US005278201A

United States Patent [19]

Dunn et al.

[11] Patent Number: 5,278,201

[45] Date of Patent: Jan. 11, 1994

[54] **BIODEGRADABLE IN-SITU FORMING IMPLANTS AND METHODS OF PRODUCING THE SAME**

[75] Inventors: **Richard L. Dunn**, Fort Collins, Colo.; **James P. English**, Birmingham, Ala.; **Donald R. Cowsar**, Birmingham, Ala.; **David P. Vanderbilt**, Birmingham, Ala.

[73] Assignee: **Atrix Laboratories, Inc.**, Fort Collins, Colo.

[21] Appl. No.: **513,782**

[22] Filed: **Apr. 24, 1990**

Related U.S. Application Data

[62] Division of Ser. No. 252,645, Oct. 3, 1988, Pat. No. 4,938,763.

[51] **Int. Cl.**[5] **A61F 2/02**; A61F 2/00

[52] **U.S. Cl.** **523/113**; 424/422; 424/426; 524/113; 524/173; 524/233; 524/361; 524/386; 524/391; 525/937; 604/218

[58] **Field of Search** 523/105, 113; 524/173, 524/113, 233, 361, 386, 391; 424/422, 426; 525/937; 523/113

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,155,658	4/1939	Herrmann et al.	514/772.2
3,068,188	12/1962	Beste et al.	524/173
3,218,283	11/1965	Miller	524/173
3,887,699	6/1975	Yolles	424/444
3,939,111	2/1976	Schollenberger et al.	524/233
4,161,948	6/1979	Bichon	4228/474.4
4,447,562	5/1984	Ivani	523/105
4,631,188	12/1986	Stoy et al.	424/81
4,745,160	5/1988	Churchill et al.	523/105
4,767,627	8/1988	Caldwell et al.	424/426
4,920,203	4/1990	Tang et al.	523/105

OTHER PUBLICATIONS

Holland et al, *Journal of Controlled Release*, 4 (1986) pp. 155-180.

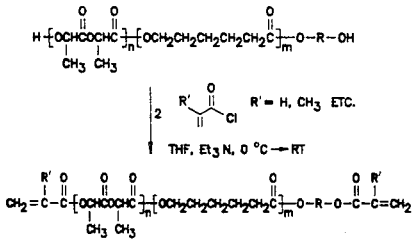
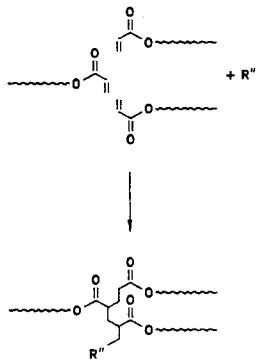
Gilding, *Biodegradable Polymers*, 9, pp. 210-232.

Billmeyer, *Textbook of Polymer Science*, 3rd Ed., p. 390-391.

Encyclopedia of Polymer Science and Engineering, John Wiley & Sons, Inc., 1985, vol. 2, pp. 236-237.

Primary Examiner—Paul R. Michl
Assistant Examiner—Andrew E. C. Merriam
Attorney, Agent, or Firm—Merchant, Gould, Smith, Edell, Welter & Schmidt

[57] **ABSTRACT**

A biodegradable polymer is provided for use in providing syringeable, in-situ forming, solid biodegradable implants for animals. The polymer is placed into the animal in liquid form and cures to form the implant in-situ. A thermoplastic system to form said implant comprises the steps of dissolving a non-reactive polymer in biocompatible solvent to form a liquid, placing the liquid within the animal, and allowing the solvent to dissipate to produce the implant. An alternative, thermosetting system comprises mixing together effective amounts of a liquid acrylic ester terminated, biodegradable prepolymer and a curing agent, placing the liquid mixture within an animal and allowing the prepolymer to cure to form the implant. Both systems provide a syringeable, solid biodegradable delivery system by the addition of an effective level of biologically active agent to the liquid before injection into the body.

21 Claims, 9 Drawing Sheets