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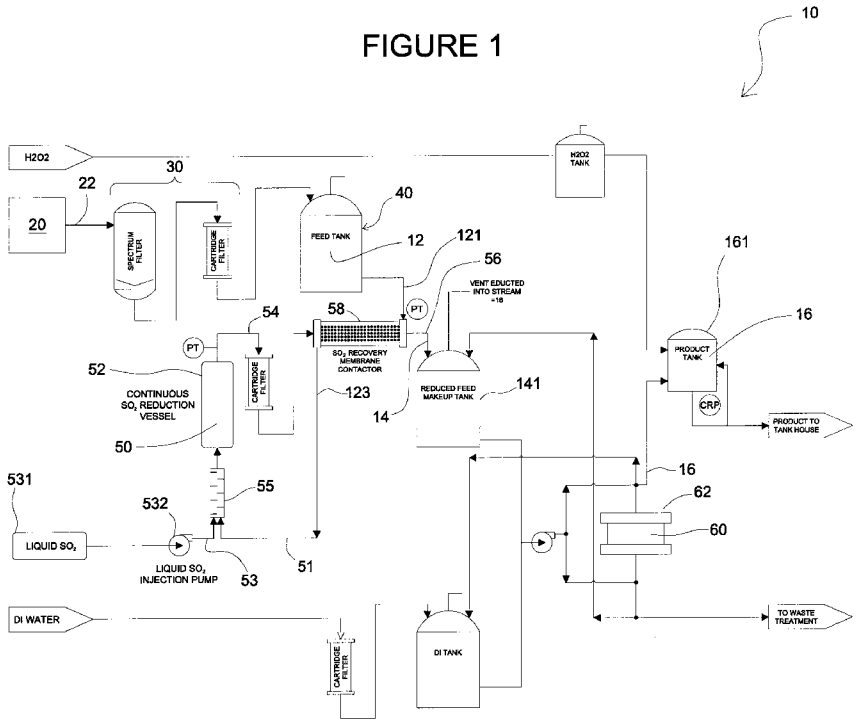
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(54) Title: PROCESSES FOR TREATING ELECTROLYTE FROM AN ELECTROREFINING PROCESS

FIGURE 1



(57) **Abstract:** Process of treating an aqueous solution comprising arsenic impurities, such as an electrolyte from electrorefining of copper, the process comprising reducing As(V) to As(III) using SO_2; and removing As(III) via cation exchange using a chelating resin, such as a polymeric resin with a polyhydroxy amine functional group. The process can further comprise membrane contact between electrolyte feed stream and reduction reaction product stream to transfer residual SO_2 in the product stream to the electrolyte feed steam.

[Continued on next page]

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

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see Notice of 05 November 2020 (05.11.2020)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2020/050370

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***C02F 9/04*** (2006.01) , ***C02F 1/28*** (2006.01) , ***C02F 1/42*** (2006.01) , ***C02F 1/70*** (2006.01) , ***C25C 1/12*** (2006.01) , ***C25C 7/06*** (2006.01) (more IPCs on the last page)

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: C02F, C25C, C01G

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Databases: Questel Orbit, SciFinder; STN; Google
Keywords: electroly+, ion#exchange, reduc+, arsenic, As(III), As(V), electrorefining, purifying copper electrorefining electrolyte solns, arsenite removal, membrane contactor, Liqui-Cel EXF, liquid-liquid membrane transfer/contactor, SO2 recovery, residual, aqueous

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US5366715A (DREISINGER, DB et al.) 22 November 1994 (22-11-1994) *see whole document	1-33
Y	US6495024B1 (LINDROOS, L et al.) 17 December 2002 (17-12-2002) *see whole document	1-33
Y	EP1568660A1 (BARRETT, JH et al.) 31 August 2005 (31-08-2005) *see whole document	1-33

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

*	Special categories of cited documents:
"A"	document defining the general state of the art which is not considered to be of particular relevance
"D"	document cited by the applicant in the international application
"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 15 September 2020 (15-09-2020)	Date of mailing of the international search report 17 September 2020 (17-09-2020)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 819-953-2476	Authorized officer Tham T. Pham (819) 639-8529

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US1952290A (WALTER, S) 27 March 1934 (27-03-1934) *see whole document, particularly p. 2, lines 21-40	34-36
X	US5449503A (REDMON, CL et al.) 12 September 1995 (12-09-1995) *see whole document, particularly column 4, lines 16-57	34-36
A	US2010122784A1 (JEMAA, N et al.) 20 May 2010 (20-05-2010) *see Figure 1; paragraphs 6, 24 and 36	34-36

Box No. II **Observations where certain claims were found unsearchable (Continuation of item 2 of the 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. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim 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. ☐ Claim 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 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 claim Nos.:

☐ 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 claim 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.

Continuation of Box No. III

The claims are directed to a plurality of inventive concepts as follows:

Group A - Claims 1-33 are directed to a process for treating an aqueous solution including impurity material disposed in a first state, comprising: modifying the state of the impurity material, disposed in the first state, from the first state to the second state, such that a conditioned aqueous solution, including the modified impurity material, is obtained; and contacting the conditioned aqueous solution with an operative sorptive media with effect that at least a portion of the modified impurity material becomes sorbed to the operative sorptive media, such that an impurity material-depleted aqueous solution is produced.; and

Group B - Claims 34-36 are directed to a process for treating a feed material with a reagent, comprising: emplacing a reaction zone discharge in selective mass transfer communication with the feed material such that reagent material is transferred from the reaction zone discharge to the feed material, with effect that a modified feed material is obtained that is augmented with the transferred reagent material; contacting the modified feed material with an adscititious reagent material within a reaction zone, such that a reactive process is effected to produce a reaction product, and such that a reaction zone material becomes disposed in the reaction zone and includes the reaction product and residual reagent material; and discharging the reaction zone material from the reaction zone; wherein the discharged reaction zone material defined the reaction zone discharge.

Claims 1 and 34 are extremely broad. As worded, the claims are not linked by any common technical feature. When claims 1 and 34 are limited to subject matter supported by the description, the broad features "modifying the state of the impurity material" in claim 1 and "reactive process" in claim 34 can be considered as being limited to reduction of As (V) to As (III) using SO_2, as the common technical feature. Reduction of As (V) to As (III) by SO_2 is a well-known reaction (see D2). Therefore, claims lack unity *a posteriori*.

The claims must be limited to one inventive concept as set out in PCT Rule 13.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2020/050370

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US5366715A	22 November 1994 (22-11-1994)	AU7588294A	11 May 1995 (11-05-1995)
		CA2118208A1	20 April 1995 (20-04-1995)
		EP0648709A1	19 April 1995 (19-04-1995)
		FI944890A	20 April 1995 (20-04-1995)
		JPH07187618A	25 July 1995 (25-07-1995)
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		FI109922B	31 October 2002 (31-10-2002)
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		US7282153B2	16 October 2007 (16-10-2007)
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		CA2155949A1	27 October 1994 (27-10-1994)
		DE69407645D1	12 February 1998 (12-02-1998)
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		EP0620189B1	07 January 1998 (07-01-1998)
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		BRPI0813953A2	30 December 2014 (30-12-2014)
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		CA2694223C	31 January 2012 (31-01-2012)
		EP2188216A1	26 May 2010 (26-05-2010)
		EP2188216A4	04 July 2012 (04-07-2012)
		EP2188216B1	25 April 2018 (25-04-2018)
		ES2672768T3	18 June 2018 (18-06-2018)
		PT2188216T	03 July 2018 (03-07-2018)
		WO2009012597A1	29 January 2009 (29-01-2009)

C02F 1/461 (2006.01) , *C01G 3/00* (2006.01)