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- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,

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- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, 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).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

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

(88) Date of publication of the international search report:

26 March 2015

(54) **Title:** PRODUCTION OF PRODUCTS FROM NATURAL RESOURCES

(57) **Abstract:** The method disclosed herein relates to two stage catalytic processes for converting syngas to acetic acid, acrylic acid and/or propylene. More specifically, the method described and claimed herein relate to a method of producing acrylic acid and acetic acid comprising the steps of: a) providing a feedstream comprising syngas; b) contacting the feedstream with a first catalyst to produce a first product stream comprising C₂-C₃ olefins and/or C₂-C₃ paraffins; and c) contacting the first product stream with oxygen gas and a second catalyst, thereby producing a second product stream comprising acrylic acid and acetic acid, wherein there is no step for separating the components of the first product stream before the first product stream is contacted with the second catalyst



WO 2014/174372 A3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/001420

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07C29/50 C07C1/04 C07C51/25
ADD.

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)
C07C C10G

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/161602 A1 (WANG KUN [US] ET AL) 3 July 2008 (2008-07-03) paragraphs [0003], [0090] - [0092], [0103]; claims 15,22,24,25; figures 15,16 -----	1-8, 24-48
X	WO 00/29106 A1 (SAUDI BASIC IND CORP [SA]; KARIM KHALID [GB]; BHAT YAJNAVALKYA SUBRAI) 25 May 2000 (2000-05-25) cited in the application page 5, line 28 - line 31; claims 1,22,24 -----	1-8, 24-48
A	US 2011/118365 A1 (STEINER JOCHEN [DE] ET AL) 19 May 2011 (2011-05-19) claims 1,5,6 ----- -/-	1-8, 24-48



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

"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

22 October 2014

Date of mailing of the international search report

05/01/2015

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/001420

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	MULPURI JANARDANARAO: "Direct Catalytic Conversion of Synthesis Gas to Lower Olefins", INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH, AMERICAN CHEMICAL SOCIETY, US, vol. 29, no. 9, 31 December 1990 (1990-12-31), pages 1735-1753, XP002628374, ISSN: 0888-5885, DOI: 10.1021/IE00105A001 page 1736 -----	1-8, 24-48
A	WO 2011/141374 A1 (CASALE CHEMICALS SA [CH]; FERRINI CRISTINA [CH]) 17 November 2011 (2011-11-17) claim 1 -----	1-8, 24-48
A	FR 2 391 978 A1 (INST FRANCAIS DU PETROLE [FR] INST FRANCAIS DU PETROLE) 22 December 1978 (1978-12-22) claim 1 -----	1-8, 24-48
A	EP 0 196 732 A1 (STANDARD OIL CO OHIO [US]) 8 October 1986 (1986-10-08) page 8, line 15 - line 21; claims 1,8 -----	1-8, 24-48

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2014/001420

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008161602 A1	03-07-2008	US 2008161602 A1	03-07-2008
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2014/001420

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 additional 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 an 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.:

1-8(completely); 24-48(partially)

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8(completely); 24-48(partially)

a method of producing acrylic acid and acetic acid from syngas

2. claims: 9-12(completely); 24-48(partially)

a method of producing acrylic acid and acetic acid from syngas wherein the first catalyst comprises a mixed metal oxide represented by the formula $\text{Co}_2\text{O}_3 \cdot \text{Mn}_2\text{O}_3 \cdot \text{La}_2\text{O}_3 \cdot \text{Py}_2\text{O}_3 \cdot \text{M}_2\text{O}_3 \cdot \text{O}_2$

3. claims: 13-23(completely); 24-48(partially)

a method of producing acrylic acid and acetic acid from syngas wherein the first catalyst comprises Coa Mob Sc Md Ke Of.
