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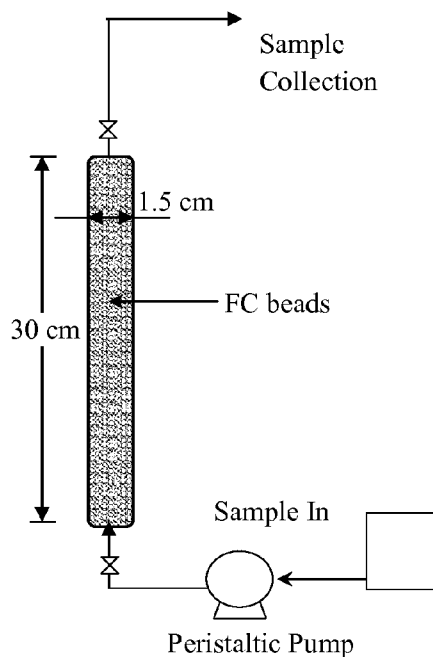
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[Continued on next page]

(54) Title: IRON-FUNCTIONALIZED ALGinate FOR PHOSPHATE AND OTHER CONTAMINANT REMOVAL AND RECOVERY FROM AQUEOUS SOLUTIONS

Figure 3



(57) Abstract: A biodegradable iron-cross-linked alginate is useful as a remediation agent for environmental contaminants such as phosphate. When charged with phosphate, or other nutrients, the iron-functionalized alginate can be used as an agricultural fertilizer.

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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).

— *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))*

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/28524

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C05D 9/02; C05B 15/00 (2014.01)

CPC - C05D 9/02 ; C05B 7/00; C05F 3/00

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 C05D 9/02; C05B 15/00 (2014.01)

CPC: C05D 9/02 ; C05B 7/00; C05F 3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC:71/11,29,31,32;210/614

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, Google Scholar (NPL); Keywords: Alginate iron fertilizer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6203709 B1 (Min et al.) 20 March 2001 (20.03.2001) col 2, ln 20-32	1-5
X	US 6143692 A (Sanjay et al.) 07 November 2000 (07.11.2000) col 2, ln 48-60; col 3, ln 5-28; col 4, ln 59-65; col 6, ln 40-45	1, 3-5, 39-41
X	US 4,589,906 A (Brunn et al.) 20 May 1986 (20.05.1986) especially example 24	1
A	US 2012/0288479 A1 (Melman) 12 November 2012 (12.11.2012) para [0005], [0022]	1-5, 39-41

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

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/28524

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.: 45
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:
claim 45 is an omnibus claim.

3. Claims Nos.: 6-30, 35-36, 42
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. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-5 and 39-41, directed to a biodegradable material/composition comprising iron-functionalized alginate

Group II: Claims 31-34, directed to a method for increasing the nutrient content of a soil

Group III: Claims 37-38 and 43-44, directed to a method of preparing an iron-functionalized alginate fertilizer

The inventions listed as Groups I-III 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:

--see extra sheet--

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.:
1-5 and 39-41

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.

Continued from Box no III

Special Technical Features

Group II requires a method for increasing the nutrient content of a soil, not required by Groups I and III

Group III requires a method of preparing an iron-functionalized alginate fertilizer, not required by Groups I-II

Common Technical Features

Groups I-III share the common feature of a composition of a biodegradable material comprising iron-functionalized alginate (group I).

Groups I-III share additional technical feature of at least one sorbed contaminant, wherein the contaminant comprises a nutrient.

Groups III and I share additional technical feature of fertilizer. However, these technical feature, do not represent a contribution over prior art, as being anticipated by US 6,143,692 A to Sanjay et al. (hereinafter 'Sanjay'). Sanjay teaches a biodegradable material comprising iron-functionalized alginate, at least one sorbed contaminant, wherein the contaminant comprises a nutrient (col 2, In 48-53, adsorbents to remove contamination; and col 2, In 58-60, recover agriculturally valuable metals; col 3, In 5-28, such as iron and other metals, some of which are plant nutrients; col 4, In 59-65, using natural material humic acid; col 6, In 62-65, immobilized on alginate; col 6, In 40-45, for metal sorption) and the recovered material is then used for fertilizer (figure 12).

Therefore, Groups I-III lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.

Note RE: Item 4:

Claims 6-30, 35-36, 42 have been held unsearchable because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Claim 45 has been held unsearchable because it is omnibus claim not drafted in accordance with Rule 6.2(a).