Acta Mineralogica-Petrographica, Abstract Series 4, Szeged, 2004

THE APPLICATION OF ZEOLITE AND ALGINITE FROM SLOVAKIA FOR ZEOPONIC SUBSTRATES

UHLÍK, P., VAJDOVÁ, M., SHIWA, A.

Department of Geology of Mineral Deposits, Comenius University [Katedra ložiskovej geológie, Univerzita Komenského], Mlynska dolina G, Bratislava, 84215, Slovakia

E-mail: uhlik@fns.uniba.sk

Term zeoponic represents artificial soils having zeolites as a major component. Their development has emerged as one of the leading research topics in the area of using natural zeolites in the agricultural and horticultural industries for cultivation of plants. Another component frequently added to the zeoponics are apatite-rich phosphate rocks. The combination of the zeolite ion exchange capacity and slow apatite dissolution leads to optimal conditions for the slow-release fertilisation (Ming and Allen, 2001).

The possibility to use zeolite from Nižný Hrabovec for zeoponic substrates has been the main point of our interest. The volcano-sedimentary zeolite body at Nižný Hrabovec is the most important zeolite deposit in the Western Carpathians. These zeolites are clinoptilolite-rich, and they are mostly used in building industry as an admixture to cement.

The mixture of NH_4 and K-exchanged zeolites are predominately used in zeoponic substrates. Therefore five samples (pure NH_4 zeolite, mixtures of NH_4 and K zeolites in ratio 4:1, 1:1, 1:4 and pure K zeolite) were added to distilled water for 5, 30 and 60 days to determine their relationship at the releasing of exchangeable K^+ and NH_4^+. The experiment showed that the amount of released 'K and also NH_4 to a water solution depends on the total amount of K zeolite. The highest amount of NH_4 has been released by 50 and 80% content of K zeolite in the zeolite mixture.

In the next step, we prepared artificial soils following procedures published over the last 15 years (Lai and Eberl, 1986). A 1:1 mixture of NH_4- and K-exchanged Nižný Hrabovec zeolite was mixed with apatite concentrate from an unknown Russian deposit. Three zeolite-apatite mixture (1:1, 5:1, 20:1) were immersed in water and the K, NH_4, Ca, P, Na and Mg concentrations in the solution were analysed after 4 and 30 days. The phosphate concentration was increasing with increasing zeolite–apatite ratio, in agreement with previously published work. This trend indicates that the zeolites preferentially uptake Ca^{2+} from the solution, thus driving the dissolution of apatite.

Since a phosphate-rich rock similar to that used in our experiments is not available locally, we have chosen alginite as an alternative component for the zeoponic substrate. Alginite is a rock rich in algal organic matter with significant amount of clay fraction. Slovak alginite from Pincina was used. The mean contents of clay minerals on the alginite deposit are following: illite 35%, kaolinite 15% and smectite 10% (Vass et al., 1997).

Three zeolite-alginite mixtures (5:1, 1:1, 1:5) were prepared. The concentration of dissolved ions was increasing during the leaching in all mixtures. The highest ion concentration was detected in leachates from mixtures with larger zeolite proportions, regardless of whether the second component was apatite or alginite. The zeolite-alginite or zeolite-apatite mixtures were mixed with sand in three different ratios and horticulture grass was sown into these artificial soils. The grass production is higher at the alginite-based zeoponics. Similar production at the apatite-based zeoponics was achieved only for the 5:1 zeolite-apatite mixture. These differences are owing to the fact that alginite is a good soil conditioner. On the other hand the Slovak alginite has low content of N and therefore the production of grass on the pure alginite is lower than on the substrates with alginite and zeolites. Mixture of modified zeolite with alginite showed better results than commercial mixture of zeolite and fertiliser.

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