Controlling Drug Release From Alginate Hydrogel Beads Using Polymer Coatings

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Controlled drug delivery systems can improve chemotherapy effectiveness while reducing side effects. This study investigated how pH and polymer coatings affect the release of doxorubicin from calcium - alginate beads. Beads were prepared with sodium alginate and calcium chloride, then left uncoated or coated with chitosan, polyethyleneimine (PEI) , or a combination of PEI and polyacrylamide (PAA) . Drug release was tested in citrate buffer (pH 5) , phosphate - buffered saline (PBS, pH 7) , and Tris buffer (pH 9) . Uncoated beads released about 75% of doxorubicin within 4 hours at all pH levels, with the fastest release at pH 9 and slowest at pH 5. Polymer coatings slowed release across all pH values, with chitosan + alginate most effective at pH 5, PEI + alginate at pH 7, and PEI + PAA at pH 9. These results show that polymer - coated alginate beads provide pH - dependent, controlled drug release, demonstrating their potential for targeted chemotherapy and reduced harm to healthy cells.

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