Determining the Effect of Acetic Acid on Alginate Bead Membrane Permeability to Aid the Implementation of Allogeneic Transplantation Without Immunosuppression

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Alginate beads are used to encapsulate cells in allogeneic transplants to avoid rejection from the patient's immune system. The permeability of these beads plays a crucial role in the survival of the encapsulated cell by allowing the ingress of nutrients and oxygen and exit of waste products. The effect of acetic acid on the permeability of alginate beads was studied through the addition of acetic acid to sodium alginate. It was expected that more acetic acid would create oblate beads with higher surface area and increased permeability. Alginate was used for bead formation due to its inexpensiveness and gelling abilities when crosslinked with divalent cations. Alginate beads of pHs 4, 5, and 6, containing starch, were created using varying amounts of acetic acid. The beads were dropped into IKI, and the time taken for each bead to fully blacken was recorded. The average times for beads of pH 4, 5, and 6 were 15.95, 14.60, and 17.45 seconds respectively. The data partially supports the hypothesis as the permeability increased with the initial addition of acetic acid, from pH 6 to 5, but decreased from pH 5 to 4. An ANOVA test was run and a statistically significant difference was found in the time taken for IKI to fully permeate through alginate beads of different pHs, meaning that a specific level of permeability can be created by altering the acetic acid concentration of alginate beads. Further testing of permeability can lead to advancements in effectiveness of alginate beads in transplants.

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