Book Review

Environmental Zeolites and Aqueous Media: Examples of practical Solutions

By Eva Chmielewska

The book 'Environmental Zeolites and Aqueous Media: Examples of Practical Solutions' is a relevant book because it can help professionals to better understand how zeolites work and can be used and useful to our daily life. Eva Chmielewska's book enlarges the perspectives to expand the use of an abundant resource that is relatively cheap and can be found in several countries around the world.

The book is interesting, simply because zeolites are fascinating and it tells their story. The Swedish mineralogist Axel Fredrik in 1756 called them "*boiling stones*", after observing that upon heating zeolites produced large amounts of steam from water that had been previously absorbed by the material. Zeolites have excellent adsorption and ion exchange properties. That is why they are widely used to remove pollutants from solutions and gases; they are good catalysts as well. To help understand their relevance and its discovery, the Introduction Chapter and Chapter 2, 'Some Retrospectives and Outlooks on Zeolite Science History', describe the principles of their functioning, the importance of natural and synthetic zeolites in our daily lifeand how their different uses have been discovered. For example, the book describes the importance of zeolites application in the petrochemical industry, where synthetic zeolites are used as catalyzers for the cracking of hydrocarbons; in the nuclear industry where they are used to retain radioactive compounds from nuclear wastes; in detergents; for pets litter; in Portland cement and many other construction materials. In the latter case, one of the applications is to decrease the temperature of the manufacturing process resulting in a lower consumption of fossil fuels, saving energy but also reducing the production of green house gases. They are also used in the production of pure gases, to amend agricultural soil and improve its productivity, and to clean water. Zeolites can be used, too, as solar thermal collectors and for adsorption refrigeration because of their hygroscopic and exothermic properties.

From a scientific perspective, Chapter 3 'Occurrence, Diagenesis and Crystal Structure of Zeolites' and Chapter 4 'Basic research of Ion Exchange and Adsorption onto Zeolites in

Aqueous Solutions', the book teaches us,respectively, about the chemical composition and structure of zeolites, and about zeolites' thermodynamic and kinetic properties, so as to understand their behavior in numerous of its applications. We discover that although the zeolites' outstanding exchange properties were known since the 1910s, their commercial use was not significant before the 1960s, when they were used to treat spent nuclear fuel. The need to understand zeolite structures becomes evident when Chmielewska explains that chemists have the possibility to design new materials of this type that are better adapted to commercial needs. Industrially important zeolites hold some key advantages over their natural analogs and can have additional properties. It is also possible to produce zeolite structures that do not appear in nature.

In Chapter 5 'Kinetics and Thermodynamics Studies for Phosphate Removal Using Natural Adsorption and Chapter 6, 'Natural Zeolite – A Versatile commodity – Some Retrospectives in Water Clean-up Processes', the reader learns about the theory for the application of zeolites in phosphate removal and the domain of water treatment in general. The last chapter, Chapter 7 'Study On Going Absorption Phenomena on Clinoptilolite-Rich Tuff with Immobilized Interfaces' presents new ways to use zeolites as carriers of polymeric constituents, which allows coupling the zeolites' properties with those of nanomaterials with a large spectrum of applications. The combination is opening a universe of new potential uses.

In summary, anyone who would like to understand how, why and for what purpose the *boiling stones* are an increasingly growing market — currently amounting for synthetic zeolites alone to 1.4 million metric tons per year, 80% of which for laundry detergent — has to read this book.

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