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[Continued on next page]

(54) Title: METHOD FOR PURIFYING WATER BY CYCLIC IONIC EXCHANGE

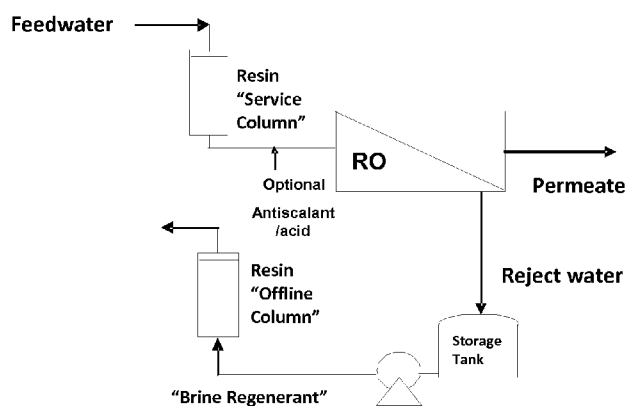


FIG. 2 Cyclic Ion Exchange Process

(57) Abstract: The present invention provides a method for purifying or softening water comprising: passing a specific volume of feedwater through at least one service column comprising a strong acid cationic exchange resin capable of binding divalent cations that are present in the feedwater, wherein the loading of the divalent cations on the resin is restricted to about 1 to 25% of the available ion exchange sites on the resin, and the total dissolved solids in the feedwater is greater than 100 mg/l; feeding the water exiting the service column to a reverse osmosis membrane or a nanofiltration membrane to produce permeate water stream and a reject water stream; and passing all or some of the volume of the reject stream corresponding the specific volume of feedwater through at least one off-line column capable of binding monovalent cations; wherein the chemical equivalent ratio of monovalent to divalent cations in the water exiting the service column is greater than 20 to 1; wherein no external source of regenerant salt is used. The inventive method allows for multiple softening/regeneration cycles so that steady state hardness leakage is achieved that is lower than obtainable with conventional ion exchange softening systems.



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PCT/US2011/034836**A. CLASSIFICATION OF SUBJECT MATTER***C02F 1/42(2006.01)i, C02F 1/44(2006.01)i, B01D 35/00(2006.01)i*

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)

C02F 1/42; B01D 15/04; C02F 1/469; B01D 61/04; C02F 1/44; B01J 20/34; B01D 61/02; B01D 61/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: ion, exchange, SWRO, osmosis

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 08-089958 A (ISHIGAKI MECH. IND. CO., LTD.) 09 April 1996 See abstract, figure 1, paragraphs 0004-0011 and claim 1.	1-13
A	US 2008-0135479 A1 (JENSEN, CHARLES E. et al.) 12 June 2008 See abstract, figures 1-10, paragraphs 0076-0126 and claim 1.	1-13
A	US 2010-0089756 A1 (WILKINS, FREDERICK C. et al.) 15 April 2010 See abstract, figure 1, pages 2-4 and claim 1.	1-13
A	US 2002-0100729 A1 (BRADLEY, ROBERT L.) 01 August 2002 See abstract, figure 1 and claim 1.	1-13
A	WO 01-12302 A1 (MOBILE PROCESS TECHNOLOGY, CO., LTD.) 22 February 2001 See abstract, figures 1,2, pages 2-4 and claim 1.	1-13

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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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