Release property of temperature-sensitive alginate beads containing poly(N-isopropylacrylamide)

Mi Hee Kim[b], Seong-Min Jo[a], Hyang Hee Joo[a], Jae Hyung Choi[a], Jin-Chul Kim[a]

[a]School of Biotechnology & Bioengineering, Kangwon National University, 192-1, Hyoja 2-dong, Chunchon, Kangwon-do 200-701, Korea

[b]Department of Biochemical Engineering, Chonnam National University, Kwangju 500-070, Korea

Abstract

The graft copolymer (APN) of alginate and poly (N-isopropylacrylamide) (PNIPAM) were synthesized and APN beads were prepared by dropping the aqueous solution of the copolymer into an aqueous solution of Ca^{2+} solution. Alginate chains were employed to play a role in forming beads by electrostatic interactions with a multivalent ion, Ca^{2+}. Grafted PNIPAM segments were adopted to act as a valve for the pores of the beads, since they exhibit the properties of thermal contraction and expansion. The % of release of blue dextran from APN beads was higher at 40℃ than at 25℃. The difference in the release between two temperatures became more distinguishable when the content of PNIPAM in APN beads is higher. Below lower critical solution temperature (LCST), the expanded PNIPAM would close the pores of the beads, resulting in a lower release rate. Above LCST, the thermally contracted polymer would open the pores, resulting in a higher release rate. The % of release from APN beads were investigated when the temperature of the release medium is altered. The release rate was relatively low at 25℃. The temperature, however, changed up to 40℃, a marked increase in the release rate was observed. These trends were found to be reproducible when the temperature was repeatedly altered between 25℃ and 40℃. As a result, a stepwise response to the temperature alteration was obtained.

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