



US009409848B2

(12) **United States Patent**
Shaver et al.(10) **Patent No.:** **US 9,409,848 B2**
(45) **Date of Patent:** ***Aug. 9, 2016**(54) **PROCESSES FOR PRODUCING ACETIC ACID**(71) Applicant: **Celanese International Corporation**,
Irving, TX (US)(72) Inventors: **Ronald D. Shaver**, Houston, TX (US);
Mark O. Scates, Houston, TX (US);
Raymond J. Zinobile, Houston, TX
(US)(73) Assignee: **CELANESE INTERNATIONAL**
CORPORATION, Irving, TX (US)(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.This patent is subject to a terminal dis-
claimer.(21) Appl. No.: **14/849,003**(22) Filed: **Sep. 9, 2015**(65) **Prior Publication Data**

US 2015/0376105 A1 Dec. 31, 2015

Related U.S. Application Data(63) Continuation of application No. 14/488,900, filed on
Sep. 17, 2014, now Pat. No. 9,149,735, which is a
continuation of application No. 13/109,348, filed on
May 17, 2011, now Pat. No. 8,889,904.(60) Provisional application No. 61/345,833, filed on May
18, 2010.(51) **Int. Cl.****C07C 51/44** (2006.01)
C07C 51/48 (2006.01)
B01D 3/14 (2006.01)
B01D 11/04 (2006.01)
C07C 51/12 (2006.01)
C07C 51/42 (2006.01)(52) **U.S. Cl.**CPC **C07C 51/44** (2013.01); **B01D 3/143**
(2013.01); **B01D 11/0492** (2013.01); **C07C**
51/12 (2013.01); **C07C 51/42** (2013.01); **C07C**
51/48 (2013.01)(58) **Field of Classification Search**None
See application file for complete search history.(56) **References Cited**

U.S. PATENT DOCUMENTS

3,769,329 A 10/1973 Knox et al.
5,001,259 A 3/1991 Smith et al.
5,026,908 A 6/1991 Smith et al.
5,144,068 A 9/1992 Smith et al.
5,625,095 A 4/1997 Miura et al.
5,756,836 A 5/1998 Shimizu et al.
6,143,930 A 11/2000 Singh et al.
6,339,171 B1* 1/2002 Singh C07C 51/12
562/519
7,208,625 B1 4/2007 Wang et al.7,223,883 B2 5/2007 Picard et al.
7,223,886 B2* 5/2007 Scates C07C 51/44
560/232
7,271,293 B2 9/2007 Trueba et al.
7,524,988 B2 4/2009 Harris et al.
7,855,306 B2 12/2010 Zinobile et al.
7,884,237 B2 2/2011 Shaver
7,989,659 B2 8/2011 Powell et al.
8,076,508 B2* 12/2011 Brtko B01D 3/143
562/519
8,207,377 B2 6/2012 Zinobile et al.
8,501,990 B2 8/2013 Zinobile et al.
8,889,904 B2 11/2014 Shaver et al.
2006/0247266 A1 11/2006 Yamada et al.
2006/0247466 A1* 11/2006 Zinobile C07C 51/44
562/517
2015/0021160 A1 1/2015 Shaver et al.

FOREIGN PATENT DOCUMENTS

CN 101391946 3/2009
EP 0161874 11/1985
JP 2007-284404 11/2007

OTHER PUBLICATIONS

Office Action for Chinese Appl. No. 201180032069.7 dated Oct. 10,
2014. (with translation).Office Action for corresponding Chinese Appl. No. 201180032069.7
dated Mar. 5, 2014 (with translation).International Preliminary Report on Patentability for PCT/US2011/
036765 mailed Jan. 29, 2013.International Preliminary Report on Patentability for PCT/US2011/
036765 mailed Aug. 10, 2012.International Search Report and Written Opinion for PCT/US2011/
036765 mailed Sep. 28, 2011.Watson, "The Cativa Process for the Production of Acetic Acid",
Catalysis of Organic Reaction, 75, pp. 369-380, 1998.Non-Final Office Action mailed on Jan. 16, 2015 for U.S. Appl. No.
14/488,900, 9 pages.Notice of Allowance mailed on Jun. 10, 2015 for U.S. Appl. No.
14/488,900, 7 pages.Non-Final Office Action mailed on Jul. 15, 2013 for U.S. Appl. No.
13/109,348, 11 pages.Final Office Action mailed on Jan. 13, 2014 for U.S. Appl. No.
13/109,348, 8 pages.Notice of Allowance mailed on Jul. 7, 2014 for U.S. Appl. No.
13/109,348, 7 pages.

* cited by examiner

Primary Examiner — Karl J Puttlitz(74) *Attorney, Agent, or Firm* — Kilpatrick Townsend &
Stockton LLP(57) **ABSTRACT**Processes for the reduction and/or removal of permanganate
reducing compounds (PRC'S) formed by the carbonylation
of methanol in the presence of a Group VIII metal carbony-
lation catalyst to produce acetic acid are disclosed. More
specifically, processes for reducing and/or removing PRC's
or their precursors from intermediate streams during the for-
mation of acetic acid by said carbonylation processes are
disclosed. In particular, processes in which a low boiling
overhead vapor stream from a light ends column is subjected
to a distillation to obtain an overhead that is subjected to an
extraction to selectively remove and/or reduce PRC's from
the process is disclosed. The processes include steps of recy-
cling one or more return streams derived from the distillation
step and/or the extraction step to a light ends column and/or a
drying column in order to improve water control in the overall
reaction system.**20 Claims, 2 Drawing Sheets**