

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
12 May 2005 (12.05.2005)

PCT

(10) International Publication Number
WO 2005/042808 A1

(51) International Patent Classification⁷: **C25D 17/00**

(21) International Application Number:
PCT/US2004/034909

(22) International Filing Date: 20 October 2004 (20.10.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/512,661 20 October 2003 (20.10.2003) US

(71) Applicant (for all designated States except US): **IONICS, INCORPORATED** [US/US]; 65 Grove St., Watertown, MA 02472 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **GREBENYUK, Vladimir** [US/US]; 7 Kenney Court, Woburn, MA 01901

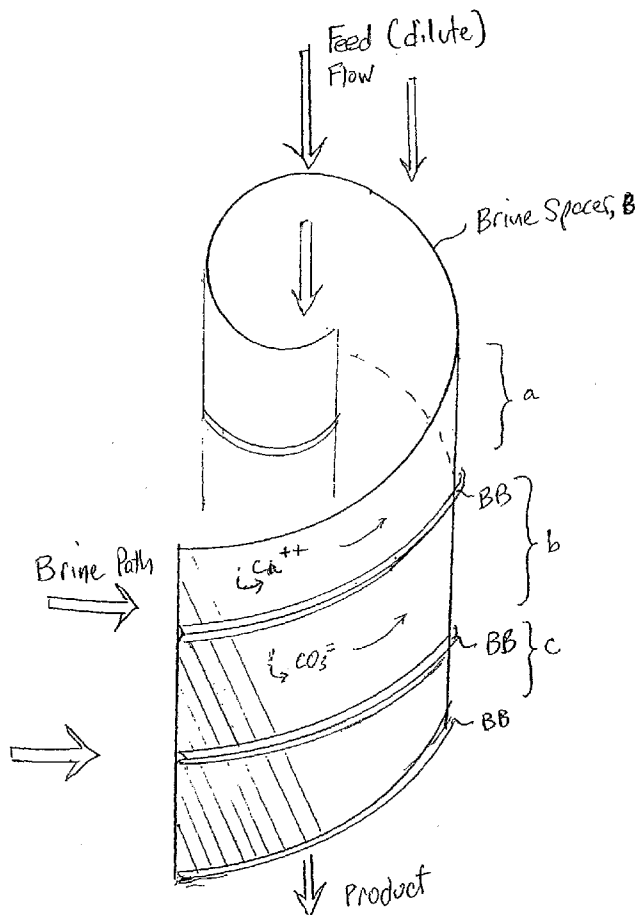
(US). **GREBENYUK, Oleg** [US/US]; 147 Captain Eames Circle, Ashland, MA 01721 (US). **SIMS, Keith, J.** [US/US]; 47 Rice Spring Lane, Wayland, MA 01778 (US). **CARSON, William, W.** [US/US]; 14 Schofield Road, Hopkington, MA 01748 (US). **MACDONALD, Russell, J.** [US/US]; 24 Bay Street, Wilmington, MA 01887 (US). **ZHANG, Li** [US/US]; 49 Amherst Road, Belmont, MA 02478 (US).

(74) Agent: **FALKOFF, Michael, I.**; Ionics, Incorporated, 65 Grove Street, Watertown, MA 02472 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,

[Continued on next page]

(54) Title: SPIRAL ELECTRODEIONIZATION DEVICE AND COMPONENTS THEREOF



(57) Abstract: A spiral electrodeionization device comprising flow paths within helical cells, which form a path-lengthening maze. Impermeable barriers between membranes prevent the feed and concentrate flows from mixing. Seals along or between portions of the flow path may define a multi-stage device, a separate feed device and/or concentrate flows for different stages, and/or direct the feed and concentrate flows along preferred directions which may be co-current, counter-current or cross-current with respect to each other. Bands (BB) in the concentrate compartments may channel scale-forming species along separate paths in different regions so that scaling does not occur, and the separation of species may be enhanced by arranging the feed flows along an axial direction through layers of different monotype resins that enhance species transport into one region of the concentrates and/or inhibit transport of the complementary sealant species in that region.



TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.