

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/IB2020/053120

International filing date (day/month/year)
02.04.2020

Priority date (day/month/year)
04.04.2019

International Patent Classification (IPC) or both national classification and IPC
INV. A01N59/16 A01P1/00

Applicant
INMOLECULE INTERNATIONAL LIMITED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0
Fax: +49 89 2399 - 4465

Date of completion of
this opinion

see form
PCT/ISA/210

Authorized Officer

Lorusso, Patrizia

Telephone No. +49 89 2399-0



Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. ☐ forming part of the international application as filed:
 - ☐ in the form of an Annex C/ST.25 text file.
 - ☐ on paper or in the form of an image file.
 - b. ☐ furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
 - ☐ in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
 - ☐ on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>5-12, 14, 17, 18, 20, 22-24</u>
	No: Claims	<u>1-4, 13, 15, 16, 19, 21</u>
Inventive step (IS)	Yes: Claims	
	No: Claims	<u>1-24</u>
Industrial applicability (IA)	Yes: Claims	<u>1-24</u>
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

The present invention refers to the use of titanium dioxide modified with functional organic groups, inorganic radicals and fruit and/or herbal extracts adsorbed on its surface and pores to produce aqueous composition for application in various fields.

Reference is made to the following documents:

- D1 EP 3 012 225 A1 (INMOLECULE INTERNAT LTD [GB]) 27 April 2016 cited by the applicant as MX339086
- D2 CN 102 077 865 B (UNIV SOUTH CHINA AGRICULT) 4 December 2013
- D3 WO 2009/046081 A2 (3M INNOVATIVE PROPERTIES CO [US]; KSHIRSAGAR MANJIRI T [US] ET AL.) 9 April 2009
- D4 ALLAHVERDIYEV ET AL: "Coping With Antibiotic Resistance: Combining Nanopartides With Antibiotics And Other Antimicrobial Agents", EXPERT REVIEW OF ANTI-INFECTIVE THERAPY, FUTURE DRUGS, LONDON, GB, vol. 9, no. 11, 1 November 2011 (2011-11-01), pages 1035-1052

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Novelty (Art 33(2) PCT)

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-4, 13, 15-16, 19 and 21 is not new in the sense of Article 33(2) PCT.

Document D1, cited in the application as MX339086, discloses the same titanium dioxide nanomaterial with herbal or fruit extracts adsorbed thereon. D1 mentions the antimicrobial effect of said nanoparticulate product to inactivate virus and kill bacteria, mycobacteria, mycoplasma, fungi, protozoa and spores ([0009]). The particulate is formulated with water and other materials for use in cleaning, disinfection, antiseptic and healing products in an amount which is 0.0001 and 40% ([0056]).

The disclosure of D1 is thus relevant to the novelty of the subject-matter of claims 1-3, 13, 16, 19, 21.

Document D2 discloses titanium dioxide nanoparticles which are functionalized with noble metals and prepared in water. They are used for preserving fruit (post-harvest) (abstract). Document D2 is relevant for the novelty of claims 1 and 4.

Document D3 discloses titanium dioxide nanoparticles which are functionalized with gold particles: its antimicrobial effect against *salmonella enterica* is shown in the examples. Its application as aqueous solution is disclosed (page 13, I. 18-20) and its use to combat various microorganisms for diverse sterilization methods including the field of food or medical safety is disclosed (page 14-17). Document D3 is relevant for the novelty of claims 1-2, 13, 15-16.

Document D4 discloses coping with antibiotic resistance by combining titanium dioxide nanoparticles with antibiotics and other antimicrobial agents; the effect against methicillin resistant *S. aureus* in vitro is disclosed (page 1041-1042). Specific uses are not mentioned in D4.

Inventive step (Art. 33(3) PCT)

The gist of the invention is the use of titanium dioxide modified with functional organic groups, inorganic radicals and fruit and/or herbal extracts adsorbed on its surface as antimicrobial.

For the subject-matter of the present claims which might be seen as novel, the following applies: the use of titanium dioxide nanoparticulate in combination with active ingredient for combating virus and kill bacteria, mycobacteria, mycoplasma, fungi, protozoa, spores is known in the art as explained above (D1-D4). The application of functionalized nanoparticles or of titanium dioxide nanoparticles as such in various fields eg. in the food, cosmetic, or medical fields is well known. The specific application in certain formulations or amounts, or in specific technical fields is considered obvious because the effect on the pathogens is known and the skilled person would merely apply a known antimicrobial product wherein pathogens are or might be present.

An inventive step in the meaning of Art. 33(3) PCT cannot be acknowledged.

Industrial applicability

The use of the present nanoparticulate compound by administering it to humans or animals as of claims 19 and 24 relates to methods of treatment of human/animal body, considered by this Authority to be covered by the provisions of Rule 39.1(iv) / 67 PCT. Consequently, an opinion in respect to the industrial applicability of said claims is not established in the present Search Report.

Re Item VIII

Certain observations on the international application

Lack of disclosure (Art 5 PCT)

The present claims refer to the use of the titanium dioxide nanoparticles in various amounts in the most diverse fields: as water disinfectant (claim 2-3), bio-pesticide and post-harvest (pesticide) in agriculture (claims 4-12), as a preservative for hygienic, cosmetic, food products (13-16), as an inductor or activator of tissue regeneration (17-18), as a pharmaceutical systemic medicament for treating infections caused by different pathogens (claim 19-20), as microbial agent (presumably antimicrobial was meant; claim 21), as antineoplastic (claims 22-23) and in cattle and aquaculture industries by mixing the nanoparticles with the food for treating the animals.

The present claims refer to the use of titanium dioxide on which different compounds (organic or inorganic) might be adsorbed for the various purposes. The claims and the application do not refer to any of those compounds, but merely indicates the purpose for which the compositions should be used. The description presents tables and examples. However, the exact composition of the functionalized titanium dioxide is not disclosed. The only description thereof appears on page 9, l. 9-14 and makes reference to a product described in patent MX339086. In this respect, the applicant is reminded that the patent specification should be self-contained.

Of the entire application, only these lines of page 9 refer that "the fruit and/or herbal extracts are selected from the group comprising grapefruit, lemon, tangerine, among other citrus fruits". No other technical details are disclosed regarding the functionalized titanium dioxide nanoparticulate.

The skilled person has no idea how to carry out the current invention and could only do so by carrying out a research program in order to find out which compound, among all possible organic groups, inorganic radicals and fruit and/or herbal extracts, 1) adsorb on the titanium dioxide nanoparticles and 2) have the wished effect for the different applications in the diverse technical fields.

Even if it could be speculated that citrus extracts are adsorbed on the titanium dioxide nanoparticles, it is hardly credible that this undefined extracts would actually have the desired effects when used in the several technical fields mentioned above (no definition whatsoever of what the citrus extracts should contain is present in the present application or in the references therein).

The current set of claims merely amount to an invitation to the skilled person to carry out a research program. Consequently, the application is not considered to fulfill the requirements of Art. 5 PCT.

Clarity (Art. 6 PCT)

Present claim 1 refers to the use of functionalized nanoparticulate titanium dioxide to produce liquid aqueous compositions. The claim further specifies that those composition possess microbial application (antimicrobial is supposedly meant) and can be used in various fields. The claim is not directed to the use of the composition as antimicrobial, as it would appear to be the scope of the invention and as reflected in claims 2-24. Consequently the claim is unclear.

In claims 2, 8-10, 14, 18, 20-21 and 23 a % is indicated as for the amounts to be used, but it is not specified what kind of % it is.

Remark on unity of the invention

The applicant attention is drawn to the fact that this Authority considers that the application does not meet the requirements of unity of invention as required by Rule 13.1 PCT.

Document D1 discloses the same functionalized nanoparticulate titanium dioxide of the present application and its use in cleaning, disinfection, antiseptic and healing products.

Therefore the general linking concept among the uses of claim 1, the functionalized nanoparticulate titanium dioxide, is not new.

The uses as of present claim 1 are not linked by common or corresponding special technical features, therefore claim 1 defines at least 8 different inventions not linked by a single general inventive concept:

the use of functionalized nanoparticulate titanium dioxide as: 1) water disinfectant, 2) bio-pesticide and post-harvest (pesticide) and in agriculture, 3) preservative for hygienic, cosmetic, food products, 4) inductor or activator of tissue regeneration, 5) pharmaceutical systemic medicament for treating infections caused by different pathogens, 6) microbial agent, 7) antineoplastic, 8) in cattle and aquaculture industries.

For reasons of efficiency, an objection for lack of unity was not raised at this stage, but could be possibly raised at a later stage, i.e. upon entry in the regional phase.