Abstract: Disclosed herein are granulated heavy metal adsorbent materials such as granulated mercury adsorbent materials, processes of making the same, and methods for their use. Also disclosed herein are granulated heavy metal adsorbent materials including a sol-gel three-dimensional cross-linking network of oxides. Further disclosed herein is a process for preparing heavy metal adsorbent powders and granules without the use of a solvent, for example, chloroform.
(88) Date of publication of the international search report:
   25 September 2008
INTERNATIONAL SEARCH REPORT

International application No
PCT/US 07/88269

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B01D 39/00 (2008.04)
USPC - 210/502.1

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) - B01D 39/00 (2008.04)
USPC - 210/502.1

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

Google

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PUBWEST [PGB, USPTO, USOCEPAB, JPA] Terms - diatom zeolite sol mercury gold tetramethylorthosilicate organosilane spray world minerals gamma mercaptopropyltrimethoxysilane
Google - agglomerate diatom sol mercury, (diatom OR diatom(β) OR diatomaceous) tetramethylorthosilicate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 2005/0207955 A1 (WANG) 22 September 2005 (22.09.2005), entire document, especially para [0022], [0073], [0112]</td>
<td>1, 3-6, 10-12, 21-30</td>
</tr>
<tr>
<td>Y</td>
<td>US 4,935,062 A (BROWN ET AL.) 19 June 1990 (19.06.1990), col 7, ln 9-24</td>
<td>2, 92-100</td>
</tr>
<tr>
<td>Y</td>
<td>US 6,685,889 B1 (RAFTERY ET AL.) 03 February 2004 (03.02.2004), entire document, especially col 4, in 20-23, col 6, ln 5-22</td>
<td>31-71, 87-91, 101-113</td>
</tr>
</tbody>
</table>

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 novel or 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: 20 June 2008 (20.06.2008)
Date of mailing of the international search report: 26 JUN 2008

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 DSP 571-272-7774

Form PCT/ISA/2 10 (second sheet) (April 2007)
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. 1-4 because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos. 1-1 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. D because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

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

Group I claims 1-71 and 87-1-13 directed to a heavy metal adsorbent material comprising diatomite and a surface treatment agent Group II claims 72-86 directed to a method for separating a heavy metal from a fluid comprising contacting a heavy metal adsorbent material with a fluid.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.2 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I does not include the inventive concept of contacting a heavy metal adsorbent material with a fluid, as required by Group II.

Group II does not include the inventive concept of at least one surface treatment agent, as required by Group I.

Groups I and II share the technical feature of a granulated heavy metal adsorbent material. However, this shared technical feature does not represent a contribution over the prior art of US 2005/0207955 A1 to Wang (22 September 2005), which teaches use of a granulated heavy metal adsorbent (abstract). As the above granulated heavy metal adsorbent was known at the time, this cannot be considered a special technical feature that would otherwise unitify the groups.

Groups I and II therefore lack unity under PCT Rule 15 because they do not share a same or corresponding special technical feature.

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. Group I claims 1-71 and 87-1-13.

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.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2007)