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Published:

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

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

[Continued on next page]

(54) **Title**: COMPOSITIONS AND METHODS FOR PRODUCING HIGH PURITY FILTER AIDS

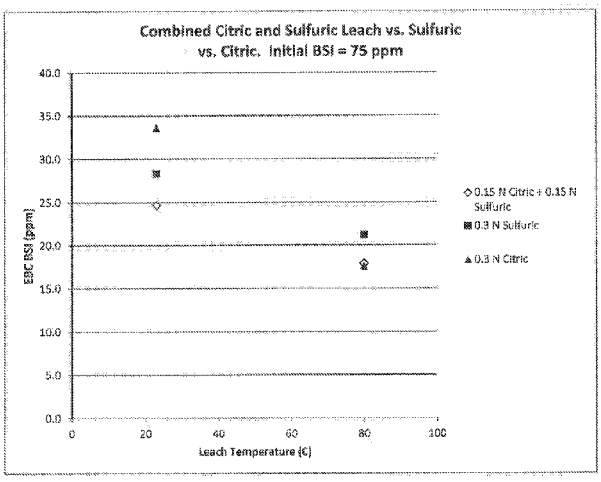


FIG. 1

(57) **Abstract**: A filter aid may include acid-washed diatomaceous earth having high purity, and perlite, A method of making a high purity filter aid may include acid washing diatomaceous earth to reduce the h in the diatomaceous earth, and combining the acid-washed diatomaceous earth with high purity perlite to obtain to obtain a high purity filter aid. A method of reducing extractable metals from diatomaceous earth may include washing the diatomaceous earth in a first acid, rinsing the diatomaceous earth, and washing the diatomaceous earth in a second acid. The first acid may include an inorganic acid having a first strength, and the second acid may include an organic acid having a second strength different than the first strength. A method of filtering a beverage may include passing the beverage through a filter including a filter aid including acid-washed diatomaceous earth having high purity, and perlite.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/13267

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B01J 20/14, B02C 23/00, B02C 23/08 (2017.01)
CPC - B01D 39/06, B01J 20/14, B01J 20/10, B01J 20/106
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)
IPC(8) - B01J 20/14, B02C 23/00, B02C 23/08 (2017.01)
CPC - B01D 39/06, B01J 20/14, B01J 20/10, B01J 20/106

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Scholr; Search terms: filter aid media acid-washed diatomaceous earth purity perlite celite arsenic acid soluble iron calcium aluminum harborlite fcc food chemicals codex ebc european brewery convention bsi beer soluble iron ppm

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 5,776,353 A (Palm et al.) 07 July 1998 (07.07.1998); column13, column14, column15, column16	1, 14-22 --- 2-13
Y	US 2009/0264287 A1 (Wang et al.) 22 October 2009 (22.10.2009); Table III, Fig. 8	2-4
Y	US 7,524,794 B2 (Boddu et al.) 28 April 2009 (28.04.2009); column3, column4	5-9
Y	Sulpizio et al. 'Advances In Disposable Diatomite Filter Aid Systems For CGMP Bioseparations', AFSS Annual Meeting, 20 May 2008 (20.05.2008), page1-7; page2, page3	10-13
Y	Imerys Performance & Filtration Minerals, 'Celite 545', World Minerals, February 2009, page1; page1 retrieved from http://www.imerys-oilfieldsolutions.com/Library/PDS/CELITE_545_Quincy_US.pdf	11
A	US 5,656,568 A (Shiuh et al.) 12 August 1997 (12.08.1997); entire document	1-22
A	US 8,663,475 B2 (Lu) 04 March 2014 (04.03.2014); entire document	1-22

☐ 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	Date of mailing of the international search report
13 January 2017	07 FEB 2017

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/13267

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:
See 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.:

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.:
Claims 1-22

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

International application No.
PCT/US 16/13267

--- Continuation of Box III Lack of Unity ---

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. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-22 directed towards a filter aid comprising: an acid-washed diatomaceous earth having high purity; and perlite

Group II: Claims 23-40 directed towards a method of making a high purity filter aid, the method comprising: acid washing diatomaceous earth to reduce the trace amounts of extractable
metal in the diatomaceous earth; combining the acid-washed diatomaceous earth with high purity perlite to obtain a high purity filter aid

Group III: Claims 41-54 directed towards a method of reducing extractable metals from diatomaceous earth, the method comprising the first acid comprises an inorganic acid having a first strength, and the second acid comprises an organic acid having a second strength different than the first strength.

Group IV: Claims 55-58 directed towards a method of filtering a beverage, the method comprising: passing the beverage through a filter

The inventions listed as Groups I-IV 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:

Special Technical Features:

Group II requires a method of making a high purity filter aid, the method comprising: acid washing diatomaceous earth to reduce the trace amounts of extractable metal in the diatomaceous earth; combining the acid-washed diatomaceous earth with high purity perlite to obtain a high purity filter aid, not required by groups I and III-IV

Group III requires a method of reducing extractable metals from diatomaceous earth, the method comprising the first acid comprises an inorganic acid having a first strength, and the second acid comprises an organic acid having a second strength different than the first strength, not required by groups I-II and IV

Group IV requires a method of filtering a beverage, the method comprising: passing the beverage through a filter, not required by groups I-III

Shared Technical Features:

Groups I-III share the common feature of filter aid comprising an acid-washed diatomaceous earth.

Groups I-IV share the common feature of a filter aid comprising an acid-washed diatomaceous earth having high purity.

However, these shared technical features do not represent a contribution over prior art, because the shared technical feature is as being anticipated by WO 2008/062998 A1 to LG life science LTD (hereinafter 'LG'). LG teaches a filter aid comprising an acid-washed diatomaceous earth having high purity; and perlite (para [0042], depth filter or membrane filter, and diatomaceous earth or perlite.is used as a filter aid. Preferably, depth filter is used with diatomaceous earth as a filter aid)

As the shared technical features were known in the art at the time of the invention, they cannot be considered special technical features that would otherwise unify the groups. Therefore, Groups I-IV lack unity under PCT Rule 13.