PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference
19908.009WO02

FOR FURTHER ACTION
See Form PCT/PEA416

<table>
<thead>
<tr>
<th>International application No.</th>
<th>International filing date (day/month/year)</th>
<th>Priority date (day/month/year)</th>
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International Patent Classification (IPC) or national classification and IPC
INV. C01B25/12

Applicant
JDCPhosphate, Inc.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 14 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☑ (sent to the applicant and to the International Bureau) a total of 22 sheets, as follows:
      ☑ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).
      ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).
      ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).
   b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)), containing a sequence listing, in the form of an Annex CST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:
   ☑ Box No. I  Basis of the report
   ☐ Box No. II Priority
   ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   ☑ Box No. IV Lack of unity of invention
   ☑ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   ☐ Box No. VI Certain documents cited
   ☑ Box No. VII Certain defects in the international application
   ☑ Box No. VIII Certain observations on the international application

Date of submission of the demand
25.07.2016

Date of completion of this report
19.01.2017

Name and mailing address of the international preliminary examining authority:
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Authorized officer
Straub, Thomas
Telephone No. +31 70 340-9908
Box No. I  Basis of the report

1. With regard to the language, this report is based on
   ☑ the international application in the language in which it was filed
   ☐ a translation of the international application into , which is the language
     of a translation furnished for the purposes of:
     ☐ international search (under Rules 12.3(a) and 23.1(b))
     ☐ publication of the international application (under Rule 12.4(a))
     ☐ international preliminary examination (under Rules 55.2(a) and 55.3(a) and (b))

2. With regard to the elements* of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

Description, Pages
1-41 as originally filed

Claims, Numbers
1-14 filed with telefax on 29-12-2016

Drawings, Sheets
1/17-17/17 as originally filed

☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
   ☐ the description, pages
   ☐ the claims, Nos.
   ☐ the drawings, sheets/figs
   ☐ the sequence listing (specify):

4. ☑ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
   ☐ the description, pages
   ☑ the claims, Nos. 1-14
   ☐ the drawings, sheets/figs
   ☑ the sequence listing (specify):

5. ☐ This report has been established:
   ☐ taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
   ☐ without taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).
6. ☑ With regard to top-up searches (Rules 66.1ter and 70.2(f)):
   ☑ A top-up search was carried out by this Authority on 25.08.2016 (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
   ☐ Additional relevant documents have been discovered during the top-up search.
   ☐ No top-up search was carried out by this Authority because it would serve no useful purpose.

7. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked “superseded”.

<table>
<thead>
<tr>
<th>Box No. IV</th>
<th>Lack of unity of invention</th>
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<tbody>
<tr>
<td>1. ☐ In response to the invitation to restrict or pay additional fees, the applicant has, within the applicable time limit:</td>
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<td>☐ restricted the claims.</td>
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<td>☐ paid additional fees under protest but the applicable protest fee was not paid.</td>
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<td>☐ neither restricted the claims nor paid additional fees.</td>
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<td>2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.</td>
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<td>3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:</td>
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<td>4. Consequently, this report has been established in respect of the following parts of the international application:</td>
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<td>☐ all parts.</td>
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<td>☑ the parts relating to claims Nos. 1-14.</td>
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Box No. V  Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)  
Yes: Claims
No: Claims 1-14

Inventive step (IS)  
Yes: Claims
No: Claims 1-14

Industrial applicability (IA)  
Yes: Claims
No: Claims 1-14

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII  Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII  Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet
Re Item IV
Lack of Unity of the invention

1 The search authority considers that there are 3 inventions covered by the claims, indicated as follows:

I: Original claims 1 - 11
A phosphorous pentoxide producing method comprising:
forming pre-feed agglomerates containing phosphate ore particles, carbonaceous material particles, and silica particles;
heating the pre-feed agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more;
forming feed agglomerates, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2;
forming a reducing kiln bed using the feed agglomerates; and
generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas.

II: Original claims 12 - 19
A phosphorous pentoxide producing method comprising:
forming green agglomerates containing phosphate ore particles, carbonaceous material particles, silica particles, and a polymer;
drying the green agglomerates at a drying temperature from 40 °C to 300 °C, the dried agglomerates exhibiting a compression strength above 25 lb; 
heating the dried agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more;
forming feed agglomerates, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2;
forming a reducing kiln bed using the feed agglomerates; and
generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas.
III: Original claims 20 - 23

A phosphorous pentoxide producing method comprising:

extruding a material to form green agglomerates containing phosphate ore particles, carbonaceous material particles, silica particles, and 2 to 5 wt% (dry basis) clay particles;

drying the extruded, green agglomerates at a drying temperature from 40 °C to 150 °C, the dried agglomerates exhibiting a compression strength above 50 lb;

heating the dried agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more;

forming feed agglomerates, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2;

forming a reducing kiln bed using the feed agglomerates; and

generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas.

The inventions I - III are not linked as to form a single general inventive concept as required by Rule 13(1) PCT, as is evidenced a priori by the disclosed subject-matter of claims 1, 12 and 20, respectively.

A general inventive concept between inventions I - III could be considered to be the "phosphorous pentoxide producing method comprising:

forming agglomerates containing phosphate ore particles, carbonaceous material particles, and silica particles;

heating the agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more;

forming feed agglomerates, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2;

forming a reducing kiln bed using the feed agglomerates; and

generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas".
However, this concept is known (cf. US 2013/136682, WO 2005/118468; citations in the Search Report, also cf. reasoning under 1st invention, 2.1).

Therefore it is noted that the subject-matter disclosed in claims 1 - 11 (I), 12 - 19 (II) and 20 - 23 (III) does not disclose any technical features that can be considered as a single general inventive concept within the meaning of Rule 13(1) PCT.

In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 3 different inventions not linked by a single general inventive concept.

Thus, the application does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.
Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

2 Amendments (Articles 19(2) and 34(2)(b) PCT)

The amendments of present claims 1 - 12, filed with telefax of 29 December 2016, are not allowable considering Articles 19(2) and 34(2)(b) PCT.

2.0 Present claim 1 recites "the heating of the pre-feed agglomerates and maintaining the induration temperatures occurring separately from a reduction kiln."

This phrasing seems to be somehow covered by par. 53 - 55 and e.g. fig. 2. However, defining that the pre-heating takes place in an induration kiln, which is separate from a reduction kiln (as depicted in fig. 2), would clarify the issue regarding Articles 19(2) and 34(2)(b) PCT and also Article 6 PCT.

2.1 Present claim 1 further recites: "forming feed agglomerates and increasing a compression strength of the feed agglomerates to above 25 lb. (111 N) using the heating of the pre-feed agglomerates and maintaining the induration temperature."

Such phrasing can not be found in the application as filed, and has not been indicated by the Applicant (also cf. 3).

2.2 Present claim 2 recites "pre-feed agglomerates", while it reads "dried agglomerates" that are made from "green agglomerates" in claim 1 of the application as originally filed.
Basis for such change can not be found in the application, and has not been indicated by the Applicant. It appears that an entirely different method is actually claimed (also cf. VIII).

Contrary to the Applicant's opinion, the amendment is not considered to simply "revise antecedent basis because of dependency."

2.3 The reasoning under 2.2 also applies, *mutantis mutandis*, to claim 3 (also cf. VIII).

2.4 In the submission of 29 December 2016 the Applicant states that present claim 4 replaces previous (original?) claims 2 and 13 and combines the subject - matter thereof.

This statement is simply wrong.

Original claim 2 reads: "The method of claim 1, wherein the crush strength is above 50 lbₙ."  

Original claim 13 reads: "The method of claim 12, wherein the crush strength is above 100 lbₙ."

Present claim 4 reads: "The method of claims 1 or 2 wherein a crush strength of the feed agglomerates is above 50 lbₙ (222 N), preferably wherein the crush strength is above 100 lbₙ (445 N).

No basis can be found for the amendment that the crush strength refers to the feed agglomerates in any of original claims 1 (present claim 1) and 12 (present claim 2). A crush strength has not been recited in any of claims 1 (previous 1) or 2 (previous 12).

No basis can be found for (feed) agglomerates according to original claim 1 having a crush strength (or compressive strength if the Applicant considers the terms as equivalents) which is higher than 100 lbₙ. No basis for such amendment has been given by the Applicant.

2.5 Present claim 5 is a combination of original claims 3 and 4.

However, claim 5 is now dependent from "any preceding claim".

There is no basis whatsoever for the dependency from present claims 2 (original 12), 3 (original 20) and 4 (original 2).

2.6 The same applies at least to the multiple dependencies of present claims 6 - 12.

Therefore subject - matter has been added and the amendments of present claims 1 - 14, filed with telefax of 29 December 2016, are not allowable considering Articles 19(2) and 34(2)(b) PCT.
2.7 The amendments of present claims 13 and 14, filed with telefax of 29 December 2016, appear to be allowable considering Articles 19(2) and 34(2)(b) PCT.

Since an allowable set of claims has not been submitted, all objections provided with the WOISA remain valid (also non-unity. The present phrasing recites an independent claim 1 and 2 dependent claims 2 and 3, that do appear to cover entirely different subject - matter. If phrased in a logical sequence, it appears that some of the method steps as recited in independent claim 1 could hypothetically be considered as common technical features. These features are known and disclosed in the prior art as outlined under IV).

3 (Original) Independent **claim 1**

3.1 Novelty (Article 33(2) PCT)

Document D1 is regarded as being the closest prior art to the subject-matter of present independent claim 1 and discloses a phosphorous pentoxide producing method (claim 1) comprising:

- forming pre-feed agglomerates containing phosphate ore particles, carbonaceous material particles, and silica particles (for exact amounts, cf. par. 133);
- heating the pre-feed agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more (claim 1, 1180 °C; par. 133, ball heated with a ramp of 20 °C/min, thus in the claimed range);
- forming feed agglomerates and increasing a compression strength of the feed agglomerates to above 25 lb, using the heating, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2 (claim 2);
- forming a reducing kiln bed using the feed agglomerates (claim 1); and
- generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas (claim 1; also cf. claims 11 and 17, par. 27, 28, 51, 52, 70 - 77).

Therefore all features of present independent **claim 1** are disclosed in document D1. Thus, claim 1 of the present application is not new in the sense of Article 33(2) PCT.
NB: Since all process and material parameters are identical, the compression strength has to be seen as being an inherent feature of the agglomerates (same material = same properties).

3.2 The reasoning under 2.1 also applies in view of document D2 (e.g. claim 1, example 1, p. 26, l. 20 - 37).

3 (Original) dependent claims 2 - 11
Some of the dependent claims 2 - 11 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to inventive step.

4 Further prior art, the corresponding passages in the respective documents D3 and D4 and their relevance to the claims of the application are cited in the Search Report.

Documents D3 and D4 each disclose methods for preparing phosphorus pentoxide, comprises forming reducing kiln bed using feed agglomerates having phosphate ore particles, carbonaceous material particles, and silica particles, maintaining specific bed temperatures and generating kiln off gas. Thus, these methods are very similar to the ones discussed under 2.1.

However, none of these documents recites magnesium as being part of the process.

Re Item VII

Certain defects in the international application

1 The citation of the name of an author/inventor (e.g. the Megy patent”) used throughout the description does not represent a clear and unambiguous reference to a document.

2 The priority claim disclosed in par. 1 of the description does not form part of the latter under the provisions of the PCT (Article 5 PCT, Rule 4.10 PCT)
3 The reference to documents by the serial application number, e.g. as in par. 1 does not represent a clear reference to a published document (Article 5 PCT, PCT Guidelines 4.27).

4 The expression "incorporated by reference" used throughout the description is not recognised as part of the description under the provisions of the PCT (Article 5 PCT, PCT Guidelines 4.26)

5 The units such as "lb", "mesh", etc., do not meet the requirements of Rule 10.1. PCT.

6 The section "features and benefits", pa. 112 - par. 162 appears to represent an old claim set.

Thus, the subject - matter for which protection is sought is not clear. In addition, the application is not concise.

7 The passage of the description in par. 163 referring to the wording "appropriately interpreted" are vague and unclear (PCT Guidelines 5.30).

This applies to the content of the entire paragraph.

Re Item VIII

Certain observations on the international application

1 Clarity (Article 6 PCT)

The application does not meet the requirements of Article 6 PCT, because present claims 1 - 4, 8 - 12 and 14 are not clear.

1.1 Claim 1 reads: "forming feed agglomerates and increasing a compression strength of the feed agglomerates to above 25 lbf (111 N) using the heating of the pre-feed agglomerates and maintaining the induration temperature."

Thus, the claim does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not defined. The claim attempts to define the subject-matter in terms of the result to be achieved (PCT Guidelines 5.35).

The way the sentence is phrased, it appears that the heat of the pre-feed agglomerates is used. If it is the mere fact of heating them, it appears that essential features are missing in order to obtain the claimed compression strength.

1.2 The reasoning under 1.1 also applies to the phrase "forming a reducing kiln bed in the reduction kiln using the feed agglomerates;
1.3 The reasoning under 1.1 also applies to claim 2.

In addition, the phrase "drying the green agglomerates at a drying temperature from 40 to 300 C, the pre-feed agglomerates exhibiting a compression strength above 25 lb_f (111 N) contradicts the content of claim 1, wherein the same compressive strength is result of completely different temperature parameters.

Furthermore, there is no sufficient antecedence for the term "pre-feed agglomerates."

Under the conditions supposedly according to claim 1, a compressive strength of 222 N is obtained.

1.4 The reasoning under 1.1 also applies to claim 3.

In addition, the phrase "extruding a material to form green agglomerates containing phosphate ore particles, carbonaceous material particles, silica particles, and 2 to 5 wt% (dry basis) clay particles;

drying the extruded, green agglomerates at a drying temperature from 40 to 150 C, the dried agglomerates exhibiting a compression strength above 50 lb_f (222 N) contradicts the content of claim 1, wherein the same compressive strength is result of completely different temperature parameters.

Furthermore, under the conditions supposedly according to claim 1, a compressive strength of 445 N is supposedly obtained. Claimed are 200 lb_f, which converts to 490 N.

1.5 Present claim 8 reads: "preparing the phosphate ore particles, carbonaceous material particles, clay particles, and silica particles such that 80% or more exhibit a size less than 200 mesh", preferably...

Thus, the claim does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not defined. The claim attempts to define the subject-matter in terms of the result to be achieved (PCT Guidelines 5.35).

Several compositions and sizes are given in the same claim, but not a single technical feature how to achieve the individual parameters and how to discriminate between obtaining them while in the make.

1.6 The objection under 1.5 also applies to present claims 10 ("making the scrubber off-gas reducing") and 12 ("further decreasing a concentration of the contaminants in the feed agglomerates using the heating when compared to the pre-feed agglomerates").
1.7 Claim 11 reads: "adding over bed air through a plurality of ports along the bed length, the over bed air entering kiln freeboard through a plurality of standpipes extending from respective ports to a height above the bed."

The phrase appears to be incomplete and is thus not clear.

1.8 The terminology used in claim 14, such as "acrylics", "epoxies", etc. appears to be laboratory jargon, but does not properly define and compound or family of compounds.
IN THE EUROPEAN PATENT ORGANISATION

Applicant: JDCPhosphate, Inc.
International Application No.: PCT/US2015/052402
International Filing Date: 25 Sep 2015 (25-09-2015)
Agent's File No.: 19908.009WO02
Title: Phosphorous Pentoxide Producing Methods and Systems with Increased Agglomerate Compression Strength

European Patent Organisation
10958 Berlin
Germany

Sir:

RESPONSE TO SEARCH REPORT AND WRITTEN OPINION
(ARTICLE 34 AMENDMENT)

This amendment is responsive to an International Search Report and Written Opinion mailed 22 March 2016. Submitted herewith are substitute pages 42-47, which Applicant requests be entered in place of the originally-filed pages 42-47. Substitute pages 42-47 replace the originally-filed claims 1-23 with claims 1-14.
STATEMENT

The differences between claims 1-23 filed and claims 1-14 provided in the accompanying substitute pages are as follows.

Claims 7, 8, 10, and 13 replace previous respective claims 6, 7, 9, and 15 but are unchanged aside from renumbering and adding multiple dependencies or renumbering of dependencies.

Claim 1 replaces previous claim 1 and is amended as supported at least by paragraphs 53, 55, 57, and 113 of the specification along with Figures 2-10, which describe heating of the pre-feed agglomerates and maintaining of the induration temperature separately from a reduction kiln.

Claim 2 replaces previous claim 12 and is amended to depend from claim 1 and to revise antecedent basis as a result of the dependency.

Claim 3 replaces previous claim 20 and is amended to depend from claim 1 and to revise antecedent basis as a result of the dependency.

Claim 4 replaces previous claims 2 and 13 and combines the subject matter thereof.

Claim 5 replaces previous claims 3 and 4, combines the subject matter thereof, and revises antecedent basis given the amendment to claim 1.

Claim 6 replaces previous claims 5, 14, and 21, combines the subject matter thereof, and adds subject matter supported by paragraph 29 of the specification, which describes induration temperature greater than 930 C.

Claim 9 replaces previous claims 8, 19, and 22 and combines the subject matter thereof.

Claim 11 replaces previous claim 10, corrects antecedent basis, and adds multiple dependency.
Claim 12 replaces previous claims 11, 18, and 23, combines the subject matter thereof, and adds multiple dependency.

Claim 14 replaces previous claims 16 and 17 and combines the subject matter thereof.

The pending claims 1-14 are believed to be novel and further to possess an inventive step relative to the cited references, as set forth with detail in the remarks below.

Box No. V of the Written Opinion alleges that claim 1 is not novel and that claims 2-11 are novel, but lack inventive step in view of D1 as well as in view of D2. Applicant requests reconsideration.

Amended claim 1 sets forth a phosphorous pentoxide producing method that includes, among other features, forming pre-feed agglomerates and heating the pre-feed agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more. The heating of the pre-feed agglomerates and maintaining of the induration temperature occur separately from a reduction kiln. The method includes forming feed agglomerates and increasing a compression strength of the feed agglomerates to above 111 N using the heating of the pre-feed agglomerates and maintaining of the induration temperature. A reducing kiln bed is formed in the reduction kiln using the feed agglomerates. Items 2.1 and 2.2 of Box No. V of the Written Opinion allege that D1 or D2 suggest every limitation of claim 1. Applicant disagrees.

No Kiln Bed

The Written Opinion refers to paragraph 133 of D1 describing one pellet placed in a graphite crucible, heated to 1180 °C, and held for one hour under an atmosphere of nitrogen. The process was repeated for 2 hours and 4 hours. However, D1 fails to suggest forming a reducing
kiln bed in a reduction kiln, as claimed, using the heated pellet. At least for such reason, D1 fails to suggest every limitation of amended claim 1 and claim 1 possesses an inventive step.

Additionally, D1 fails to provide any motivation to use the heated pellet in a reducing kiln bed. Paragraph 133 states, "It was found that 61%, 82% and 97% of the phosphorous had evolved from the pellet in 1, 2, and 4 hours at 1180°C, respectively." Since 61% or more of the phosphorous had evolved from the pellet in D1, those of ordinary skill would not consider forming a reducing kiln bed in a reduction kiln using the heated pellet to collect phosphorous pentoxide. After the D1 heating, less than 39% of the phosphorous from the phosphate ore remained in the pellet. Forming a reducing kiln bed and collecting phosphorous pentoxide, as claimed, from the pellet would be an exceptionally inefficient endeavor. At least for such additional reason, D1 fails to suggest every limitation of amended claim 1 and claim 1 possesses an inventive step.

Not Separate From Reduction Kiln.

The Written Opinion refers to claim 1 of D1 as allegedly suggesting maintaining the induration temperature from above 900°C to less than 1180°C for 15 minutes or more. However, claim 1 of D1 expressly states that "maintaining a bed temperature at or above 1180°C" occurs in a reduction kiln. Amended claim 1 of the present application requires "heating of the pre-feed agglomerates and maintaining of the induration temperature occurring separately from a reduction kiln." At least for such reason, D1 fails to suggest every limitation of amended claim 1 and claim 1 possesses an inventive step.

Beyond Induration Temperature.

Also, paragraph 133 of D1 states that the pellet was heated "to 1180°C," held for 1, 2, and 4 hours. However, the temperature of 1180°C used in D1 is beyond the range for
induration temperature set forth in claim 1 “from above 900 C to less than 1180 C.” The claimed range does not include 1180 C described in paragraph 133. Claim 1 of D1 describes bed temperature in the reducing kiln “at or above 1180° C.” However, such range is also beyond the claimed induration temperature set forth in amended claim 1. At least for such reasons, D1 fails to suggest every limitation of amended claim 1 and claim 1 possesses an inventive step.

Not Maintained for 15 min or More.

Further, paragraph 133 describes heating the pellet “at 20° C./min.” Item 2.1 of the Written Opinion alleges that heating the pellet to 1180 C at 20 C/min discloses the claimed maintaining of induration temperature for 15 minutes from above 900 C to less than 1180 C. However, heating the pellet from above 900 C to less than 1180 C at a heating rate of 20 C/min over the 280 C temperature difference only takes 14 min. Consequently, paragraph 133 fails to suggest maintaining the induration temperature for 15 minutes or more, as set forth in amended claim 1. At least for such reason, D1 fails to suggest every limitation of amended claim 1 and claim 1 possesses an inventive step.

No Motivation to Modify D1.

Applicant asserts that no motivation exists to modify D1 in a manner such that it could be considered to suggest maintaining the claimed induration temperature for 15 minutes or more. Paragraphs 71, 89, 98, 99, 102, 105, 128, and 159 of D1 repeatedly emphasize the importance of heating kiln solids as rapidly as possible to a reaction temperature of 1180 C or higher and reducing the time the kiln feed agglomerates spend in reaching reaction temperature of 1180 C to minimize or avoid carbon burnout. D1 provides an example in paragraphs 152 and 153. Paragraph 152 describes heating from 600 C to 950 C for 10 minutes and paragraph 153 describes heating from 950 C to 1180 C for 10 minutes. Assuming a constant heating rate when
heating from 600 C to 950 C in paragraph 152, the portion that includes heating from 900 C to 950 C takes 1.4 minutes of the total 10 minutes. When added to the 10 minute heating time in paragraph 153 from 950 C to 1180 C, D1 merely describes heating from 900 C to 1180 C in 11.4 min. As a result, D1 fails to suggest every limitation of amended claim 1.

In addition, Applicant asserts that maintaining the claimed induration temperature for 15 minutes or more would frustrate the intended purpose of D1 to reduce carbon burnout by reducing the time the kiln feed agglomerates spend in reaching the reaction temperature of 1180 C. Thus, no motivation may be considered to exist to modify D1 to suggest every limitation of amended claim 1.

**No Inherent Compression Strength.**

Item 2.1 of the Written Opinion further states that all process and material parameters are identical, thus, "the compression strength has to be seen as being an inherent feature of the agglomerates." Applicant disagrees.

Paragraph 42 of D1 states that dried feed balls may exhibit a dry crush strength greater than 25 pounds [111 N] attributed to "having a coating covering the ball, a gradient of lignin sulfonate from the surface into the ball, or both." Notably, such dried feed balls were NOT heated to the temperatures set forth in amended claim 1. Paragraph 32 of D1 recognizes that at least a portion of the lignin sulfonate coating volatilizes during bed heat up from about 650 C to about 1180 C. Consequently, paragraph 26 describes including clay in the feed balls to supply strength after the carbon from the lignin sulfonate burns out. As a result, no evidence exists that those of ordinary skill viewing the teachings of D1 would expect maintaining the D1 dried feed balls at the claimed induration temperature for 15 minutes or more would yield the claimed
compression strength above 111 N. At least for such reason, D1 fails to suggest every limitation of amended claim 1.

Paragraphs 27, 31, 39, 41, 42, and 53 of the present specification describe a surprising benefit of maintaining the induration temperature as claimed. Compared to feed agglomerates of the same composition, feed agglomerates processed according to the method of amended claim 1 significantly reduce dust, allowing increased yield and increased operability of the reduction kiln and downstream equipment. The reduction in dust volume results from increasing compression strength according to the method in amended claim 1. D1 fails to recognize any benefit to the method of amended claim 1. At least for such reason, amended claim 1 possesses an inventive step.

**Document D2.**

Item 2.2 in Box No. V of the Written Opinion alleges that the reasoning of item 2.1 also applies in view of document D2. The Written Opinion refers to claim 1 of D2, Example 1 on pages 28-29, and page 26. However, D2 fails to suggest heating of the pre-feed agglomerates and maintaining of the induration temperature that occurs separately from a reduction kiln, as set forth in amended claim 1 of the present application. The referenced text of D2 expressly requires heating feed balls in a reduction kiln. Also, D2’s “reduction temperature between about 1180 and about 1330°C” in claim 1 and also on page 26 is beyond the induration temperature of amended claim 1 “from above 900°C to less than 1180°C.” D2 is silent regarding any compression strength of the feed balls. At least for such reasons, amended claim 1 possesses an inventive step.

**Dependent Claims.**

Claims 2-14 depend from claim 1 and possess an inventive step at least for such reason as well as for the additional limitations of such claims not suggested. For example, claim 6 sets
forth the induration temperature of from 930°C to 1180°C. As appreciated from the discussion above regarding the deficiencies of D1 as applied to amended claim 1, D1 also fails to suggest every limitation of claim 6. Item 2.2 of the Written Opinion refers to page 26, lines 20-37 of D2. Therein, D2 describes heating the bed in a reduction kiln at a gradual rate from 500°C to the reaction temperature of about 1180°C to about 1350°C “at a gradual rate preferably between 20 and 40 minutes.” Assuming a constant heating rate from 500°C to 1180°C for 40 minutes, the “gradual rate” would be 17°C/min. As a result, heating from 930°C to 1180°C, as claimed, takes 14.7 minutes. D2 thus fails to suggest maintaining the claimed induration temperature for 15 minutes or more as in claim 6. Claim 6 further specifies a preferable induration temperature from 930°C to 1125°C maintained for 15 minutes or more, preferably 950°C to 1100°C maintained for 30 minutes or more, preferably 1000°C to 1100°C maintained for 30 to 90 minutes. D1 and D2 additionally fail to suggest the further limitations of claim 6.

Claim 7 sets forth maintaining the induration temperature for 30 to 90 minutes. Claim 8 sets forth pre-heating in a grate heater before heating at the induration temperature in an induration kiln. Claim 10 sets forth preheating the grate heater using a scrubber off-gas generated from a product acid scrubber. As may be appreciated from the discussion above regarding the deficiencies of D1 and D2 as applied to amended claim 1, D1 and D2 fail to suggest every limitation of claims 7, 8, and 10 and such claims possess an inventive step.

Claim 12 sets forth that the method further comprises decreasing a concentration of contaminants in the feed agglomerates using the heating when compared to the pre-feed agglomerates. As set forth in amended claim 1, the heating occurs separately from the reduction kiln and the feed agglomerates are used to form a reducing kiln bed in the reduction kiln. Thus, claim 12 beneficially removes contaminants prior to forming the reducing kiln bed. As a result,
the removed contaminants do not end up in product acid. D1 and D2 fail to suggest every limitation of claim 12 and claim 12 possesses an inventive step.

Claim 14 provides a list of polymers that may be used in the green agglomerates of claim 2. D1 and D2 fail to suggest any of the polymers of claim 14 and claim 14 possesses an inventive step.

**Documents D3 and D4.**

Item 4 in Box No. V of the Written Opinion refers to documents D3 and D4. However, review of D3 and D4 fails to reveal subject matter that remedies the deficiencies of D1 and D2 discussed above. Consequently, claims 1-14 possess an inventive step in view of D3 and D4.

**Clarity.**

Box No. VIII of the Written Opinion lists several observations in the international application. Item 1.1 makes the incorrect conclusion that the claim 1 calcium-to-silica mole ratio and silica-to-(calcium + magnesium) mole ratio do not seem plausible in combination. Applicant notes that, when the calcium-to-silica mole ratio is sufficiently less than 0.5 to accommodate additional magnesium, (calcium + magnesium)-to-silica mole ratio may also be less than 0.5. In such circumstance, it follows that calcium-to-silica mole ratio is less than 1 and silica-to-(calcium + magnesium) mole ratio is greater than 2. Consequently, claim 1 possesses proper clarity.

Item 1.1 further states that claim 1 attempts to define the subject matter in terms of the result to be achieved. Applicant notes that the mole ratios of claim 1 clearly set forth a compositional specification for the feed agglomerates. Such claim limitation defines the composition of feed agglomerates suitable for use in the method of claim 1. Consequently, the
mole ratios do not constitute results to be achieved. Instead, they define the components input to the reduction kiln.

Additionally, PCT Guideline 5.33 states that no objection should be raised if the invention can only be defined in the terms allegedly lacking clarity and if the result is one which can be achieved without undue experimentation. For example, directly and positively verified tests or procedures adequately described in the specification and involving nothing more than trial and error amount to results that can be achieved without undue experimentation. Applicant notes that determination of elemental content and calculation of mole ratios may be accomplished by numerous methods widely known to those of ordinary skill. As a result, the claimed mole ratios may be determined without undue experimentation.

Item 1.2 of Box No. VIII states that the same applies to previous claims 8, 9, and 11 (new claims 9, 10, and 12). Applicant notes that determining particle sizes (claim 9) and the concentration of contaminants in feed agglomerates (claim 12) constitute well-known practices widely used by those of ordinary skill. Similarly, “making the scrubber off-gas reducing” (claim 10) as opposed to oxidizing constitutes another well-known practice widely used by those of ordinary skill. In all cases, standardized test methods and known practices may be used to verify the claimed result without undue experimentation. Reference may be made to documents D1 to D4 for support of Applicant’s assertions.

Regarding Items 1.3 and 1.4, claims 1, 2, 8, and 10 are amended and satisfy the clarity requirements of Article 6 PCT.

Applicant requests publication of a favorable Int'l. Preliminary Report on Patentability in keeping with the assertions above.
Dated: 22 July 2016
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Respectfully submitted by

By:
James E. Lake
USPTO Reg. No. 44,854
**FACSIMILE COVER SHEET**

**DATE:** December 28, 2016

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| CLIENT-MATTER NUMBER:    | 19908.009WO02 |
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**RE:** JCDPhosphate, Inc.

Response to Written Opinion.

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IN THE EUROPEAN PATENT ORGANISATION

Applicant: JDCPhosphate, Inc.
International Application No.: PCT/US2015/052402
International Filing Date: 25 Sep 2015 (25-09-2015)
Agent’s File No.: 19908.009WO02
Title: Phosphorous Pentoxide Producing Methods and Systems with Increased Agglomerate Compression Strength

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Sir:

RESPONSE TO WRITTEN OPINION

This amendment is responsive to the Written Opinion mailed 09 September 2016 (re-mailed 09 December 2016) (hereinafter “Written Opinion”). Pursuant to Form PCT/IPEA/424 sent by fax on 08 December 2016 attaching the Written Opinion, Applicant notes that the Written Opinion was “returned to the European Patent Office due to wrong address.” Since Applicant only very recently received the Written Opinion, Applicant requests expedited consideration of the present Response before issuance of the Intl. Preliminary Report on Patentability.

Submitted previously were substitute pages 42-47, for which Applicant renews the request that they be entered in place of the originally-filed pages 42-47. Substitute pages 42-47 replaced the originally-filed claims 1-23 with claims 1-14. Submitted herewith are annotated claims clearly identifying the amendments made.
STATEMENT

The differences between claims 1-23 filed and claims 1-14 provided in the accompanying substitute pages are as follows.

Claims 7, 8, 10, and 13 replace previous respective claims 6, 7, 9, and 15 but are unchanged aside from renumbering and adding multiple dependencies or renumbering of dependencies.

Claim 1 replaces previous claim 1 and is amended as supported at least by paragraphs 53, 55, 57, and 113 of the specification along with Figures 2-10, which describe heating of the pre-feed agglomerates and maintaining of the induration temperature separately from a reduction kiln.

Item V.1 of the Written Opinion states, “Pre-feed agglomerates are not recited in original claim 1.” Contrary to Item V.1, original claim 1 expressly recites both forming and heating “pre-feed agglomerates,” as is clear from the included annotated claims and from the original claims.

Also, Item V.1 of the Written Opinion states, “the same goes for the subject - matter now related to the reduction kiln.” Applicant presumes the Written Opinion refers to the added limitation “heating of the pre-feed agglomerates and maintaining of the induration temperature occurring separately from a reduction kiln.” Also, original claim 1 recited “forming a reducing kiln bed” and amended claim 1 clarifies that it occurs “in the reduction kiln.” Though these limitations were added to claim 1, a proper basis for them exists in the Description.

Paragraph 53 of the Description states, “The present methods and systems may provide various processes to harden the feedstock agglomerates above 25 lbf by compression strength before they are fed to the ported kiln.” (Emphasis added.) Paragraphs 55 (“the ported reduction kiln”), 46 (“the ports inside the reducing kiln”), 41 (“the ported-reduction kiln”), and elsewhere specify
that the “ported kiln” is a reduction kiln. Paragraph 55 states, “A benefit of such a system is the ability to harden the agglomerates, maintain their hardness, and to remove dust prior to feeding the agglomerates to the reduction rotary kiln.” (Emphasis added.) Paragraph 57, referring to Figure 4 describes “a Straight Grate DRYER/Heater to indurate the agglomerates before they are fed directly to the PORTED ROTARY KILN.” (Emphasis added.) Paragraph 113 describes “forming feed agglomerates prior to entering a rotary kiln (reduction kiln …) that exhibits compression strength above 25 lbf.” Each of Figures 2-10 show a REDUCTION ROTARY KILN receiving pellets from an upstream INDURATION KILN, INDURATION STRAIGHT GRATE-KILN, or STRAIGHT GRATE DRYER/HEATER after the forming the pellets in AGGLOMERATION.

Claim 2 replaces previous claim 12 and is amended to depend from claim 1 and to revise antecedent basis because of the dependency.

Claim 3 replaces previous claim 20 and is amended to depend from claim 1 and to revise antecedent basis because of the dependency.

Claim 4 replaces previous claims 2 and 13 and combines the subject matter thereof.

Claim 5 replaces previous claims 3 and 4, combines the subject matter thereof, and revises antecedent basis given the amendment to claim 1.

Claim 6 replaces previous claims 5, 14, and 21, combines the subject matter thereof, and adds subject matter supported by paragraph 29 of the specification, which states, “The process engineering described in the methods and systems herein is the practical means to achieve hardened agglomerates with compression strength above 25 lbf if heated to temperatures above 900 C, such as above 930 C, hereby referred to as induration.” (Emphasis added.)

Claim 9 replaces previous claims 8, 19, and 22 and combines the subject matter thereof.
Claim 11 replaces previous claim 10, corrects antecedent basis, and adds multiple dependency.

Claim 12 replaces previous claims 11, 18, and 23, combines the subject matter thereof, and adds multiple dependency.

Claim 14 replaces previous claims 16 and 17 and combines the subject matter thereof.

The pending claims 1-14 are believed to be novel and further to possess an inventive step relative to the cited references. Applicant requests reconsideration and reiterates, and herein incorporates by reference, all previous remarks regarding novelty, inventive step, and clarity of the claims made in Applicant’s 22 July 2016 Response.

Applicant requests publication of a favorable Int’l. Preliminary Report on Patentability in keeping with the assertions above.

Dated: 28 December 2016

Respectfully submitted by

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USPTO Reg. No. 44,854
Docket No. 19908.008WO02

CLAIMS

What is claimed is:

1. A phosphorous pentoxide producing method comprising:
   forming pre-feed agglomerates containing phosphate ore particles, carbonaceous material particles, and silica particles;
   heating the pre-feed agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more, the heating of the pre-feed agglomerates and maintaining of the induration temperature occurring separately from a reduction kiln;
   forming feed agglomerates and increasing a compression strength of the feed agglomerates to above 25 lb (111 N) using the heating of the pre-feed agglomerates and maintaining of the induration temperature, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2;
   forming a reducing kiln bed in the reduction kiln using the feed agglomerates;
   and
   generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas.

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drying the green agglomerates at a drying temperature from 40 to 300 °C to form the pre-feed agglomerates, the dried pre-feed agglomerates exhibiting a compression strength above 25 lb (111 N); heating the dried agglomerates in a reducing or inert atmosphere to an induration temperature from above 900 °C to less than 1180 °C and maintaining the induration temperature for 15 minutes or more;

forming the feed agglomerates and increasing the compression strength of the feed agglomerates to above 50 lb (222 N) using the heating of the pre-feed agglomerates and maintaining of the induration temperature, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2;

forming a reducing kiln bed using the feed agglomerates; and generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas.

The method of claim 1 further comprising:

extruding a material to form green agglomerates containing phosphate ore particles, carbonaceous material particles, silica particles, and 2 to 5 wt% (dry basis) clay particles;

drying the extruded, green agglomerates at a drying temperature from 40 to 150 °C to form the pre-feed agglomerates, the dried pre-feed agglomerates exhibiting a compression strength above 50 lb (222 N); heating the dried agglomerates in a reducing or inert atmosphere to an
induration temperature from above 900 to less than 1180 °C and maintaining the induration temperature for 15 minutes or more;

forming the feed agglomerates and increasing the compression strength of the feed agglomerates to above 200 lb (445 N) using the heating of the pre-feed agglomerates and maintaining of the induration temperature, the feed agglomerates exhibiting a calcium-to-silica mole ratio less than 1 and a silica-to-(calcium + magnesium) mole ratio greater than 2;

— forming a reducing kiln bed using the feed agglomerates; and

— generating kiln off-gas and collecting phosphorous pentoxide from the kiln off gas.

24. The method of claims 1 or 2, wherein the crush strength of the feed agglomerates is above 50 lb (222 N), preferably wherein the crush strength is above 100 lb (445 N).

35. The method of claim 4 any preceding claim, wherein the heating of the pre-feed agglomerates and maintaining of the induration temperature occurs in an induration kiln selected from among a tunnel kiln, a rotary co-current kiln, and a rotary counter-current kiln; or wherein the heating of the pre-feed agglomerates and maintaining of the induration temperature occurs in a grate heater.

4. The method of claim 1, wherein the heating occurs in a grate heater.

56. The method of claim 4 any preceding claim wherein the induration temperature is from 930 to 1180 °C, preferably wherein the induration temperature is from 930 to 1125 °C, preferably wherein the induration temperature is from 950 to
1100 °C and is maintained for 30 minutes or more, preferably wherein the induration temperature is from 1000 to 1100 °C and is maintained for 30 to 90 minutes.

67. The method of claim 44, any preceding claim, wherein the induration temperature is maintained for 30 to 90 minutes.

78. The method of claim 77, any preceding claim, further comprising pre-heating the pre-feed agglomerates in a grate heater to a pre-heat temperature from 950 °C to less than 1180 °C before the heating at the induration temperature, which occurs in an induration kiln.

89. The method of claim 88, any preceding claim, further comprising preparing the phosphate ore particles, carbonaceous material particles, and silica particles such that 80% or more exhibit a size less than 200 mesh (74 μm), preferably wherein the pre-feed agglomerates further contain clay particles and further comprising preparing the phosphate ore particles, carbonaceous material particles, clay particles, and silica particles such that 80% or more exhibit a size less than 200 mesh (74 μm), preferably wherein 80% or more exhibit a size less than 325 mesh (44 μm).

910. The method of claim 90, further comprising:

- scrubbing the kiln off-gas in a product acid scrubber and generating a scrubber off-gas;
- making the scrubber off-gas reducing; and
- the pre-heating in the grate heater using the reducing scrubber off-gas.
11. The method of claim 1, any preceding claim, further comprising adding over bed air through a plurality of ports along the bed—a length of the bed, the over bed air entering kiln freeboard through a plurality of standpipes extending from respective ports to a height above the bed.

12. The method of claim 1, any of claims 1-5, wherein the pre-feed agglomerates comprise one or more contaminants selected from the group consisting of Al, As, Cd, Cl, Pb, and Hg and wherein the method further comprises decreasing a concentration of the contaminants in the feed agglomerates using the heating when compared to the pre-feed agglomerates, preferably wherein the induration temperature is maintained for 60 minutes or more.

13. The method of claim 12, wherein the crush strength is above 100 lb.

14. The method of claim 12, wherein the induration temperature is from 950 to 1100 C and is maintained for 30 minutes or more.

15. The method of claim 12, wherein the drying temperature is from 40 to 150 C and the green agglomerates further contain clay particles.

16. The method of claim 12, wherein the polymer comprises a compound selected from among acrylics, silicones, cross-linkable polyimides, epoxies, silicates of sodium, potassium, or lithium, and a combination of organic and inorganic polymers; or.

17. The method of claim 12, wherein the polymer comprises Na₂(SiO₂)₉O.
The method of claim 12, wherein the dried agglomerates comprise one or more contaminants selected from the group consisting of Al, As, Cd, Cl, Pb, and Hg, and wherein the method further comprises decreasing a concentration of the contaminants in the feed agglomerates using the heating when compared to the dried agglomerates.

The method of claim 12, further comprising preparing the phosphate ore particles, carbonaceous material particles, and silica particles such that 80% or more exhibit a size less than 200 mesh.

The method of claim 20, wherein the induration temperature is from 1000 to 1100 °C and is maintained for 30 to 90 minutes.

The method of claim 20, further comprising preparing the phosphate ore particles, carbonaceous material particles, clay particles, and silica particles such that 80% or more exhibit a size less than 325 mesh.

The method of claim 20, wherein the dried agglomerates comprise one or more contaminants selected from the group consisting of Al, As, Cd, Cl, Pb, and Hg, wherein the induration temperature is maintained for 50 minutes or more, and wherein the method further comprises decreasing a concentration of the contaminants in the feed agglomerates using the heating when compared to the dried agglomerates.