



(43) International Publication Date
11 December 2014 (11.12.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/197634 A3

(51) International Patent Classification:

A01N 3/02 (2006.01) C07F 5/02 (2006.01)
A01N 55/08 (2006.01) A01N 43/38 (2006.01)
A61K 31/69 (2006.01)

(21) International Application Number:

PCT/US2014/040960

(22) International Filing Date:

4 June 2014 (04.06.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/831,187 5 June 2013 (05.06.2013) US
13/945,577 18 July 2013 (18.07.2013) US

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(88) Date of publication of the international search report:

26 November 2015

(54) Title: ANTIMICROBIAL COMPOUNDS AND COMPOSITIONS

(57) Abstract: This invention is related to use of antimicrobial compounds and/or compositions against pathogens affecting meats, plants, or plant parts. In one embodiment, the provided antimicrobial compounds are volatile as adducted products of certain oxaborole moieties. Delivery systems are provided to take advantage of the volatile nature of these antimicrobial compounds and/or compositions. Also combinations with a volatile plant growth regulator, for example 1-methylcyclopropene, are disclosed.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/40960

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A01N 3/02, A01N 55/08, A61K 31/69, C07F 5/02, A01N 43/38 (2014.01)

CPC - A61K 31/69, C07F 5/02, A01N 55/08, A01N 3/02, A23B 4/20, A23B 7/154, C07D 209/88; C07D 491/04

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- 504/193Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8)- A01N3/02, A01N55/08, A61K31/69, C07F5/02, A01N 43/38 (2014.01) CPC- A61K31/69, C07F5/02, A01N55/08, A01N3/02, A23B4/20, A23B7/154, C07D 209/88; C07D 491/04; USPC- 514/64, 558/287, 558/288, 514/411, 548/491, 514/415, 548/444Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase (PGPB, USPT, USOC, EPAB, JPAB, DWPI, TDBD), FreePatentsOnline (US Pat, PgPub, EPO, JPO, WIPO, NPL), GoogleScholar (PL, NPL); search terms: antimicrobial compounds ethylene glycol agricultural oxaborole dimer meat plant anti microbial benzoxaborole alkylene ethylene diol volatile agriculture horticulture plant phyto

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2009/0227541 A1 (Baker et al.) 10 September 2009 (10.09.2009) Abstract, para [0003]-[0003], [0015], pg 6-10, para [0060]-[0064], [0126], [0990]-[0992], [0238]-[0241]	1-4, 6-11, 14-22, 29-30 ----- 23-28, 31-33
Y	WO 2013/057740 A2 (Rajan et al.) 24 April 2013 (25.04.2013) Abstract, pg 24, ln 15 to pg 30 ln 35; claims 1, 4, 5	23-28, 31
Y	US 5,518,988 A (Sisler et al.) 21 May 1996 (21.05.1996) Abstract, col 1, ln 51 to col 2, ln 38; col 3, ln 28 to col 4, ln 45; col 6, ln 60 to col 9, ln 3	32-33
Y	WO 2007/131072 A2 (Lee et al.) 15 November 2007 (15.11.2007) Abstract, para [0014], [0024], [0059], [0067], claim 1	1-4, 6-11, 14-33
Y	WO 1995/033754 A1 (Austin et al.) 14 December 1995 (14.12.1995) Abstract, pg 1-12; pg 2, ln 1-24; pg 3, ln 8-9; pg 4, ln 4-20; pg 5, ln 1-37, 38-42; pg 6, ln 5-10; 11-17; 18-24, pg 15-41; and ISR therein	1-4, 6-11, 14-33
Y	WO 2013/078070 A1 (Akama et al.) 30 May 2013 (30.05.2013) Abstract, pg 47, ln 24 to pg 48, ln 11	1-4, 6-11, 14-33



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

27 October 2014 (27.10.2014)

Date of mailing of the international search report

13 NOV 2014

Name and mailing address of the ISA/US

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PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,880,188 A (Austin et al.) 09 March 1999 (09.03.1999) Abstract, col 1, ln 7 to col 5, ln 10	1-4, 6-11, 14-33
Y	US 2003/0170308 A1 (Cleary et al.) 11 September 2003 (11.09.2003) Abstract, para [0063], [0159], [0238]	1-4, 6-11, 14-33
Y	US 2012/0035132 A1 (Jarnagin et al.) 09 February 2012 (09.02.2012) Abstract, Figures 1-91; para [0002]-[0042], [0046], [0342]-[0370]	1-4, 6-11, 14-33

INTERNATIONAL SEARCH REPORT

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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.:
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:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I+, claims 1-13, directed to an antimicrobial compound of formula (A) and a mixture or composition containing the same. Group I+ will be searched to extent that it reads on the antimicrobial compound of claim 10, without fee. It is believed that claims 1-11 read on this first named invention. Applicants must indicate the claims which read on the first named invention, if different than what was indicated above for this group. Failure to clearly identify how any paid additional invention fees are to be applied to the inventions in "+" group will result in only the first named invention to be examined. For additional fees, an exemplary election would be 1-methylcyclopropene (1-MCP), reading on claims 1, and 11-13.

Group II, claims 14-33, method of using an antimicrobial compound

Group III, claims 34-51, method of preparing an antimicrobial compound

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

-----Continued in the supplemental Box-----

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.:
1-4, 6-11, 14-33
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.

INTERNATIONAL SEARCH REPORT

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Continued from box III:

The special technical feature of each invention of Group I+ is a unique compound of formula A, not required in any other invention of Group I+.

The special technical feature of Group II is method of using an antimicrobial compound, not required in any other group.

The special technical feature of Group III is method of preparing an antimicrobial compound, not required in any other group.

Common Technical Features (Features Do Not Make a Contribution Over the Prior Art):

Groups I+, II and III are related as a composition (Group I+), a method of making the composition (Group III) and a method of using the composition (Group II), and share the technical feature of claim 1. However, this technical feature is not a unifying technical feature as it does not make a contribution over the prior art as being anticipated by US 2009/0227541 A1 to Baker et al. (hereinafter Baker).

Baker discloses an antimicrobial compound (abstract, ara [0238]-[0239]; exemplary embodiment, the bacterium is a *Pseudomonas* species) having a structure of formula (A) (pg 6-10, para [0060]-[0064]); RA-LA-G-LB-RB (A), wherein each of RA and RB is independently a radical comprising an oxaborole moiety (pg 6-10, para [0060]-[0064]); each of LA and LB is independently -O- (pg 6-10, para [0060]-[0064]); G is a C1-18 'alkylene (pg 7, G is propyl) and methods of use thereof (para [0238]-[0239]) making thereof (para [0045], [0137]-[0188]; synthetic and analytic procedures).

Therefore, inventions of Group I+, II-III lack unity under PCT Rule 13.

nOTE: Claim 5 is excluded from this ISR because it does not read on the first invention.