Effectiveness of Sr-binders tested using an *In Vitro* model

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Abstract

The radioisotope ^{90}Sr is a fision product that in biological systems will behave like calsium and accumulate in bone. Because of the dose effect and the long biological half life of radiostrontium in humans the best countermeasure is to avoid absorption. Low levels of radiostrontium in food products are therefore necessary. To obtain food products, particularly milk, with low radiostrontium levels, the use of Sr-binders in animals may be required. We have tested a number of potential Sr-binders that may be used in animal production.

Preliminary studies testing the Sr-binding effect of several compounds in goats demonstrated that only zeolite A(Na) and zeolite P would be of practical interest. Given at a rate of up to 30 g/d the Sr transfer to milk was reduced by 40%. However, because of the chemical properties of the zeolites, they may also bind other cations like Ca, Mg, Cu and Zn, all important minerals for animals. We have therefore tested the binding kinetics of Sr, Ca and Mg by the zeolites in rumen liquid from cows. We used ^{85}Sr to measure Sr binding and the stable elements of Ca and Mg naturally present in the rumen liquid to measure the binding of these minerals. In the rumen liquid mixture the pH was varied to simulate the pH variation in the digestive system of ruminants and the binding of the minerals to the zeolites were measured at each step.

The time dependant ^{85}Sr binding showed that zeolite A(Na), at 0.5% in rumen liquid, pH 7.3, bound 98% of the ^{85}Sr already after 10 min. This proportion of Sr binding was persistent for the tested period of 24 h. The zeolite P at 0.5% in rumen liquid, pH 7.3, bound ca 85% and had a similar time dependant behavior. When pH was reduced to 2.5, similar to the pH in the abomasum, no Sr was bound to the zeolites. This was also the case at pH 3 and 4. At pH 5 ca 10% of the Sr was bound. Theses levels of pH simulated the conditions in the small intestine. To simulate the conditions in the large intestine the pH was increased to pH 8, and subsequently the Sr-binding was elevated to 80%.

The zeolite A(Na) bound between 80 and 95% of the Ca, while zeolite P bound between 60 and 75% of the Ca in the rumen liquid mixture at pH 7.3. For all treatments and binders the binding of Mg was less than 20%.

We conclude that zeolite A(Na) has promising properties as a Sr binding agent in animals. The zeolite is very efficient in binding Sr in the rumen and the large intestine, while it is not likely to affect the absorption taking place in the small intestine. Because the zeolite A(Na) demonstrated high affinity also to Ca, further studies of the binding of other minerals are required before zeolite A(Na) should be taken into practical use.

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KEYWORDS: strontium binder, countermeasures in food production, mineral absorption, zeolite A, zeoliteP, contamination of foodstuff.