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Title: Ion exchange kinetics of magnetic alginate ferrogel beads produced by external gelation

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1 **Ion exchange kinetics of magnetic alginate ferrogel beads produced by external**
2 **gelation**

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12

13 **Abstract**

14 This paper reports on a study of the influence of sodium alginate concentration and iron
15 addition on the ion exchange kinetics of calcium alginate ferrogel beads produced by external
16 gelation. The calcium absorption and sodium release of the beads were fitted to Fick's second law
17 for unsteady state diffusion in order to obtain the effective diffusion coefficients of Na⁺ and Ca²⁺.
18 The dried beads were characterized concerning their thermal stability, particle size distribution and
19 morphology. The gelation kinetics showed that an increase in alginate concentration from 1% to
20 2% increased the Ca²⁺ equilibrium concentration, but presented no effect on Ca²⁺ effective
21 diffusion coefficient. Alginate concentration higher than 2% promoted saturation of binding sites at
22 the bead surfaces. The addition of iron promoted faster diffusion of Ca²⁺ inside the gel beads and
23 reduced the Ca²⁺ equilibrium concentration. Also, iron particles entrapped in the alginate gel beads
24 promoted greater absorption of water compared to pure alginate gel and lower thermal stability of
25 the beads. The main diffusion of Ca²⁺ into and Na⁺ out from the bead took place during the first 60

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