

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
9 November 2006 (09.11.2006)

PCT

(10) International Publication Number
WO 2006/119020 A3

- (51) **International Patent Classification:**
B29B 17/00 (2006.01) **B29C 47/00** (2006.01)
- (21) **International Application Number:**
PCT/US2006/016236
- (22) **International Filing Date:** 28 April 2006 (28.04.2006)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
60/676,657 29 April 2005 (29.04.2005) US
60/774,848 17 February 2006 (17.02.2006) US
- (71) **Applicant (for all designated States except US):** **MICHIGAN STATE UNIVERSITY** [US/US]; 238 Administration Building, East Lansing, Michigan 48824 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** **MOHANTY, Amar** [US/US]; 2313 East Jolly Road, Apt. 5, Lansing, Michigan 48910 (US). **RAHUL, Bhardwaj** [IN/US]; 1529b Spartan Village, East Lansing, Michigan 48823 (US).
- (74) **Agent:** **MCLEOD, Ian**; MCLEOD & MOYNE, P.C., 2190 Commons Parkway, Okemos, Michigan 48864 (US).
- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

- (84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

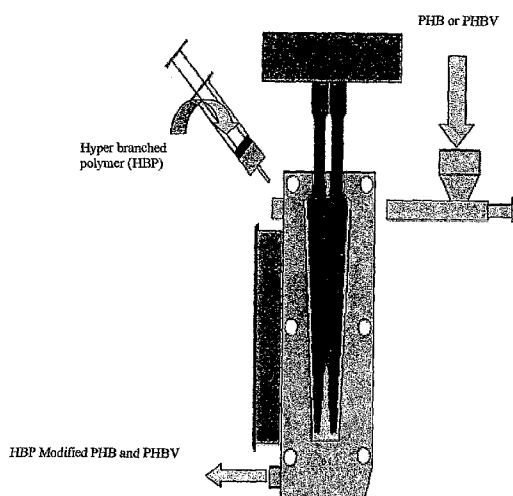
Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

- (88) **Date of publication of the international search report:**
25 October 2007

[Continued on next page]

(54) **Title:** HYPERBRANCHED POLYMER MODIFIED BIOPOLYMERS, THEIR BIOBASED MATERIALS AND PROCESS FOR THE PREPARATION THEREOF



The cross-sectional view of co-rotating twin screw mini-extruder used for blending PHB and PHBV with HBP.

(57) **Abstract:** Compositions of biodegradable polymers and hyperbranched dendritic polymer (HBP) are described. The compositions can also include anhydride modified HBP. The resulting compositions have superior elongation at break and can be as cast or blown films for packaging, for example.



WO 2006/119020 A3



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 06/16236

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8): B29B 17/00; B29C 47/00 (2007.01)

USPC: 264/37.26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC: 264/37.26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 264/3.3, 37.32, 45.9, 452, 464, 623; 521/84.1, 109.1; 554/25; 525/413; 524/445 (see text search terms)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWEST (USPT,PGPB,EPAB,JPAB); DialogPRO(Engineering); Google Scholar

text search terms: hyperbranched; dendron; dendritic; dendrimer; polyester; polylactic; anhydride; biodegradable; clay; extruding; extrude

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,093,777 A (Sorensen et al.) 25 July 2000 (25.07.2000), col 7, ln 19 to col 9, ln 36; col 12, ln 10; See examples 1 and 2	1-20, 22-30
Y	US 6,583,232 B1 (Brown) 24 June 2003 (24.06.2003), col 2, ln 64 to col 3, ln 8; col 3, lines 50-60	1-20, 22-30
Y	US 6,706,942 B1 (Zhao et al.) 16 March 2004 (16.03.2004), col 7, lines 3-10; col 6, lines 19-35	1-20, 22-30
A	US 6,720,402 B2 (Langer et al.) 13 April 2004 (13.04.2004), col 7, ln 49 to col 9, ln 8	1-20, 22-30

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

15 May 2007 (15.05.2007)

Date of mailing of the international search report

15 AUG 2007

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 06/16236

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 21
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.