



US008383092B2

(12) **United States Patent**  
**Lee et al.**

(10) **Patent No.:** **US 8,383,092 B2**  
(45) **Date of Patent:** **Feb. 26, 2013**

(54) **BIOADHESIVE CONSTRUCTS**  
(75) Inventors: **Bruce P. Lee**, Madison, WI (US); **Laura Vollenweider**, Middleton, WI (US); **John L. Murphy**, Madison, WI (US); **Fangmin Xu**, Middleton, WI (US); **Jeffrey L. Dalsin**, Madison, WI (US); **Jeanne Virosco**, Madison, WI (US); **William Lew**, Mendota Heights, MN (US); **Jed White**, Madison, WI (US)

(73) Assignee: **KNC NER Acquisition Sub, Inc.**, Wilmington, DE (US)  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 320 days.

(21) Appl. No.: **12/568,527**  
(22) Filed: **Sep. 28, 2009**

(65) **Prior Publication Data**  
US 2010/0137902 A1 Jun. 3, 2010

**Related U.S. Application Data**  
(63) Continuation-in-part of application No. 12/099,254, filed on Apr. 8, 2008, which is a continuation-in-part of application No. 11/676,099, filed on Feb. 16, 2007, now Pat. No. 7,732,539, and a continuation-in-part of application No. 11/834,651, filed on Aug. 6, 2007, now Pat. No. 7,622,533.

(60) Provisional application No. 61/100,560, filed on Sep. 26, 2008, provisional application No. 61/100,738, filed on Sep. 28, 2008, provisional application No. 60/910,683, filed on Apr. 9, 2007.

(51) **Int. Cl.**  
**A61K 31/74** (2006.01)  
(52) **U.S. Cl.** ..... **424/78.27**; 606/213; 424/78.08  
(58) **Field of Classification Search** ..... 424/78.27  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,339,561 A	7/1982	Jacquet et al.
4,496,397 A	1/1985	Waite
4,585,585 A	4/1986	Waite
4,615,697 A	10/1986	Robinson
4,687,740 A	8/1987	Waite
4,795,436 A	1/1989	Robinson
4,808,702 A	2/1989	Waite
4,908,404 A	3/1990	Benedict et al.
4,978,336 A	12/1990	Capozzi et al.
4,983,392 A	1/1991	Robinson
5,015,677 A	5/1991	Benedict et al.
5,024,933 A	6/1991	Yang et al.
5,030,230 A	7/1991	White
5,049,504 A	9/1991	Maugh et al.
5,098,999 A	3/1992	Yamamoto et al.
5,108,923 A	4/1992	Benedict et al.
5,116,315 A	5/1992	Capozzi et al.
5,156,956 A	10/1992	Motoki et al.
5,192,316 A	3/1993	Ting

5,197,973 A	3/1993	Pang et al.
5,202,236 A	4/1993	Maugh et al.
5,202,256 A	4/1993	Maugh et al.
5,225,196 A	7/1993	Robinson
5,242,808 A	9/1993	Maugh et al.
5,260,194 A	11/1993	Olson
5,374,431 A	12/1994	Pang et al.
5,410,023 A	4/1995	Burzio
5,428,014 A	6/1995	Labroo et al.
5,487,739 A	1/1996	Aebischer et al.
5,490,980 A	2/1996	Richardson et al.
5,520,727 A	5/1996	Vreeland et al.
5,525,336 A	6/1996	Green et al.
5,549,904 A	8/1996	Juergensen et al.
5,563,047 A	10/1996	Petersen
5,574,134 A	11/1996	Waite
5,580,697 A	12/1996	Keana et al.
5,582,955 A	12/1996	Keana et al.
5,605,938 A	2/1997	Roufa et al.
5,618,551 A	4/1997	Tardy et al.
5,628,793 A	5/1997	Zirm
5,705,177 A	1/1998	Roufa et al.
5,705,178 A	1/1998	Roufa et al.
5,736,132 A	4/1998	Juergensen et al.
5,776,747 A	7/1998	Schinstine et al.
5,800,828 A	9/1998	Dionne et al.
5,817,470 A	10/1998	Burzio et al.
5,830,539 A	11/1998	Yan et al.
5,834,232 A	11/1998	Bishop et al.
5,858,747 A	1/1999	Schinstine et al.
5,935,849 A	8/1999	Schinstine et al.
5,939,385 A	8/1999	Labroo et al.
5,955,096 A	9/1999	Santos et al.
5,968,568 A	10/1999	Kuraishi et al.
5,985,312 A	11/1999	Jacob et al.
5,994,325 A	11/1999	Roufa et al.
6,010,871 A	1/2000	Takahara et al.

(Continued)

**FOREIGN PATENT DOCUMENTS**

JP	03-294292	12/1991
JP	2000-281699	10/2000

(Continued)

**OTHER PUBLICATIONS**

Lee et al. Biological Adhesives, 2006,257-277.\*

(Continued)

*Primary Examiner* — Michael G Hartley

*Assistant Examiner* — Sean R Donohue

(74) *Attorney, Agent, or Firm* — Casimir Jones S.C.

(57) **ABSTRACT**

The invention describes substrates, such as prosthetics, films, nonwovens, meshes, etc. that are treated with a bioadhesive. The bioadhesive includes polymeric substances that have phenyl moieties with at least two hydroxyl groups. The bioadhesive constructs can be used to treat and repair, for example, hernias and damaged tendons.

**8 Claims, 13 Drawing Sheets**

U.S. PATENT DOCUMENTS

6,020,326 A 2/2000 Roufa et al.  
 6,022,597 A 2/2000 Yan et al.  
 6,083,930 A 7/2000 Roufa et al.  
 6,093,686 A 7/2000 Nakada et al.  
 6,129,761 A 10/2000 Hubbell  
 6,150,461 A 11/2000 Takei et al.  
 6,156,348 A 12/2000 Santos et al.  
 6,162,903 A 12/2000 Trowern et al.  
 6,235,313 B1 5/2001 Mathiowitz et al.  
 6,267,957 B1 7/2001 Green et al.  
 6,284,267 B1 9/2001 Aneja  
 6,294,187 B1 9/2001 Boyce et al.  
 6,306,993 B1 10/2001 Rothbard et al.  
 6,309,669 B1 10/2001 Setterstrom et al.  
 6,322,996 B1 11/2001 Sato et al.  
 6,325,951 B1 12/2001 Soper et al.  
 6,331,422 B1 12/2001 Hubbell et al.  
 6,335,430 B1 1/2002 Qvist  
 6,365,187 B2 4/2002 Mathiowitz et al.  
 6,368,586 B1 4/2002 Jacob et al.  
 6,417,173 B1 7/2002 Roufa et al.  
 6,486,213 B1 11/2002 Chen et al.  
 6,491,903 B1 12/2002 Forster et al.  
 6,497,729 B1 12/2002 Moussy et al.  
 6,506,577 B1 1/2003 Deming et al.  
 6,555,103 B2 4/2003 Leukel et al.  
 6,565,960 B2 5/2003 Koob et al.  
 6,566,074 B1 5/2003 Goetinck  
 6,566,406 B1 5/2003 Pathak et al.  
 6,635,274 B1 10/2003 Masiz et al.  
 6,663,883 B1 12/2003 Akiyama et al.  
 6,821,530 B2\* 11/2004 Koob et al. .... 424/458  
 6,887,845 B2 5/2005 Barron et al.  
 7,009,034 B2 3/2006 Pathak et al.  
 7,208,171 B2 4/2007 Messersmith et al.  
 7,300,991 B2 11/2007 Nishimura et al.  
 7,622,533 B2 11/2009 Lee et al.  
 7,732,539 B2 6/2010 Shull et al.  
 2001/0043940 A1 11/2001 Boyce et al.  
 2001/0049400 A1 12/2001 Alli et al.  
 2002/0022013 A1 2/2002 Leukel et al.  
 2002/0049290 A1 4/2002 Vanderbilt  
 2002/0182633 A1 12/2002 Chen et al.  
 2003/0009235 A1 1/2003 Manrique et al.  
 2003/0012734 A1 1/2003 Pathak et al.  
 2003/0039676 A1 2/2003 Boyce et al.  
 2003/0065060 A1 4/2003 Qvist et al.  
 2003/0069205 A1 4/2003 Roufa et al.  
 2003/0087338 A1 5/2003 Messersmith et al.

2003/0099682 A1 5/2003 Moussy et al.  
 2003/0109587 A1 6/2003 Mori  
 2003/0119985 A1\* 6/2003 Sehl et al. .... 525/54.1  
 2003/0194610 A1 10/2003 Nishimura et al.  
 2003/0208888 A1 11/2003 Fearing et al.  
 2004/0005421 A1 1/2004 Gervase et al.  
 2004/0028646 A1 2/2004 Gross et al.  
 2004/0049187 A1\* 3/2004 Burnett et al. .... 606/52  
 2005/0032929 A1 2/2005 Greener  
 2005/0155937 A1 7/2005 Zawada et al.  
 2005/0208091 A1\* 9/2005 Pacetti ..... 424/423  
 2005/0288398 A1 12/2005 Messersmith et al.  
 2006/0009550 A1 1/2006 Messersmith et al.  
 2007/0031498 A1\* 2/2007 Zong et al. .... 424/486  
 2007/0208141 A1 9/2007 Shull et al.  
 2008/0171836 A1 7/2008 Lee et al.  
 2008/0247984 A1 10/2008 Messersmith  
 2008/0286326 A1 11/2008 Benco

FOREIGN PATENT DOCUMENTS

WO 2005/056708 6/2005  
 WO 2010/091300 8/2010

OTHER PUBLICATIONS

Oxlund et al, Collagen deposition and mechanical strength of colon anastomoses and skin incisional wounds of rats, J Surg Res. Nov. 1996;66(1):25-30.  
 Jorgensen et al., Dose-response study of the effect of growth hormone on mechanical properties of skin graft wounds, J Surg Res. Mar. 1995;58(3):295-301.  
 da Silva, L.F.M., T.N.S.S. Rodrigues, M.A.V. Figueiredo, M.F.S.F. de Moura, and J.A.G. Chousal, Effect of Adhesive Type and Thickness on the Lap Shear Strength J. Adh., 2006. 82: p. 1091-1115.  
 Santillan-Doherty, P., R. Jasso-Victoria, A. Sotres-Vega, R. Olmos, J.L. Arreola, D. Garcia, B. Vanda, M. Gaxiola, A. Santibanez, S. Martin, and R. Cabello, Thoracoabdominal wall repair with glutaraldehyde-preserved bovine pericardium. Journal of investigative surgery : the official journal of the Academy of Surgical Research, 1996. 9(1): p. 45-55.  
 Burger, J.W.A., J.A. Halm, A.R. Wijsmuller, S. ten Raa, and J. Jeekel, Evaluation of new prosthetic meshes for ventral hernia repair. Surgical endoscopy, 2006. 20(8): p. 1320-5.  
 Lo Menzo, E., J.M. Martinez, S.A. Spector, A. Iglesias, V. Degennaro, and A. Cappellani, Use of biologic mesh for a complicated paracolostomy hernia. American journal of surgery, 2008. 196(5): p. 715-9.

\* cited by examiner

Figure 1

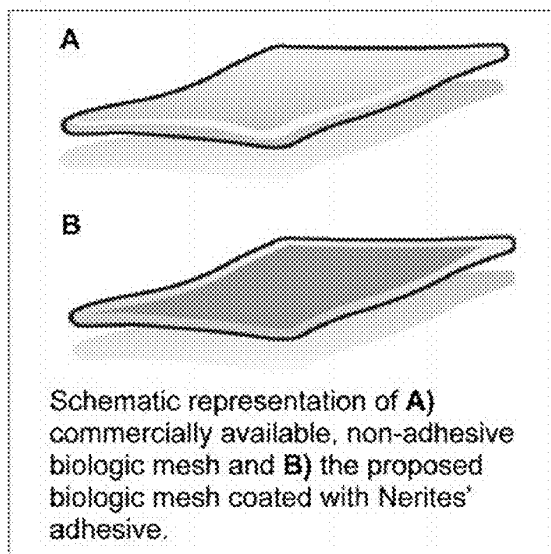


Figure 2

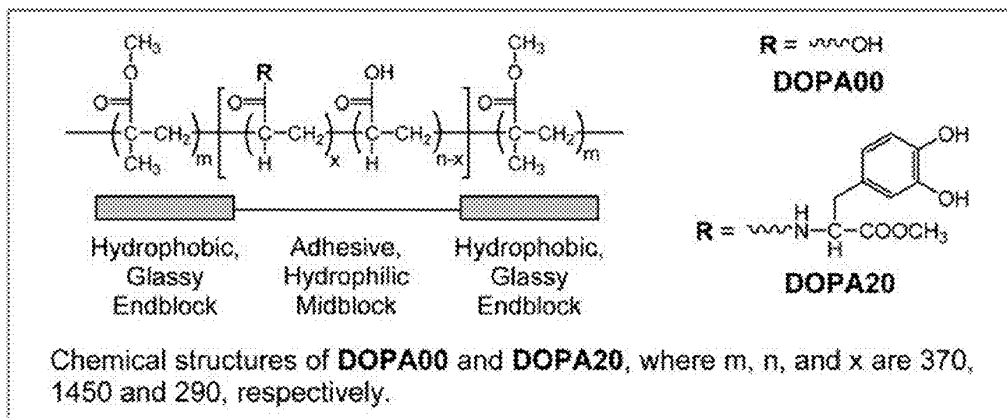


Figure 3

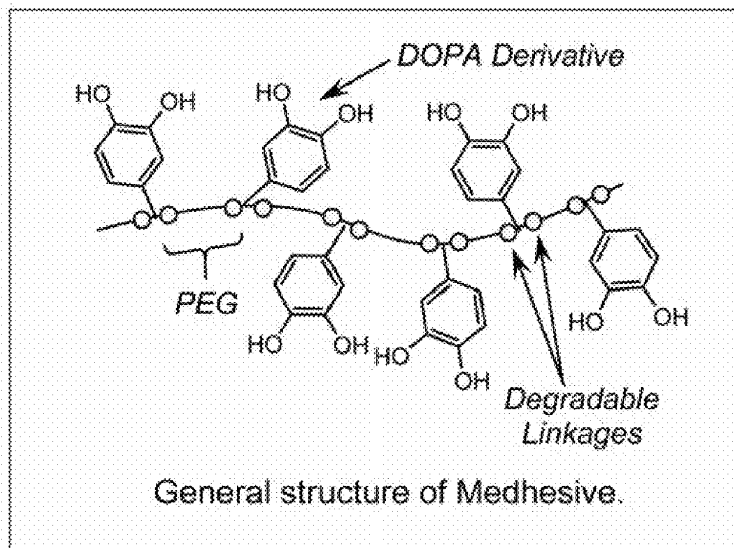
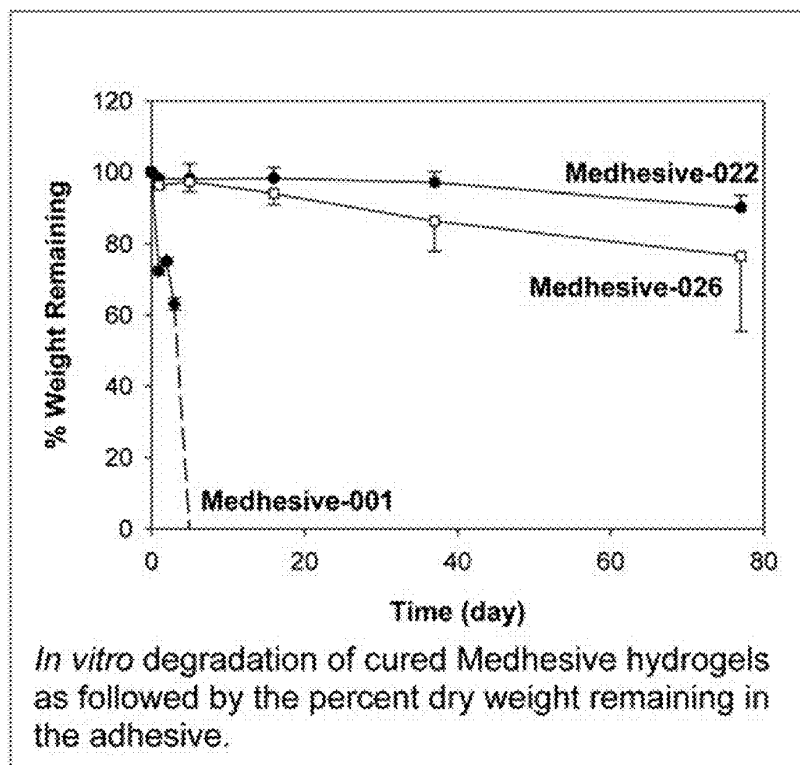


Figure 4





# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.