United States Patent [19]

Tsang et al.

[11] **Patent Number: 4,663,286**

[45] **Date of Patent: May 5, 1987**

[54] **ENCAPSULATION OF MATERIALS**

[75] Inventors: **Wen-Ghih Tsang**, Lexington; **Ann W. Shyr**, Newton Center, both of Mass.

[73] Assignee: **Damon Biotech, Inc.**, Needham Heights, Mass.

[21] Appl. No.: **579,494**

[22] Filed: **Feb. 13, 1984**

[51] **Int. Cl.**[4] **C12N 11/10**; C12N 11/04; C12N 5/00

[52] **U.S. Cl.** **435/178**; 264/4.1; 264/4.32; 435/182; 435/240

[58] **Field of Search** 435/174, 177, 178, 182, 435/240, 241; 264/4, 4.1, 4.3, 4.32, 4.33, 4.7; 424/34, 35, 94

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,352,883	10/1982	Lim	435/178
4,391,909	7/1983	Lim	435/178
4,407,957	10/1983	Lim	435/178
4,409,331	10/1983	Lim	435/178
4,582,799	4/1986	Jarvis, Jr.	435/178 X

Primary Examiner—David M. Naff
Attorney, Agent, or Firm—Lahive & Cockfield

[57] **ABSTRACT**

A core material such as viable cells is encapsulated by gelling an alginate polymer with a polyvalent cation to form shape-retaining gelled masses containing the core material, expanding and hydrating the gelled masses by contacting the masses with an aqueous saline solution, and forming a membrane about the expanded gelled massed to form capsules by contacting the gelled masses with a polycationic polymer having a molecular weight greater than 3,000 daltons. Expanding before membrane formation, permits better control of permeability properties and uniformity of the membrane. The gelled masses within the membrane may be liquified by contacting the capsules with a chelating agent which is preferably ethylene glycol bis-(β-amino ethyl ether)-N,N-tetra-acetic acid. A second membrane layer may be formed by contacting the capsules with a second polycationic polymer. The second membrane may be coated with a polyanionic polymer such as alginate.

51 Claims, No Drawings