

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
2 October 2003 (02.10.2003)

PCT

(10) International Publication Number
WO 03/080225 A1

(51) International Patent Classification: **B01D 61/00**

COSTA, Lawrence, C. [US/US]; 35 Southpark Lane, Mansfield, MA 02048 (US). **SUSA, Thomas, J.** [US/US]; 444 Ventura Street, Ludlow, MA 01056 (US).

(21) International Application Number: PCT/US03/08373

(22) International Filing Date: 18 March 2003 (18.03.2003)

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

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/365,366	18 March 2002 (18.03.2002)	US
60/386,972	6 June 2002 (06.06.2002)	US
60/414,049	27 September 2002 (27.09.2002)	US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, 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, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

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

(84) Designated States (*regional*): European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR).

(72) Inventors; and

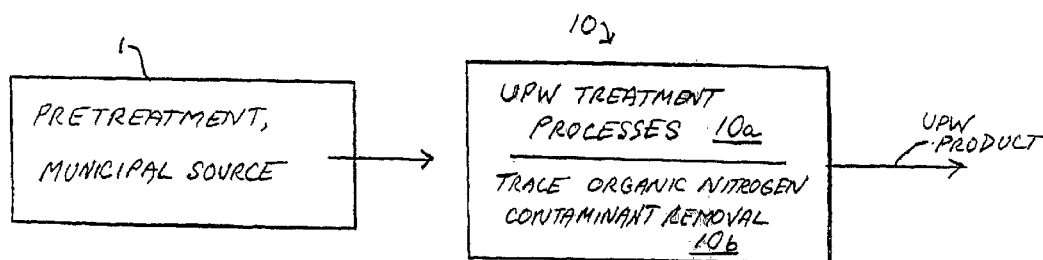
(75) Inventors/Applicants (*for US only*): **LIN, Juchui, R.** [US/US]; 9 Highland Avenue, Bedford, MA 01730 (US). **MACDONALD, Russell, J.** [US/US]; 24 Bay Street, Wilmington, MA 01887 (US). **GODEC, Richard, D.** [US/US]; 1038 Spencer Street, Longmont, CO 80516 (US). **MELANSON, Paul,** [US/US]; 6060 Spine Road, Boulder, CO 80301 (US). **CARSON, William, W.** [US/US]; 14 Schofield Road, Hopkinton, MA 01748 (US).

Published:

— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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.

(54) Title: UPW TREATMENT AND SYSTEM WITH ORGANIC NITROGEN REMOVAL



(57) Abstract: A UPW plant (100) treats feed fluid having an organic nitrogen contaminant by contact with a targeted removal unit (30) to reduce a trace concentration below a threshold. The removal unit may include an enzyme or other agent, free or bound, which is specifically effective to break down the contaminant. The enzyme is preferably stabilized, immobilized or protected, such that its integrity, or at least its activity, is maintained for hours, days or longer, operating without a cofactor and with high efficiency. The system is useful for removal of urea, which impairs a self-catalyzed lithography process or a pharmaceutical preparation process. Enzyme is, for example a lyophilized/crystallized urease, may be contacted with the stream by direct injection, or may pass through a reaction tank or delay and mixing line to assure adequate contact time for breakdown or capture of the contaminant. The enzyme may be immobilized on a support, e.g. a membrane or beads, forming a bead or column or surface across which the feed flows to cleave the urea in the feed stream, or may comprise microparticles that reside in the fluid and are themselves separated and re-used. When using free or microparticle-bound enzyme, microparticle substrate may be recovered as retentate from a downstream or side loop RO (215) or other filtration unit, or may be recovered in a settling tank, and returned to the reaction to maintain a high concentration of the enzyme or agent in operation.



WO 03/080225 A1