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(54) Title: NANOPARTICLE-MEDIATED MICROWAVE TREATMENT METHODS

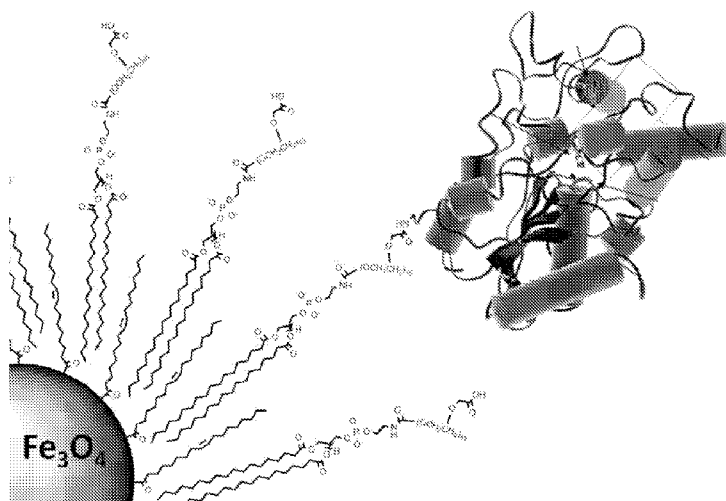


FIG. 2B

(57) Abstract: A method is provided for using magnetic nanoparticles to enhance microwave therapies for treating cells and tissues. The nanoparticles are designed to transduce microwave radiation into heat and furthermore, the nanoparticles may include specific tissue targeting and other functionality for enhancing in situ effects. In one embodiment, nanoparticles are introduced into a tissue system and a microwave field is applied. The nanoparticles react to the microwave energy by releasing heat thus heating the tissue and inducing hyperthermia (below 50°C) or thermotherapy (above 50°C). The nanoparticles can be designed for optimal heat production response at specific microwave frequencies and/or ranges of microwave frequencies where these frequencies may span the entire microwave spectrum, namely 300 MHz (310⁸ Hz) to 300 GHz (310¹¹ Hz).

A. CLASSIFICATION OF SUBJECT MATTER*A61B 18/18(2006.01)i, A61N 5/02(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)

IPC: A61N

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 since 1975

Japanese Utility models and applications for Utility models since 1975

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

eKOMPASS(KIPO Internal) "nanoparticle", "cell", "tissue", "treat", "microwave", "coating", "biocompatible", "inorganic", "hydrophilic", "ligand", "radiation", "hyperthermia"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2003-0028071 A1 (ERIK SCHROEDER HANDY et al.) 6 February 2003 See claims 1-8 and 39-42, paragraphs [0034]-[0038], figures 1-3	17-19, 21, 22 20
X A	US 2004-0181114 A1 (JAMES F. HAINFELD et al.) 16 September 2004 See claims 1 and 22, abstract, paragraphs [0022]-[0023]	17-19, 21 20, 22
X	US 6165440 A (RINAT O. ESENALIEV) 26 December 2000 See claim 14, column 3, line 66 - column 4, line 67, figures 1a and 1b	22
X	US 2007-0168001 A1 (XIAO-DONG XIANG et al.) 19 July 2007 See claims 1-2, abstract, paragraphs [0021]-[0027]	17, 21
A	US 2006-0190063 A1 (JOHN KANZIUS) 24 August 2006 See claim 1, abstract, figures 1-2	17-22



Further documents are listed in the continuation of Box C.



See patent family 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 application or patent 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 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

"&" document member of the same patent family

Date of the actual completion of the international search

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Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/039652**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 1-16
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 1-16 pertains to methods for treating a cell, tissue or cancerous tissue of human body by therapy and thus relate to a subject matter which this International Searching Authority is not required to search under Article 17(2)(a)(i) and Rule 39.1(iv) PCT.
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/039652

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