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(54) Title: APPARATUS FOR THE USE OF NANOPARTICLES IN REMOVING CHEMICALS FROM AQUEOUS SOLUTIONS WITH SUBSEQUENT WATER PURIFICATION

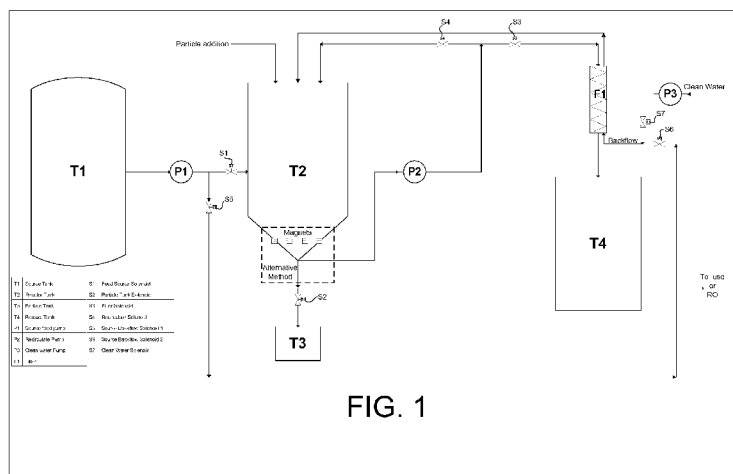


FIG. 1

(57) Abstract: An apparatus for removing target chemicals from water includes a reaction chamber, a source of an aqueous solution of the target chemicals that can be supplied on demand to the reaction chamber, a timer that times a reaction between the particles and the target chemicals such that a concentration of the target chemicals in the aqueous solution reaches a predetermined low level in a desired time, and elements for removing the aqueous phase from the reactor while keeping the particles entrained inside the reactor using a microfilter configured to be back flushed, adding aqueous solution to the reactor from the source and continuing cycles until the particles are saturated, removing and replacing the particles in a final cycle of a particle charge lifetime, and recovering the target chemicals from the particles such that the particles can be reused.

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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US2013/025650

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC(8) - C02F 9/00 (2013.01)  
 USPC - 210/650  
 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(8) - B01D 15/00, 24/00, 24/46, 61/14, 61/16; C02F 1/00, 1/44, 1/58, 9/00, 9/04 (2013.01)  
 USPC - 210/97, 634, 636, 650, 651, 670, 695, 723

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
 CPC - B01D 61/02, 61/022, 61/025, 61/027, 61/147; C02F 1/001, 1/441, 1/444, 9/00 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 Orbit.com, Google Patents, Google Scholar

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,556,545 A (VOLCHEK et al) 17 September 1996 (17.09.1996) entire document	1-27
Y	US 7,837,866 B2 (BURROWS) 23 November 2010 (23.11.2010) entire document	1-27
Y	US 5,575,919 A (SANTINA) 19 November 1996 (19.11.1996) entire document	2, 9, 20
Y	US 2006/0076294 A1 (SIRKAR et al) 13 April 2006 (13.04.2006) entire document	5, 12, 23
Y	US 2009/0211973 A1 (GILRON) 27 August 2009 (27.08.2009) entire document	6, 7, 13, 14, 24
Y	US 2011/0056876 A1 (IDE et al) 10 March 2011 (10.03.2011) entire document	7, 14, 25

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search 26 April 2013	Date of mailing of the international search report <b>10 MAY 2013</b>
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