions as well as catalytic properties useful for the conversion of toxic componentsin exhaust gases into nontoxic. This material is natural zeolite. The peculiarity of its structure is of great interest nowadays. Due to its chemical and physical properties it has a wide range of applications in ecology, industry and technology as well as in agricultural production. In Slovakia, there are significant deposits of zeolites in Nižný Hrabovec and Majerovce, where the main rock-forming mineral is clinoptilolite. Natural zeolite clinoptilolite is rankedamong the most widely used zeolite minerals. In addition to the significant physical and chemical properties such as adsorption, on exchange and catalytic properties, its non-toxicity and affordability is very important for environmental and industrial purposes.

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Figure 1: Natural clinoptilolite zeolite