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(54) Title: ELECTROADSORPTION AND CHARGE BASED BIOMOLECULE SEPARATION AND DETECTION IN POROUS SENSORS

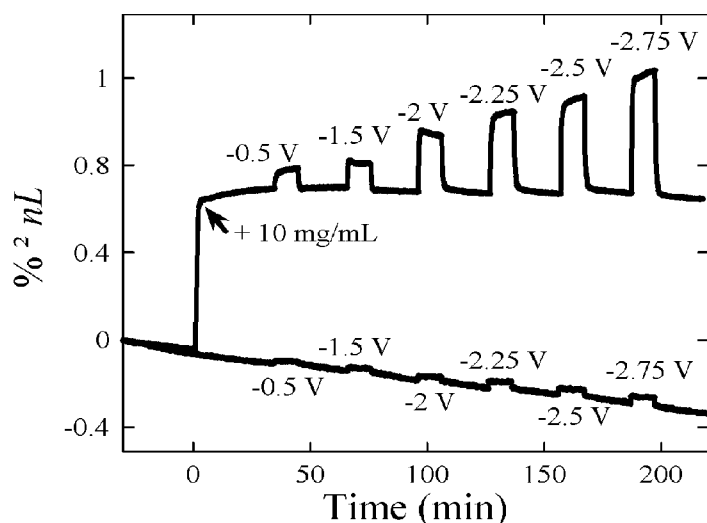


FIG. 2A

(57) Abstract: Electroadsorption and charged based biomolecule separation, concentration and detection with porous biosensors. In preferred embodiments, a potential is applied to a porous electrode to separate and concentrate molecules from solution. The bimolecular analytes are captured by the porous electrode itself, the same electrode that is used to generate the electric field for electroadsorption. In additional preferred embodiments, pH of the solution is adjusted to separate and concentrate biomolecules. Setting the pH equal to the protein isoelectric point was determined by the inventors to maximize concentration of biomolecules into the porous biosensor. The methods include simultaneously optically detecting charged molecules captured by the porous electrode. Methods of the invention are benign to biomolecules of interest, which are demonstrated to retain a high percentage of their activity after being released from the biosensor. Methods of the invention provide label-free detection. Advantageously, small voltages and ultrasmall volumes of solution are used in methods of the invention.

A. CLASSIFICATION OF SUBJECT MATTER*G01N 27/02(2006.01)i, G01N 21/45(2006.01)i, G01N 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)

G01N 27/02; G01N 27/30; G01N 21/55; C08G 8/28; G01N 21/00; G01N 33/543; C12M 1/34

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: optical,responsive,conductive,porous,electrode,capture,pH

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 7042570 B2 (MICHAEL J. SAILOR et al.) 09 May 2006 See abstract, columns 3-6, claims 1-7 and fig. 1.	1-7 16 8-15, 17-19
Y A	US 7759129 B2 (SAILOR MICHAEL J. et al.) 20 July 2010 See abstract, column 9; lines 16-36 and figs. 1-5.	16 1-15, 17-19
A	US 6897965 B2 (GHADIRI M. REZA et al.) 24 May 2005 See abstract, claims 1-9 and figs. 1-4D.	1-19
A	WO 2008-130463 A2 (THE TRUSTEES OF THE UNIVERSITY OF PENNSYLVANIA et al.) 30 October 2008 See abstract, claims 1-17 and figs. 1-10.	1-19

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

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

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"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

"&" document member of the same patent family

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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
US 7042570 B2	09.05.2006	US 2003-146109 A1	07.08.2003
US 7759129 B2	20.07.2010	US 2009-0215191 A1 WO 2007-082075 A2	27.08.2009 19.07.2007
US 6897965 B2	24.05.2005	US 2001-0044119 A1 US 2004-0152135 A1 US 6248539 B1 WO 99-12035 A1	22.11.2001 05.08.2004 19.06.2001 11.03.1999
WO 2008-130463 A2	30.10.2008	US 2011-0027913 A1 WO 2008-130463 A3	03.02.2011 12.03.2009