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[54] **PHOTOCURABLE GLYCOSAMINOGLYCAN DERIVATIVES, CROSSLINKED GLYCOSAMINOGLYCANS AND METHOD OF PRODUCTION THEREOF**

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[58] **Field of Search** 522/87, 88, 89, 522/149, 34, 35, 904, 74, 78, 79, 84, 86; 523/122, 105, 111, 118; 527/312, 313, 314, 315, 304

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,920,618	11/1975	Ichimura et al.	522/149
3,960,685	6/1976	Sano et al.	204/159.12
4,141,973	2/1979	Balazs	424/180
4,331,697	5/1982	Kudo et al.	424/183
4,716,224	12/1987	Sakurai et al.	514/54
4,722,906	2/1988	Guire	436/501
4,745,098	5/1988	Michaeli	514/2
4,863,907	9/1989	Sakurai et al.	514/56
4,886,787	12/1989	de Belder et al.	514/57
4,973,493	11/1990	Guire	427/2
4,979,959	12/1990	Guire	623/66
5,002,582	3/1991	Guire et al.	623/66
5,128,326	7/1992	Balazs et al.	514/54
5,143,724	9/1992	Leshchiner et al.	424/78.08
5,190,759	3/1993	Lindblad et al.	424/423
5,217,492	6/1993	Guire et al.	623/11
5,246,698	9/1993	Leshchiner et al.	424/78.08
5,356,883	10/1994	Kuo et al.	514/54
5,358,973	10/1994	Lindblad et al.	514/777

FOREIGN PATENT DOCUMENTS

3912122	10/1990	Denmark .	
0128482	10/1979	Japan	522/88
57-89752	6/1982	Japan .	
57-89751	6/1982	Japan .	
60-16260	4/1985	Japan .	
0139569	8/1989	Japan .	
0235750	8/1990	Japan .	
3264523	11/1991	Japan .	

OTHER PUBLICATIONS

Shimomura et al., "Photochemical Reaction of Stilbaesle Amphiphile in Cast Oriented Film", Dept. Biotechnology, Tokyo University, 184 Japan; Abstract only.

Patent Abstract of Japan vol. 5, No. 106 (C–062) 10 Jul. 1981 & JP–A–56 047 439 (Japan Synthetic Rubber Co. Ltd.) 30 Apr. 1981.

"Photoinduced Prevention of Tissue Adhesion", By T. Matsuda, M. J. Moghaddam, H. Miwa K. Sakurai and F. Iida, Asaio Journal, 1992; 38: M154–M157.

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[57] **ABSTRACT**

Photocurable glycosaminoglycan (GAG) derivatives and crosslinked glycosaminoglycans, which are highly safe and biocompatible, a method of preparing such photocurable GAG derivatives readily moldable by casting using a solvent when desired, by which method unreacted substances causative of adverse effects can be readily eliminated, and a method of producing the crosslinked GAGs and medical materials based on the photocurable GAG derivatives or crosslinked GAGs are provided. The photocurable GAG derivatives comprise a glycosaminoglycan and a photoreactive compound bound thereto and can be produced, for example, by subjecting hydroxyl or carboxyl groups of the glycosaminoglycan to esterification reaction or amidation reaction, respectively, with the photoreactive compound. The crosslinked GAGs are derived from the photocurable GAG derivatives by intermolecular crosslinking of the photoreactive compound bound thereto.

11 Claims, 20 Drawing Sheets