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## Standing Committee on the Law of Patents

**Twenty-First Session**  
**Geneva, November 3 to 7, 2014**

### FEASIBILITY STUDY ON THE DISCLOSURE OF INTERNATIONAL NONPROPRIETARY NAMES (INN) IN PATENT APPLICATIONS AND/OR PATENTS

*Document prepared by the Secretariat*

#### INTRODUCTION

1. At its twentieth session held from January 27 to 31, 2014 in Geneva, the Standing Committee on the Law of Patents (SCP) agreed that the Secretariat, in collaboration, to the extent possible, with the World Trade Organization (WTO) and the World Health Organization (WHO), would carry out a feasibility study on the disclosure of International Nonproprietary Names (INN) in patent applications and/or patents.
2. Pursuant to the above decision, this document contains the above feasibility study for the Committee's discussions at its twenty-first session to be held in Geneva from November 3 to 7, 2014. It is understood that the study is confined to fact-finding, providing a full explanation of the context and identifying and exploring the possibilities in the study, without engaging in evaluations and recommendations (see paragraph 175 of document SCP/20/13 Prov. 2). In preparing this study, the Secretariat provided the WHO and WTO with the opportunity to comment on a draft version, and consulted the WHO, in particular the WHO INN Programme, with respect to the functioning of the INN system.
3. In order to discuss feasibility of the disclosure of INN in patent applications and patents in the context, this document first describes general information about INN and the particularity of searching pharmaceutical substances disclosed in patent documents. It then explains the background of the topic, identifies issues surrounding the topic, explores the current and future possibilities of patent search for medicines and concludes with its provisional findings.

## INTERNATIONAL NONPROPRIETARY NAMES (INN)

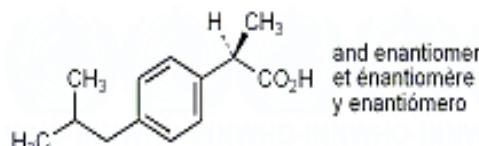
### What are INN?

4. An International Nonproprietary Name (INN), also known as a generic name, identifies a pharmaceutical substance or an active pharmaceutical ingredient.<sup>1</sup> It is a unique, globally recognized name that is in the public domain. Ibuprofen, paracetamol and ritonavir are some examples of INN. The aim of the INN system is to provide health professionals with a unique and universally available designated name to identify each pharmaceutical substance. As an international nomenclature for pharmaceutical substances, INN are intended for use in pharmacopeias, labelling, product information, advertising and other promotional material, drug regulation and scientific literature as well as a basis for product names, for example, for generics. The cumulative list of INN now stands at around 8,600 names, with 120 to 150 new INN selected every year.

Figure 1: Example of INN: ibuprofen

#### **ibuprofen**

Latin: ibuprofenum  
French: ibuprofène  
Spanish: ibuprofeno  
Russian: ибупрофен  
Arabic: إيبوبروفان  
Chinese: 布洛芬



Molecular formula: C<sub>13</sub>H<sub>18</sub>O<sub>2</sub>

5. The selection of INN and their publication are administered by the WHO INN Programme.<sup>2</sup> As the name “nonproprietary” suggests, INN can be used without any restriction to identify pharmaceutical substances. As unique names, INN have to be distinctive in sound and spelling, and should not be liable to confusion with other names in common use.<sup>3</sup>

6. Usually, an INN consists of a random, fantasy prefix and a common “stem”<sup>4</sup>. One of the important features of the INN system is that the names of pharmacologically-related substances demonstrate their relationship by using a common stem. By using common stems, medical practitioners, pharmacists, or any other person dealing with pharmaceuticals can recognize that the substance belongs to a group of substances having similar pharmacological activity. For example, a suffix “-ac” indicates anti-inflammatory ibufenac derivatives, and a common stem for monoclonal antibodies is “-mab”, placed as a suffix.

7. In principle, INN are selected only for single, well-defined substances that can be unequivocally characterized and defined. It is the policy of the INN Programme not to select

<sup>1</sup> Guidelines on the Use of International Nonproprietary Names (INN) for Pharmaceutical Substances (WHO/PHAM S/NOM 1570), p. 1. Unless expressly stated otherwise, the description in this Section regarding the INN is based on the information available on the WHO website at: <http://www.who.int/medicines/services/inn/en/>.

<sup>2</sup> The INN system as it exists today was initiated in 1950 by a World Health Assembly (WHA) Resolution (WHA3.11).

<sup>3</sup> If a trademark including an INN is found to be descriptive, trademark protection would be denied. Further, a trademark application may be refused if the sign including an INN is deceptive. For the relationship between the INN and trademarks, see documents for the Standing Committee on Trademarks, Industrial Designs and Geographical Indications (SCT), in particular, documents SCT/3/7 and SCT/16/3 and Promoting Access to medical technologies and Innovation (WHO, WIPO and WTO), p. 68 and 69.

<sup>4</sup> See “The use of stems in the selection of International Nonproprietary Names (INN) for pharmaceutical substances (Stem Book 2013) [[http://www.who.int/medicines/services/inn/StemBook\\_2013\\_Final.pdf?ua=1](http://www.who.int/medicines/services/inn/StemBook_2013_Final.pdf?ua=1)].

names for mixtures of substances. INN are selected both for chemical and biological pharmaceutical substances. INN requests for biologicals have been increasing, and currently comprise more than 40% of the requests.<sup>5</sup>

#### Modified INN (INNM)<sup>6</sup>

8. INN are usually designated for the active part of the molecule, which is usually the base, acid or alcohol. In some cases, however, the active molecules need to be expanded for various reasons, such as formulation purposes, bioavailability or absorption rate. When an INN represents an acid, for example, designation for a salt or an ester may be needed. In such cases, under the INN system, names for different salts and esters of the same active substance should differ only with regard to the inactive moiety of the molecule, and it is left to users to devise their names from the INN in conformity with normal chemical practice. The same approach is followed in the case of combination products. For example, oxacillin and ibufenac are INN and their salts are named oxacillin sodium and ibufenac sodium, respectively. The latter are called modified INN (INNM).

9. Some of the radicals and groups involved are, however, of such complexity that shorter nonproprietary names (for example, mesilate for methanesulfonate) are selected for those inactive moieties, and published by the WHO.<sup>7</sup> If such selected names for radicals and groups are used in conjunction with an INN, it is also called an INNM. For example, mepyramine maleate is used for a salt of mepyramine with maleic acid.

#### Selection of INN

10. The INN are selected by the WHO on the advice of the INN Expert Group, which is part of the WHO Expert Advisory Panel on the International Pharmacopeia and Pharmaceutical Preparations.<sup>8</sup> The selection process may be categorized essentially into the three following steps.

#### *Submission of a request form*

11. A request form for an INN is submitted to the WHO Secretariat.<sup>9</sup> An applicant may make six suggestions for an INN relating to active moiety. In the form, the applicant is requested to provide information relating to the relevant chemical substance, for example: (i) a chemical name in accordance with the nomenclature rules of the International Union of Pure and Applied Chemistry (IUPAC) or a description, or an amino acid sequence in case of biologicals; (ii) a graphic formula; (iii) a molecular formula; and (iv) a Chemical Abstracts Service (CAS) registry number.

12. The development of a drug should progress up to the point of clinical trials before a request is submitted to the INN Secretariat. This is because if a drug enters clinical trials, there is a reasonable expectation that it will be marketed and thus the name selected will be used in the market.

<sup>5</sup> The INN Expert Group has revised the nomenclature scheme for monoclonal antibodies, selected the scheme for gene therapy products and a cell therapy nomenclature scheme. Moreover, an INN proposal for a Biological Qualifier for biological substances has been proposed and is under public consultation.

<sup>6</sup> [http://www.who.int/entity/medicines/services/inn/INNMReview%20paperWkDoc167\\_Feb06\\_3\\_.pdf](http://www.who.int/entity/medicines/services/inn/INNMReview%20paperWkDoc167_Feb06_3_.pdf).

<sup>7</sup> Names for Radicals, Groups & Others: Comprehensive List 2012 (WHO/EMP/QSM/2012.2) [[http://www.who.int/entity/medicines/services/inn/Radical\\_Book\\_2012.pdf](http://www.who.int/entity/medicines/services/inn/Radical_Book_2012.pdf)].

<sup>8</sup> More recently, the INN Advisory Group on Biologicals has been established to advise the INN Expert Group on the selection of INN for biological medicinal substances.

<sup>9</sup> In countries with national nomenclature commissions, applications for INN should be made via the national authorities. In other countries, requests for INN may be forwarded directly to the WHO.

13. Precautions are taken to ensure the confidentiality of the material submitted to the WHO. However, the Guidelines on the Use of INN for Pharmaceutical Substances<sup>10</sup>, published by the WHO (hereinafter referred to as the “INN Guidelines”), stipulate that an applicant should not attempt to obtain an INN before all patent procedures are completed and until full chemical information can be made available to the WHO.<sup>11</sup> Sometimes, before an INN is selected, a new compound may have acquired a trivial name used in the laboratory and scientific literature. The fact that a trivial name has become accepted in the literature will not ensure its adoption as an INN, and may cause confusion when an official nonproprietary name is selected. The INN Guidelines therefore recommend applicants use codes before the publication of a recommended INN.<sup>12</sup>

#### *Review of application and publication for comments*

14. The WHO Secretariat examines the suggested names for conformity with the nomenclature rules and general principles, for similarities with published INN and potential conflicts with existing names. The result of the examination is forwarded to the INN experts for comments. The INN Expert Group agrees upon one name, and the applicant will be informed of the selected name.

15. The selected name (proposed INN) is then published in the publication entitled “WHO Drug Information”.<sup>13</sup> The proposed INN (in Latin, English, French and Spanish) is published together with its chemical name or description, action and use<sup>14</sup>, molecular formula, CAS registry number and graphic formula. Any objection or comment to the published name may be raised during a four-month objection period starting from the publication.

#### *Publication of recommended INN*

16. Where no objection has been filed or all objections previously filed have been withdrawn, the name is selected by the WHO as a recommended INN, which will be published in the “WHO Drug Information”.<sup>15</sup> The recommended INN (in Latin, English, French and Spanish) is published together with its chemical name or description, molecular formula and graphic formula. A corresponding CAS registry number is sometimes included in the publication of recommended INN.

#### INN Database

17. All proposed and recommended INN are searchable on-line on the WHO’s website, WHO MedNet.<sup>16</sup> It provides: (i) the Latin INN name and its equivalent in Arabic, Chinese, English, French, Spanish and Russian; (ii) national names (if any); (iii) ATC codes<sup>17</sup>; (iv) basic

<sup>10</sup> Guidelines on the Use of International Nonproprietary Names (INN) for Pharmaceutical Substances (WHO/PHAM S/NOM 1570).

<sup>11</sup> *Ibid*, p. 9.

<sup>12</sup> *Ibid*, p. 10.

<sup>13</sup> See, for example, WHO Drug Information, Vol.27, No.2, 2013.

<sup>14</sup> The statements indicating action and use are based largely on information supplied by the manufacturer. This information is merely meant to provide an indication of the potential use of new substances at the time they are accorded a Proposed INN. WHO is in a position to neither uphold these statements nor comment on the efficacy of the action claimed. Because of their provisional nature, these descriptors will neither be revised nor included in the Cumulative Lists of INN.

<sup>15</sup> See, for example, WHO Drug Information, Vol.28, No.1, 2014.

<sup>16</sup> MedNet INN Services, <https://mednet-communities.net/inn>. Currently, more than 14,000 users are members of this Community.

<sup>17</sup> Under the Anatomical Therapeutic Chemical (ATC) Classification System, each active pharmaceutical substance is given an ATC code according to the organ or system on which it acts and to its therapeutic,

chemical information (graphic formula and molecular formula); and (v) hyperlinks to the corresponding publications of proposed and recommended INN. Further, the INN Status query allows for tracking the status of INN within the INN process. In addition, the INN Global Data Hub, a software system designed to support interoperable machine-to-machine interaction over the network, has an interface described in a machine-processable format. Other systems interact with the INN Web service allowing transparent integration on external web sites and applications (e.g., Office for Harmonization in the Internal Market (OHIM) in Alicante). The Cumulative List, which contains all published INN in Arabic, Chinese, English, French, Latin, Russian and Spanish, is published in a CD-ROM format every two years.

## SEARCHING PHARMACEUTICAL SUBSTANCES DISCLOSED IN PATENT APPLICATIONS AND PATENTS

18. While a patent search in each technological field requires particular knowledge and know-how, one of the particularities in searching for a chemical substance is that it can be described in different ways in patent applications and patents: in general, by its names and by its chemical structure. A chemical substance, particularly a pharmaceutical substance, may have more than one name officially accepted or commonly used by experts in the relevant field. Therefore, in order to conduct a thorough patent search related to pharmaceutical substances, researchers often use various technical search parameters, and a number of specialized database services have been developed for this technical field.<sup>18</sup>

19. Typically, various types of search parameters, such as those described in Table 1, may be used in searching patent documents related to pharmaceutical substances. In the absence of a global, unique indication for chemical compounds, they are often used in combination for a pharmaceutical patent search, i.e., a structure search and a keyword search by its various names, CAS registry number, pharmaceutical use etc., together with patent classification codes. Searching patents by a name or a registry number only is often not sufficient to identify all the relevant patent documents, particularly where the compound is disclosed in Markush structures.<sup>19</sup> According to the patent search history related to a patent landscape report on Ritonavir, a chemical structure search uncovered 119 records that were not included in 841 records identified by a text-based search using the terms Ritonavir and its commonly used synonyms (which include the brand name, INN, manufacture name, CAS number and molecular formula).<sup>20</sup>

20. The choice of search parameters and strategies differ depending on the purpose of a patent search and the types of information sought. Different search needs may arise where, for example, a patent search is to be performed on a marketed medicine or on a substance which is still a drug candidate. Examples of various purposes for conducting a pharmaceutical patent search include:

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[Footnote continued from previous page]

pharmacological and chemical properties. It is administered by the WHO Collaborating Centre for Drug Statistics Methodology (WHOCC). See [http://www.whocc.no/atc/structure\\_and\\_principles/](http://www.whocc.no/atc/structure_and_principles/).

<sup>18</sup> Chemistry and Pharmaceuticals Searching Best Practices,

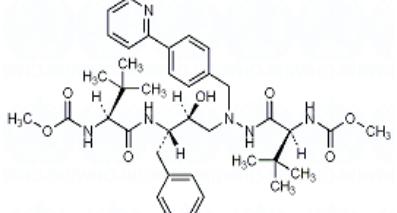
[http://www.intellogist.com/wiki/Chemistry\\_and\\_Pharmaceuticals\\_Searching\\_Best\\_Practices](http://www.intellogist.com/wiki/Chemistry_and_Pharmaceuticals_Searching_Best_Practices).

<sup>19</sup> Patent Landscape Report on Ritonavir, WIPO, 2011, p. 12.

<sup>20</sup> *Idem*. See also Hazel V J Moir and Luigi Palombi, Patents and Trademarks: empirical evidence on “evergreening” from Australia, p.5, Fourth Asia-Pacific Innovation Conference, National Taiwan University, College of Law, December 6-7, 2013, which shows that, with respect to searching patents relating to five particular medicines, a patent search conducted by an experienced patent attorney was more reliable than the search based on the INN only.

- a patent examiner may conduct a prior art search to identify publications relevant to the assessment of novelty and inventive step of the claimed invention under consideration;
- a scientific researcher may search patent documents to seek solutions that can be applied to his/her research problem;
- a patent search may be conducted in the context of procurement of medicines to assess whether patents have been applied for and granted with respect to that medicine in a certain jurisdiction. In that case, a searcher may be interested in identifying patent applications and patents, the claims of which may cover the already commercialized medicine;
- a generic company, a competitor company or other third parties may search patent applications and patents to assess their business opportunities in different jurisdictions and if necessary, challenge the validity of a patent.

Table 1: Examples of search parameters for pharmaceutical substances

Parameters	Examples	Explanation
Manufacturer name	BMS-232632	During the R&D stage, a substance is identified by a code (a combination of alphabets and numbers) in the laboratory or in publications.
INN (generic name)	atazanavir	A unique and universally available designated name to identify each pharmaceutical substance.
Brand name	Reyataz®	Once a drug receives marketing approval, it is sold with a proprietary name registered for trademark protection.
IUPAC chemical name	methyl N-[(1S)-1-[(2S,3S)-3-hydroxy-4-[(2S)-2-[(methoxycarbonyl)amino]-3,3-dimethyl-N'-{[4-(pyridin-2-yl)phenyl]methyl}butanehydrazido]-1-phenylbutan-2-yl]carbamoyl]-2,2-dimethylpropyl]carbamate	The International Union of Pure and Applied Chemistry (IUPAC) sets standards for the naming of the chemical elements and compounds in a structured manner.
CAS Registry Number	198904-31-3	Upon publication of chemical literatures and patents, the Chemical Abstracts Service (CAS) assigns a unique numeric identifier for a newly published compound. <sup>21</sup>
International Patent Classification (IPC) code	A61P 31/18	Although the IPC codes do not pin point a particular substance, it is used with other search parameters to narrow down a search result.
Molecular formula	C <sub>38</sub> H <sub>52</sub> N <sub>6</sub> O <sub>7</sub>	A chemical formula that shows the number and kinds of atoms in a molecule.
Chemical structure (graphic formula)		Several commercial services offer patent search databases that allow searching compounds by chemical structure in addition to keywords (names) and classification codes. They use various indexing rules so that searchers can also search chemical compounds described in a Markush structure.

<sup>21</sup> While there are other organizations that assign identifiers to chemical compounds, the CAS Registry Number is one of the most widely used codes by experts in the field of chemistry.

## DISCLOSURE OF INN IN PATENT DOCUMENTS – BACKGROUND

21. At this point in time, no national/regional patent law requires the identification of pharmaceutical substances by INN, where applicable, in patent applications and patents. In general, national/regional patent laws require an applicant to disclose the invention in a manner sufficiently clear and complete for the invention to be carried out by a person skilled in the art, and that the claims be clear and concise.<sup>22</sup>

22. Often, secondary legislation, such as regulations and administrative guidelines, provide further detailed requirements and guidance regarding the description of an invention in a patent application. With respect to the Patent Cooperation Treaty (PCT), for example, PCT Rule 10.1(d) states that “[...] for chemical formulae, the symbols, atomic weights, and molecular formulae, in general use, shall be employed”. PCT Rule 10.1(e) indicates that “[i]n general, only such technical terms, signs and symbols should be used as are generally accepted in the art”. Further, in the PCT International Search and Preliminary Examination Guidelines, paragraph 4.24 states that “chemical and mathematical symbols, atomic weights and molecular formulae should be those in general use [...]. In particular, if there are any agreed international standards in the art in question, these should be adopted wherever practicable”. Therefore, in order to meet the above legal requirements under the PCT, an applicant can use, wherever practicable, any international standards to identify a pharmaceutical substance, if they are generally used by a person skilled in the art.

23. While generally the supplier of procured medicines is responsible for ensuring that all necessary rights to products, including IPRs, have been secured in accordance with the specifications in tender documents and procurement contracts, procurement agencies have to consider the patent status of products early in the procurement process.<sup>23</sup> Unlike IP professionals, they often do not have access to commercial patent databases specialized for chemistry and pharmaceuticals search, and thus conduct patent search on publicly available, free sources. As health specialists, they are familiar with INN, and some consider it problematic that a list of patents relating to a particular pharmaceutical product cannot be obtained by a patent search using the corresponding INN as a keyword without employing patent classifications or conducting chemical structure (or chemical name) search.<sup>24</sup>

24. In 2007, the Indian Pharmaceutical Alliance suggested that the Indian government require applicants to indicate INN in the title of the invention within 30 days from the allocation of the INN.<sup>25</sup> It was explained that while a patent database available on the website free of charge provided the title of invention and information about inventors, any further information, such as abstracts and specifications, was at that time not searchable on-line and could be accessible only by payment.<sup>26</sup> Since a chemical formula as the title of an invention could be considered too vague or too technically complex, the mandatory use of INN in the title was suggested in order to ensure the public-notice function (e.g., for pre-grant opposition) and a better understanding of the inventions contained in patent applications.

<sup>22</sup> See also Articles 5 and 6 of the PCT and Article 29 of the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS Agreement).

<sup>23</sup> Promoting Access to Medical Technologies and Innovation (WHO, WIPO and WTO), p.162.

<sup>24</sup> How to conduct patent search for medicines: a step-by-step guide, World Health Organization, 2010. See also a comment by the *Médecins sans frontières* on the Revised Guidelines for Examination of Patent Applications in the Field of Pharmaceuticals, submitted to the Controller General of Patents, Designs and Trademarks, Ministry of Commerce and Industry, India.

([http://www.ipindia.nic.in/ponew/comments\\_Pharmaguidelines/FeedBack\\_Pharmaceuticals.htm](http://www.ipindia.nic.in/ponew/comments_Pharmaguidelines/FeedBack_Pharmaceuticals.htm)).

<sup>25</sup> Bhuma Shrivastava, Leave formula in lab is activists' prescription for drug companies

(<http://www.livemint.com/Politics/t1Aygh3QbdnYVCjO6MpYOK/Leave-formula-in-lab-is-activists8217-prescription-for-dr.html>).

<sup>26</sup> This is no longer the case in India, since published patent applications and patents are searchable on the website of the Indian Patent Office at: <http://ipindiaservices.gov.in/patentsearch/search/index.aspx>.

25. Since then, similar proposals have been published elsewhere: (i) mandatory disclosure of INN in patent applications at the time of filing if the INN is available or at a later stage immediately upon the allocation of the INN<sup>27, 28</sup>; (ii) mandatory inclusion of a reference to the relevant INN in the first sentence of the abstract upon filing or if not, mandatory notification of the relevant INN to the patent office once it is known<sup>29</sup>; and (iii) mandatory disclosure of INN in the title and abstract at the time of filing, if known.<sup>30</sup> The offered justifications are to improve the identification of patents relevant to a medicine for the purposes of prior art search, to analyze the implications of patents on access to medicines in developing countries, and to increase the transparency of the patent system.

26. More recently, the Controller General of Patents, Designs & Trademarks of India published, for public comments, draft Guidelines for Examination of Patent Applications in the Field of Pharmaceuticals, the latest draft of which was published on August 12, 2014 (Revised Draft Guidelines).<sup>31</sup> With a view to conducting comprehensive prior art search, paragraphs 5.3 of the Revised Draft Guidelines states that the claims of the pharmaceutical compounds often involve derivatives of known compounds having established pharmaceutical activities, and such pharmaceutical substances have already been assigned INN. They add that when the patent specification under examination discloses such INN, the examiner should search the prior art on the basis of such INN as well. Paragraph 5.4 stipulates that in case it is found that the applicant claims a second use/indication in the form of a product claim of an already known pharmaceutical compound/new form of a known substance or compound, the examiner should follow the same methodology and ask the applicant to inform the INN of the said pharmaceutical substance. If the applicant does not inform the INN even on the request, the examiner should try to find out the INN and use the same in the search strategy. The comments made by stakeholders on paragraphs 5.3 and 5.4 above are mixed.<sup>32</sup> Some consider that INN is an important parameter for prior art search, while others disagree. Some were of the view that informing INN is too burdensome for applicants, while some others believe that the burden of identifying an INN should be on the applicants rather than on the examiners, and that in cases where the INN is already attributed by the WHO, there would be no cost or burden on the applicants.

## TIMEFRAMES OF PHARMACEUTICAL INNOVATION, INN PROCEDURES AND PATENTING PROCEDURES

27. In considering the feasibility of disclosure of INN in patent applications and patents, it is worth noting, in the first place, the timeframes of pharmaceutical innovation, INN procedures and patenting procedures. While it may differ from one medicine to another, in general, drug discovery and testing takes three to six years and clinical trials take six to seven years.<sup>33</sup> An INN usually is requested by an applicant after the beginning of the clinical trial stage of drug development. On average, the time period between the filing of an INN request and the

<sup>27</sup> Sudip Chaudhuri, Chan Park and K.M. Gopakumar, Five Years into the Product Patent Regime: India's Response, p. 120, UNDP, 2010.

<sup>28</sup> East African Community Policy Guide, Regional IP Policy on the Utilisation of Public Health-Related WTO-TRIPS Flexibilities and the Approximation of National IP Legislation, p.17, 2013.

<sup>29</sup> Model Provisions to Promote Access to Affordable Medicines in the Industrial Property Bill 2009 (Uganda), p.14, Center for Health Human Rights and Development (CeHURD) and UNDP Uganda, 2012.

<sup>30</sup> Carlos Correa, Pharmaceutical Innovation, Incremental Patenting and Compulsory Licensing, p. 23, South Centre, 2011.

<sup>31</sup> Revised Draft Guidelines for Examination of Patent Applications in the Field of Pharmaceuticals, p. 9, August 12, 2014 ([http://www.ipindia.nic.in/iponew/draft\\_Pharma\\_Guidelines\\_12August2014.pdf](http://www.ipindia.nic.in/iponew/draft_Pharma_Guidelines_12August2014.pdf)).

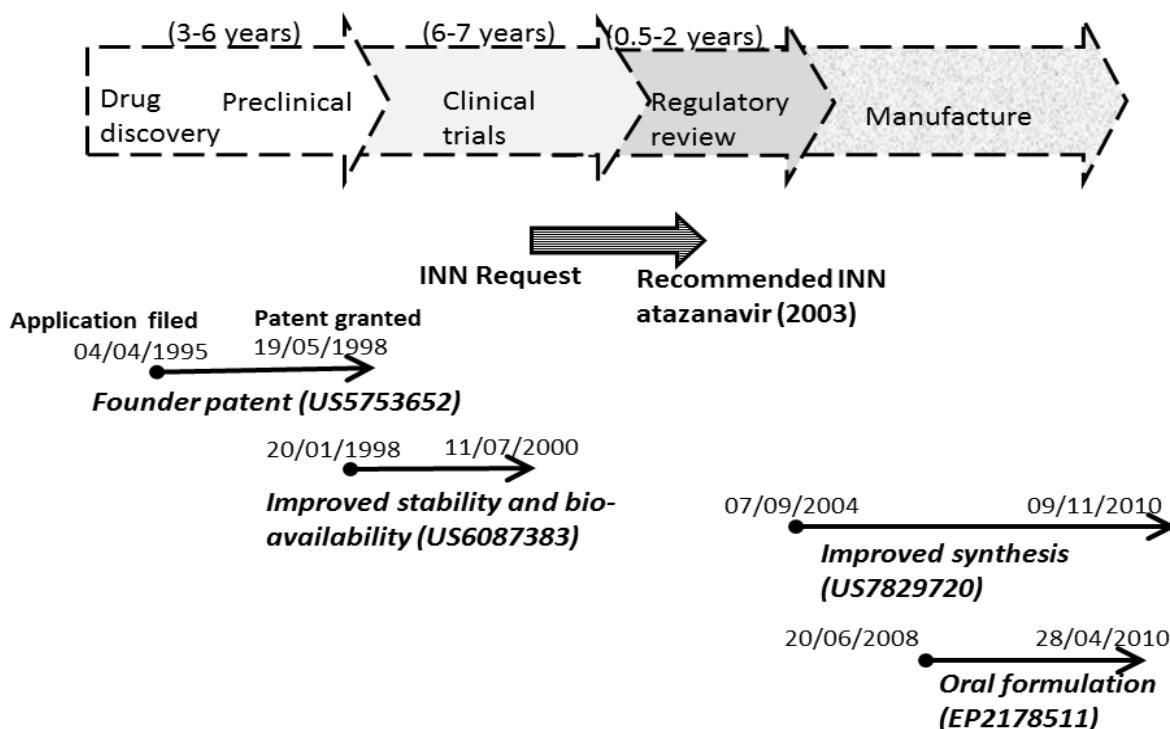
<sup>32</sup> [http://www.ipindia.nic.in/iponew/comments\\_PharmaGuidelines/FeedBack\\_Pharmaceuticals.htm](http://www.ipindia.nic.in/iponew/comments_PharmaGuidelines/FeedBack_Pharmaceuticals.htm).

<sup>33</sup> "Drug Discovery and Development – Understanding the R&D Process" ([http://www.innovation.org/drug\\_discovery/objects/pdf/RD\\_Brochure.pdf](http://www.innovation.org/drug_discovery/objects/pdf/RD_Brochure.pdf)).

publication of a Recommended INN is approximately 15 months. In contrast, a patent application is filed at the earlier R&D stage immediately after the discovery of a compound or derivative that may have medical application.<sup>34</sup> According to data available from a limited number of patent offices<sup>35</sup>, 80% of all granted patents were issued within approximately four to seven years from the filing date of a patent application, although this varies significantly from one country, and one application, to another. The differences indicated above between the timeframes show that an initial patent application on a pharmaceutical compound (often described in a Markush structure), as well as further patent applications that follow development towards the clinical trial (for example, process improvement or inventions that substitute various sites on the backbone of the Markush structure) may have been already filed, and in many cases, even finished the patenting process before the publication of a corresponding Recommended INN.

28. Innovation and patenting activities also continue throughout the later stages of drug development, clinical trials and beyond. For example, patent applications claiming improvement of a manufacturing process of a known pharmaceutical compound, a substance formed by another salt or ester of a known active moiety, a combination of a known active pharmaceutical ingredient and another substance or a second medical use of a known pharmaceutical substance, may be filed after the publication of the relevant recommended INN.

Figure 2: Timeframes of the INN procedures and the patenting procedures (atazanavir)



29. Figure 2 shows an example of the timeframes of the INN procedures and the patenting procedures, using data from the Patent Landscape Report on Atazanavir. The dotted arrows showing different phases of medicine development are indicated for the mere reference purpose. The initial patent application that disclosed the substance corresponding to atazanavir was filed

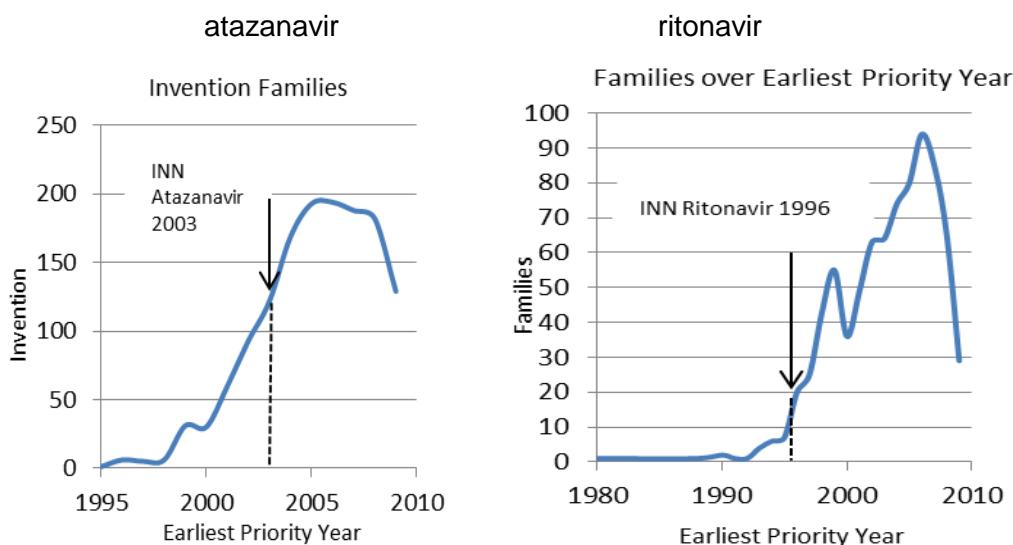
<sup>34</sup> Due to the incremental nature of pharmaceutical innovation, even the discovery of a new compound is often triggered by earlier work.

<sup>35</sup> World Intellectual Property Indicators 2013, Figure A.9.2, WIPO.

in 1995, and a patent was granted on May 19, 1998 in the United States of America, prior to the publication of the recommended INN, atazanavir, in 2003. A number of patent applications have been filed since the initial patent application, for example, applications concerning improved stability and bio-availability, combination with other HIV protease inhibitors, improved synthesis and oral formulation, building on the innovation in relation to atazanavir by the originator of the compound and other entities. With respect to patent applications filed before the publication of the corresponding INN, it is impossible to indicate, at the time of filing, the corresponding INN in the patent applications. However, for patent applications filed after the publication of the corresponding INN, if the INN is known to the applicants, it is possible to indicate, at the time of filing, the corresponding INN.

30. Further, Figure 3 indicates patenting activities relating to atazanavir and ritonavir over time with the number of patent families relating to those substances by their earliest priority year.<sup>36</sup> The Recommended INN atazanavir was published in 2003, and ritonavir in 1996. While these limited examples cannot be considered as conclusive evidence, it shows that the peak of the number of patent families filed per priority year appears after the publication of the relevant INN.<sup>37</sup>

Figure 3: Patenting activities of atazanavir and ritonavir



Source: WIPO Patent Landscape Report on Atazanavir, WIPO Patent Landscape on Ritonavir

31. The different timeframes of the INN procedures and patenting procedures also indicate that, where a patent application was filed before the corresponding INN becomes available, even if the INN is disclosed in the patent application/patent once the INN is published, that application/patent is not always retrievable through an INN keyword search if the search is conducted before the INN publication. For example, if substantive examination on a patent application takes place before the publication of the corresponding INN, a patent examiner is not able to search prior patent documents with an INN keyword (or obtain information on the corresponding INN from the applicant) even if those prior patent documents disclose the relevant pharmaceutical substance and are relevant for the examiner's assessment of novelty and inventive step. A similar limitation applies to scientific researchers and any third party who conducts a prior art search on a pharmaceutical substance before the allocation of its INN. However, if a patent searcher is interested in patent documents containing marketed active

<sup>36</sup> WIPO Patent Landscape Report on Atazanavir and WIPO Patent Landscape Report on Ritonavir.

<sup>37</sup> The Patent Landscape Report on Atazanavir clarifies that the data after 2008 is incomplete because of publication lag.

pharmaceutical substances, normally the patent search would be done after the publication of the INN. Therefore, in such a case, the time lag between the availability of patent documents and the availability of the corresponding INN would not cause a problem.

## THE NATURE AND SCOPE OF DISCLOSURE OF INN IN PATENT APPLICATIONS AND/OR PATENTS

31. Any legal requirement has to be underpinned by an objective, and each element of the legal requirement should be designed so that, as a whole, it supports that objective, taking into account various interests of the stakeholders involved. There are numerous elements that may define the nature and scope of the disclosure of the INN in patent applications and/or patents. In this Section, issues arising from the disclosure of INN in patent applications and/or patents by applicants and/or patentees are considered with regard to various elements that may define the nature and scope of the disclosure, as summarized in Table 2. The design of each element may have implications for the costs and benefits involved in the selected framework.

Table 2: The Scope and Nature of the Disclosure of the INN in Patent Applications and/or Patents

Elements that May Define Nature and Scope	Issues or Aspects to Consider Arising from the Disclosure of INN in Patent Applications and/or Patents
Timing of applications filed	<ul style="list-style-type: none"> <li>- Applications filed only after the allocation of the INN</li> <li>- Applications filed both after and before the allocation of the INN</li> </ul>
Relation between the invention contained in the application and the INN	<ul style="list-style-type: none"> <li>- The INN pharmaceutical substance is claimed</li> <li>- The INN pharmaceutical substance is not claimed, but is disclosed in the description (for example, as background art)</li> <li>- The INN pharmaceutical substance is described in a description as one of many areas in which the claimed invention can be applied</li> <li>- Other types of close or remote relationship between the INN substance and the claimed invention</li> </ul>
Part of the application in which the INN could be disclosed	<ul style="list-style-type: none"> <li>- Title</li> <li>- Abstract</li> <li>- Claims</li> <li>- Description</li> <li>- Others (ex. a box in a request form, a separate sheet)</li> </ul>
Status of applications if they are filed before the INN is available	<ul style="list-style-type: none"> <li>- All applications and patents</li> <li>- Only pending applications and patents (excluding applications no longer pending and patents no longer in force)</li> </ul>
Types of claims	<ul style="list-style-type: none"> <li>- Product claims</li> <li>- Second or subsequent medical use claims</li> <li>- Process claims</li> </ul>
Nature of the disclosure requirement	<ul style="list-style-type: none"> <li>- Mandatory disclosure</li> <li>- Voluntary disclosure</li> </ul>

### Timing of Applications Filed

32. For those applications filed after the publication of the corresponding Recommended INN, if an applicant knows the corresponding INN of the pharmaceutical substance disclosed in his/her patent application, it is at least possible for the applicant to indicate such INN. However, relevant prior patent documents filed before the publication of the corresponding INN will not be retrieved by an INN keyword search, and the completeness of search results will therefore be compromised.

32. In order for applications filed before the publication of the corresponding INN to become searchable by an INN keyword, that INN information may be “linked” to the relevant patent applications after the publication of the INN. If technically feasible, this would render a patent search using the INN keyword more comprehensive. However, it would require applicants to review all of their earlier patent applications upon the publication of the INN. In other words, applicants would have to monitor the INN process, identify the relevant applications and report them to the patent office concerned.

33. In this regard, the question arises how to collect such INN information and how to link it to the relevant already filed or already granted patent applications. One possible approach is for the applicant to submit the INN information through an amendment of his/her application. The compatibility of such amendment with the applicable national/regional law in terms of the scope of the amendment and its timing<sup>38</sup> should be considered in light of the fact that the addition of a corresponding INN would not change the substance of the patent application as filed. Another possibility of linking the INN information to earlier patent applications and granted patent would be for the applicant to submit the information in the form of a statement indicating the corresponding INN of the substance previously disclosed. The patent office could incorporate the submitted INN information into its database by indexing patent applications/patents.

### Relation between the Invention Contained in the Application and the INN

34. A pharmaceutical substance corresponding to the INN may be disclosed in a patent application in different ways. In some cases, the scope of claims covers the substance as a product claim, or a process for making or using that substance. In some other cases, the claims cover a combination of that substance and another substance, or another form of that substance. Sometimes, the pharmaceutical substance may be disclosed in the description part of the application as background art of the claimed invention consisting of another pharmaceutical substance. Yet in some other cases, the pharmaceutical substance is disclosed in the description part because it is one of many medicines to which a claimed device for drug delivery can be applied.

35. As the claimed invention and the INN substance may relate to each other differently, an INN keyword search probably needs to be supplemented by additional, case-by-case search queries using other parameters in order to obtain a result of high relevance to the purpose of the patent search. If patent applicants are to be obliged to disclose INN in their patent applications, the extent to which the corresponding INN must be disclosed needs to be explained for the sake of certainty and clarity for both applicants and patent searchers.

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<sup>38</sup> In general, national/regional patent laws provide that a patent application/patent may not be amended in such a manner that it contains subject matter that goes beyond the content of the application as filed. Further, they also provide that a patent may not be amended in such a way as to extend the scope of the patented claims. They may also provide limited timeframes during which amendments may be submitted.

### Part of the Application in which the INN could be Disclosed

36. For patent applications filed after the publication of the INN, one question may be in which part of the application the INN is to be disclosed. The above-mentioned proposals (see paragraph 25) suggest that the INN should be indicated in the title and/or abstract of the application. Although the reasons were not explicitly stated by the proponents, presumably, it may be due to the fact that at least the title of the invention and/or abstract is published in the Official Gazette in most countries, and that in some countries, information contained in the claims and description part of patent applications can be accessed only through public inspection at the patent office. On the one hand, particularly where patent information is published only on paper, it may be easier to find the relevant INN information if it is indicated in the title of the invention or in the abstract. On the other hand, if the INN information should be disclosed even if the relevant pharmaceutical substance is not claimed, describing the INN in the title of the invention or in the abstract may be inappropriate.

37. Not only developed countries but also many developing countries have been carrying out the digitization of patent documents at a rapid pace. Once patent documents become searchable in a digitized format, as long as an INN is disclosed somewhere in a patent application, it can be searchable with a keyword search regardless of the part of the application in which the information is disclosed. Consequently, it may be increasingly less important to specify the part of the application in which INN should be disclosed.

38. Another possibility to indicate the INN information may be to provide it in a box in a request form or to submit a separate sheet containing the INN information. The patent office may incorporate such information into its database.

### Status of Applications

39. In cases where patent applications are filed before the publication of the INN, one possibility is to “link” all the relevant patent applications and patents to the INN once it is published, although some of them may no longer be pending at that time. For example, earlier applications may have been withdrawn or refused prior to the allocation of the INN. Therefore, another possibility may be to provide a link to the INN keyword only where applications are pending and patents are in force. This may reduce an applicants’ work in reviewing applications filed before the publication of the INN, and it would not disturb patent searchers who are interested in only pending patent applications and patents in force. However, this approach may not be deemed sufficient by patent searchers who seek a comprehensive prior art search result.

### Types of Claims

40. A pharmaceutical substance with a given INN may be covered by, or related to, a product claim, may be a known pharmaceutical substance claiming a second or subsequent medical use of that substance, or may be related to a process claim. A process claim may be relevant to a number of pharmaceutical substances involving many INN, as it can be found for example, in a platform process for the production of one class of medicines (e.g., monoclonal antibodies). Which INN are relevant to such a process claim may not always be obvious, and if all potentially relevant INN are included in the application, it may reduce the precision of INN searches and thus compromise the retrieval of relevant documents.

### Nature of the Disclosure Requirement

41. If it is to be the applicant who discloses the corresponding INN in a patent application, the nature of the disclosure requirement may be either mandatory or voluntary. If an applicant is to

disclose a corresponding INN, a clear definition of the scope of the requirement needs to be set in order to ensure legal certainty. Amendments of national laws may be required, in order for the disclosure to have legal effect. Alternatively, a voluntary disclosure of the corresponding INN by applicants in their patent applications may be encouraged by patent offices at the practical level.

## POTENTIAL BENEFITS AND COSTS

42. Since no national/regional law requires the disclosure of INN in patent applications, any discussion on potential benefits and costs involved in the implementation of such requirement remains theoretical. Further, the design of the requirement will have an impact on the question as to which benefits and costs would be involved and who would reap the benefits and bear the costs. Nevertheless, this Section will attempt to identify, at a general level, potential benefits and costs for stakeholders if the INN is disclosed in patent applications. It was not possible to find empirical data measuring to what extent INN, if known to the applicants, have already been disclosed voluntarily in patent applications and how that disclosure affects the retrieval of information. In the absence of data, it is not possible to quantify the potential benefits and costs in this study, and therefore, they should be read as theoretical and indicative descriptions.

43. The increased searchability of patent documents concerning pharmaceutical substances through the use of an INN keyword search may potentially benefit all stakeholders. If the disclosure of INN in patent applications assists patent examiners in conducting a thorough prior art search that strengthens the validity of a patent once granted, it would generally align with the interests of applicants. If relevant INN information is linked to corresponding patent applications, one of the potential benefits is that the searchability of patents relevant to an active pharmaceutical substance on public patent databases, which are normally free of charge, might be enhanced.

44. However, in order for such benefits to be achieved by the mandatory submission of INN information by patent applicants or patentees, it must be noted that free availability of information depends on applicants and patent offices, which collect and submit information and update patent databases and records, respectively. This is particularly so in the case of patent applications filed before the publication of the corresponding INN. In that regard, one question to consider is to what extent applicants and patent attorneys are familiar with, and closely monitor, the INN process so that they can inform a patent office of the corresponding INN in a timely manner.

45. Further, different stakeholders may perceive the potential improvements that would be made by the disclosure of INN differently. Such a difference might depend on the availability of current search tools and on the purpose of any particular patent search. Patent examiners of certain patent offices who have access to specialized chemical patent search services might consider the existing search tools sufficient to conduct a wide range of prior art search. For them, if there is a means to conduct a comprehensive INN keyword search, this would complement their existing search functionalities. For the purpose of determining novelty and inventive step, patent examiners generally need to conduct a prior art search that goes beyond an INN keyword search. Similarly, scientific researchers in the field of pharmacology are probably interested in broad technical solutions that might be applied to their research challenges. Therefore, while they might consider the possibility of comprehensive patent search with an INN keyword as an extra function, in general, they seek broader technical information which may be found in either patent or non-patent literature.

46. In countries where the IP profession and private IP services are less developed, the patent office may receive queries about the patent status of a particular medicine from

stakeholders within its country as well as from international organizations. In practice, an INN keyword search could facilitate patent examiners of such patent office in searching for the patenting status of a specific medicine.

47. Generic pharmaceutical companies are primarily interested in technological contents and the patent status of successfully commercialized medicines with proven efficacy and safety. Consequently, the possibility of searching all patents relating to a particular medicine with an INN keyword may be useful to them. For generics companies that have access to specialized database platforms that allow comprehensive and sophisticated patent search, an INN keyword search could be complementary to their existing search tools.

48. Ministries of Health, procurement agencies and humanitarian organizations may be interested in knowing the patent status of medicines in order to check the validity of patents, negotiate price or license with the patent holder or to consider the possible use of compulsory licenses or governmental use. A comprehensive INN keyword search function would facilitate a search for relevant patents and their legal status without the need for specialized skills for searching pharmaceutical substances. Similarly, the possibility of a more thorough patent search for particular pharmaceutical substances through an INN keyword search may aid health policy advocates and patent landscape service providers.

49. The potential benefit of a comprehensive INN keyword search is attainable only where patent information is searchable and any relevant databases are regularly updated. In order for the information to be searchable by an INN keyword, the amendment to the patent application to include the corresponding INN, for example, has to be published by the patent office in a digitized, searchable format. Furthermore, the mere indication of INN in patent applications is not sufficient to find out, with one click, what a patent searcher is looking for. The nature and scope of INN disclosure in patent applications as well as patent search strategies applied case-by-case will affect the success of a patent search according to its objectives.

#### IMPROVING THE SEARCHABILITY OF PATENTS RELATING TO A PARTICULAR MEDICINE – POSSIBILITY OF ALTERNATIVE SOLUTIONS

50. It appears that the objective addressed by proposals for a mandatory disclosure of INN in patent applications is to improve the searchability of patents relating to a particular medicine of interest. To achieve that objective, the indication of INN “in” a patent application is not an end in itself. The critical issue may be whether and how data that corresponds to a particular pharmaceutical substance can be linked to patent documents relating to that substance. In this Section, alternative solutions to improve the searchability of patents relating to a particular medicine will be explored.

##### Patent Data in Regulatory Approval Databases

51. In view of the limitation of an INN keyword search and in the absence of a unique nomenclature for the indication of chemical compounds in patent applications, patent searchers have developed methodologies for searching patents relating to a particular medicine for addressing health policy, procurement, patent landscaping and other purposes. One of the methodologies widely used is to check regulatory approval databases in order to link a particular medicine and related patent data.<sup>39</sup> The regulatory authorities of the United States of America

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<sup>39</sup> How to conduct patent search for medicines: a step-by-step guide, World Health Organization, 2010; Patent information and transparency: A methodology for patent searches on essential medicines in developing countries, United Nations Development Programme, July 2012; Patent Landscape Report on Ritonavir, WIPO,

[Footnote continued on next page]

and Canada maintain publicly available databases of medicines that have received marketing approval, namely, the Orange Book and Health Canada Patent Register, respectively, in which information regarding relevant United States or Canadian patent numbers is also included. From the United States or Canadian patent numbers, the patent contents and their legal status information can be retrieved from the public database of the United States Patent and Trademark Office (USPTO) and the Canadian Intellectual Property Office (CIPO). Further, by obtaining information on a patent family of the United States or Canadian patent, it is possible to access information on corresponding patents in other countries.

52. The Orange Book and Health Canada Patent Registry, however, do not list all patents that relate to the approved medicines. For example, they do not cover patents regarding processes for making the approved product and intermediate compounds used during the process of making the approved active ingredient. Further, patent information regarding medicines which are not marketed in the United States of America or Canada cannot be obtained from the Orange Book or Health Canada Patent Registry, respectively.

#### Supplementary Protection Certificates (SPC)

53. In Europe, information on basic patents relating to a particular medicine may be obtained from the publicly available records of the Supplementary Protection Certificates (SPC).<sup>40</sup> Where an SPC has been applied for and registered, the IMPADOC legal status field may include the generic and/or proprietary name of the medicine concerned. Consequently, it is possible to link the generic and/or proprietary name of the medicine with a European patent number from which a patent family of the European patent can be searched. The obvious limitation of relying on the SPC data is that not all patents are eligible for SPC protection.

#### Re-classifying Patent Documents with INN

54. In view of facilitating access to patent information in the field of medicines through a dedicated customization of the patent information system in this area, under the European Commission's DG Enterprise initiative "Process on Corporate Responsibility in the Field of Pharmaceuticals", the Working Group on Patent Information conducted a pilot project that identified patent family members with respect to a compound known as the INN "sofosbuvir", and sorted them to a number of categories, such as synthesis, derivative, combination, dosage etc.<sup>41</sup>

55. The Final Report of the Working Group indicates that the pilot's outcome represents an initial patent information product in the form of a more structured parent documentation collection on sofosbuvir, while noting challenges such as the level of resources required for manual sorting and the necessity of constant updating of data. The Report also recommends a detailed evaluation of the pilot product by potential users in order to assess the feasible scope of further pilot projects.

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[Footnote continued from previous page]

October 2011; Study on the impact of intellectual property on the pharmaceutical industry of Uruguay (document CDIP/13/INF/5).

<sup>40</sup> Patent Landscape Report on Atazanavir, WIPO, November 2011.

<sup>41</sup> Process on Corporate Responsibility in the Field of Pharmaceuticals, Working Group on Patent Information, Final Report October 2013.

## Development of Software Algorithms to Match Chemical Names to a Given Compound in Patent Databases

56. Since each INN has one-to-one correspondence with a particular chemical structure, if a patent searcher has access to an appropriate database service, he/she can search patents relating to a particular medicine using its structure without relying on an INN keyword search. Such database services often charge fees since they require a high level of investment to collect and properly index numerous patent documents with machine-assisted human processing, such as indexing chemical names and structures.

57. With the development of computing technology, it appears that automatic identification, extraction and indexing of chemical data from a source (such as patent documents) with complex software algorithms is increasingly practical.<sup>42</sup> Some websites host free databases that enable users to conduct a patent search with various query variations, including chemical structure search, although their contents, coverage and functionalities remain limited.<sup>43</sup> Further development of chemical natural language engines might, in the future, substantially reduce the cost of the translation of one search query variation (for example, an INN) to other query variations (for example, a corresponding molecular name, CAS registry number and chemical structure). In other words, a query with an INN could be automatically translated into other queries that correspond to its chemical name, structure etc., and software will carry out a set of comprehensive queries. Such development might significantly contribute to a simpler and more cost efficient patent search in the fields of chemistry and pharmacology. The WIPO Secretariat will closely follow the development in this area.

## PRELIMINARY FINDINGS

58. The following points may be particularly highlighted as preliminary findings:

- (i) A chemical compound may have more than one officially accepted name or name commonly used by experts. Patent examiners and IP professionals use various search parameters to conduct a thorough search, often assisted by commercial database services that supplement free, public databases. Patent searches require technical knowledge, skills and search know-how;
- (ii) Health professionals and other stakeholders carry out patent searches to find out, for example, the existence, or non-existence, of patents relating to a marketed pharmaceutical product in the country of their interest. Such marketed pharmaceutical products often have INN designations, which are widely used by health professionals. These searchers might have no access to commercial database services, and thus rely on free, public databases for searching patents;
- (iii) The desirability of a mandatory disclosure requirement of INN in patent applications and patents by applicants and patentees has been raised by some stakeholders as a way to find out all relevant patents relating to a particular medicine with an INN keyword search in a simpler manner;

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<sup>42</sup> Debra L. Banville, Mining chemical structural information from the drug literature, *Drug Discovery Today*, Vol. 11, Nos. 1-2, 35-42, 2006 (<http://www.sciencedirect.com/science/article/pii/S1359644605036822>). The author addressed unique challenges associated with the mining of chemical names and structures and some solutions to them. See also the website of CambridgeIP [<http://www.cambridgeip.com/services/search/data/>].

<sup>43</sup> “Patent database of 15 million chemical structures goes public” (<http://blogs.nature.com/news/2013/12/patent-database-of-15-million-chemical-structures-goes-public.html>); PubChem (<http://pubchem.ncbi.nlm.nih.gov/>).

- (iv) The differences between the timeframes of a pharmaceutical innovation, INN procedures and patenting procedures indicate that it is impossible to disclose, at the time of filing, the future corresponding and yet to be published INN in patent applications filed before the publication of the Recommended INN. For patent applications filed after such publication, if the INN is known to the applicant, it is possible to indicate, at the time of filing, the corresponding INN. While a general conclusion cannot be drawn from the limited examples in this study, WIPO Patent Landscape Reports on Atazanavir and Ritonavir show that the peak of the number of patent families filed per priority year appears after the publication of the relevant INN;
- (v) If applicants will be required to submit the corresponding INN, the objective of the requirement should be clearly set, and its precise scope and nature has to be clarified in order to avoid legal uncertainty. The elements that may define the nature and scope of the disclosure include, among others: whether the applications filed both before and after the publication of the Recommended INN should be covered by the requirement; the relation between the invention contained in the application and the INN; the portion of the application in which the INN could be disclosed; types of claims; and mandatory or voluntary nature of disclosure.
- (vi) With respect to patent applications filed before the publication of the Recommended INN, the major challenge may be how to retroactively link the corresponding INN information to such applications without unduly burdening applicants and patent offices and at the same time, increasing the searchability of patent documents with an INN keyword search in a manner that potentially benefits all stakeholders. Considerations should be given to the extent of applicants' burden on monitoring the INN process and reporting a corresponding INN to a patent office and practical ways that the patent office can take to incorporate such information in its database;
- (vii) While the lack of data made it impossible to quantify the potential benefits and costs, theoretically, an INN keyword search may particularly assist those who search patent information on a specific medicine that has been already approved and commercialized. Different stakeholders may have different perceptions with respect to potential benefits that might arise from the disclosure of INN in patent applications. The mere indication of INN in patent applications is not sufficient to find out, with one click, what a patent searcher is looking for.
- (viii) In the absence of a simple and perfect solution to conduct a thorough patent search on pharmaceutical substances, patent searchers have developed methodologies to search patents for a medicine, primarily using publicly available databases, such as the Orange Book and records from the Supplementary Protection Certificate (SPC), although they have their own limitations;
- (ix) Automatic identification, extraction and indexing of chemical data from a source (such as patent documents) with complex software algorithms is increasingly practical, and further development of chemical natural language engines might significantly contribute to a simpler and more cost efficient patent search in the fields of chemistry and pharmacology.

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