

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
20 November 2003 (20.11.2003)

PCT

(10) International Publication Number
WO 2003/096014 A3

(51) International Patent Classification⁷: **G01N 33/543**,
C12Q 1/26, 1/68, G01N 33/487

(74) Agent: **REINHOLD COHN AND PARTNERS**; P.O.Box
4060, 61040 Tel Aviv (IL).

(21) International Application Number:
PCT/IL2003/000369

(22) International Filing Date: 6 May 2003 (06.05.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/378,410 8 May 2002 (08.05.2002) US
60/436,005 26 December 2002 (26.12.2002) US

(71) Applicant (for all designated States except US): **YISSUM
RESEARCH DEVELOPMENT COMPANY OF THE
HEBREW UNIVERSITY OF JERUSALEM** [IL/IL];
Hi Tech Park, Edmond Safra Campus, Givat Ram, 91390
Jerusalem (IL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WILLNER, Itamar**
[IL/IL]; 12 Hashalom Street, 90805 Mevasseret Zion (IL).
KATZ, Eugenii [IL/IL]; Neve Yaakov 121 Apt.16, 97350
Jerusalem (IL). **WEIZMANN, Yossi** [IL/IL]; Moshav Gi-
vat Yoav, 12946 DN Ramat HaGolan (IL). **PATOLSKY,**
Fernando [IL/IL]; 8/3 Mera Street, Ramat Beit HaKerem,
96343 Jerusalem (IL).

(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, NI, 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.

(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
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), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

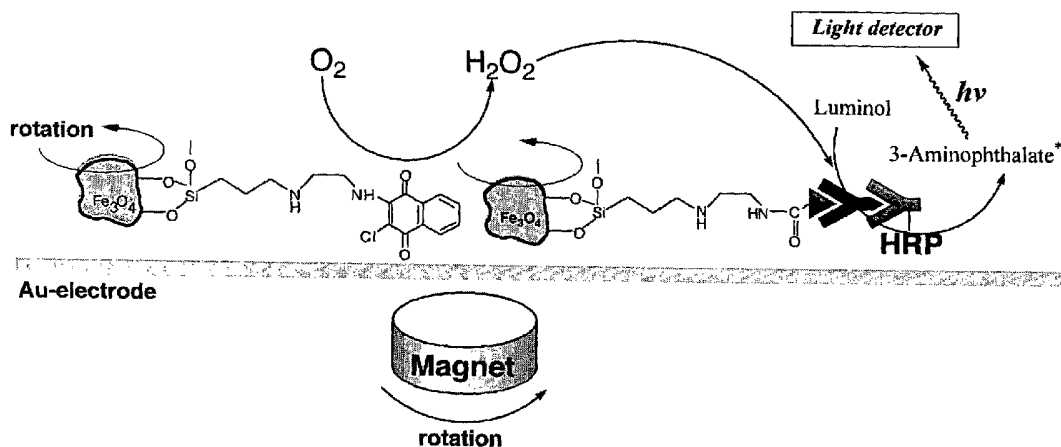
Published:

- 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

(88) Date of publication of the international search report:
4 March 2004

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

(54) Title: **MAGNETO-CONTROLLED METHOD AND SYSTEM FOR DETERMINING AN ANALYTE IN A LIQUID MEDIUM**



(57) Abstract: The present invention concerns a magneto-controlled method and system for the determination of an analyte in a liquid medium. The method and system of the invention are based on the use of functionalized magnetic particles, e.g. magnetic particles that carry a recognition agent, such that in the presence of the analyte and under appropriate conditions, a chemical reaction occurs yielding a reaction signal. The reaction signal may be an electric signal, a colorimetric signal, light emission or the formation of a precipitate. In accordance with the invention the reaction is significantly enhanced by inducing rapid vibrations or rotations of the magnetic particles on the barrier surface.

INTERNATIONAL SEARCH REPORT

Internat Application No
PCT/IL 03/00369

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01N33/543 C12Q1/26 C12Q1/68 G01N33/487

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 7 G01N C12Q

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

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

BIOSIS, EPO-Internal, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	E. KATZ & I. WILLNER: "magnetic control of chemical transformations: application for programmed electrocatalysis and surface patterning" ELECTROCHEMISTRY COMMUNICATIONS, vol. 4, 2002 - 1 February 2002 (2002-02-01), pages 201-204, XP002263852 cited in the application the whole document --- -/--	1,2,5-9, 18, 25-32,37

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

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)

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

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

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

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.

G document member of the same patent family

Date of the actual completion of the international search

4 December 2003

Date of mailing of the international search report

22/12/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Diez Schlereth, D

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 03/00369

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	E. KATZ ET AL: "dual biosensing my magneto-controlled bioelectrocatalysis" ANGEW. CHEM INT. ED., vol. 41, no. 8, 2002 - 1 April 2002 (2002-04-01), XP002263853 cited in the application	27-32, 37
A	the whole document	1-26, 39-41
X	WO 00 47983 A (MACPHEE ROBERT D ;UNIV SOUTHERN CALIFORNIA (US)) 17 August 2000 (2000-08-17)	27-30, 32-37
A	page 6, line 31 -page 13, line 7; figure 1	1-26, 39-41
X	WO 92 14138 A (EISAI CO LTD ;IGEN INC (US)) 20 August 1992 (1992-08-20)	27, 28, 30, 33-37
A	examples 1-3	1-26, 39-41
X	YU H: "Comparative studies of magnetic particle-based solid phase fluorogenic and electrochemiluminescent immunoassay" JOURNAL OF IMMUNOLOGICAL METHODS, ELSEVIER SCIENCE PUBLISHERS B.V.,AMSTERDAM, NL, vol. 218, no. 1-2, 1 September 1998 (1998-09-01), pages 1-8, XP004146527 ISSN: 0022-1759	27-30, 32-37
A	figure 2	1-26, 39-41
X	J. WANG ET AL: "magnetically-induced solid-state electrochemical detection of DNA hybridization" J. AM. CHEM. SOC., vol. 124, no. 16, 2002, XP002263854	27, 28, 30, 33-35, 37
A	figure 1	1-26, 39-41
P, X	KATZ EUGENII ET AL: "Magneto-stimulated hydrodynamic control of electrocatalytic and bioelectrocatalytic processes" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 124, no. 35, 4 September 2002 (2002-09-04), pages 10290-10291, XP002263855 ISSN: 0002-7863 the whole document	1-41

-/--

INTERNATIONAL SEARCH REPORT

Internatⁿ Application No
PCT/IL 03/00369

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WEIZMANN YOSSI ET AL: "Amplified DNA sensing and immunosensing by the rotation of functional magnetic particles." JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 125, no. 12, 26 March 2003 (2003-03-26), pages 3452-3454, XP002263856 ISSN: 0002-7863 (ISSN print) the whole document	1-41
A	WANG J ET AL: "METAL NANOPARTICLE-BASED ELECTROCHEMICAL STRIPPING POTENTIOMETRIC DETECTION OF DNA HYBRIDIZATION" ANALYTICAL CHEMISTRY, AMERICAN CHEMICAL SOCIETY, COLUMBUS, US, vol. 73, no. 22, 15 November 2001 (2001-11-15), pages 5576-5581, XP001122155 ISSN: 0003-2700 the whole document	1-41
A	WO 00 32813 A (PATOLSKY FERNANDO ;YISSUM RES DEV CO (IL); KATZ EVGENY (IL); BAR D) 8 June 2000 (2000-06-08) abstract	1-41

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IL 03/00369

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0047983	A	17-08-2000	AU 3487800 A	29-08-2000
			CA 2364288 A1	17-08-2000
			EP 1151288 A1	07-11-2001
			JP 2002536660 T	29-10-2002
			WO 0047983 A1	17-08-2000
			US 2002166764 A1	14-11-2002
WO 9214138	A	20-08-1992	AT 173542 T	15-12-1998
			AU 668085 B2	26-04-1996
			AU 1420692 A	07-09-1992
			AU 1530492 A	07-09-1992
			CA 2103674 A1	07-08-1992
			CN 1065339 A ,B	14-10-1992
			CN 1064945 A ,B	30-09-1992
			DE 69227624 D1	24-12-1998
			DE 69227624 T2	08-07-1999
			DK 570518 T3	02-08-1999
			EP 1286164 A2	26-02-2003
			EP 0570518 A1	24-11-1993
			EP 0877252 A2	11-11-1998
			ES 2126591 T3	01-04-1999
			GR 3029446 T3	28-05-1999
			HK 1017970 A1	11-08-2000
			IE 920380 A1	12-08-1992
			IE 920381 A1	12-08-1992
			IL 100866 A	31-10-1995
			IL 100867 A	08-12-1995
			JP 3182515 B2	03-07-2001
			JP 11148901 A	02-06-1999
			JP 3128541 B2	29-01-2001
			JP 11125601 A	11-05-1999
			JP 3061416 B2	10-07-2000
			JP 6509412 T	20-10-1994
			JP 3013937 B2	28-02-2000
			JP 6508203 T	14-09-1994
			KR 226231 B1	15-10-1999
			NZ 241537 A	25-06-1993
			NZ 241538 A	25-02-1993
			WO 9214138 A1	20-08-1992
			WO 9214139 A1	20-08-1992
			US 5962218 A	05-10-1999
			US 5635347 A	03-06-1997
			US 2003008339 A1	09-01-2003
			US 6325973 B1	04-12-2001
			US 5705402 A	06-01-1998
			US 6448091 B1	10-09-2002
			US 5935779 A	10-08-1999
			US 5770459 A	23-06-1998
			US 5779976 A	14-07-1998
			US 5746974 A	05-05-1998
			US 5798083 A	25-08-1998
			US 6078782 A	20-06-2000
			ZA 9200803 A	25-11-1992
			ZA 9200804 A	30-12-1992
WO 0032813	A	08-06-2000	IL 127346 A	14-06-2001
			AU 1407400 A	19-06-2000
			CA 2353562 A1	08-06-2000

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IT 03/00369

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0032813	A	EP 1135533 A1	26-09-2001
		WO 0032813 A1	08-06-2000
		JP 2002531100 T	24-09-2002