



## Information Technologies in Public Health Management: A Database on Biocides to Improve Quality of Life

*\*C Roman<sup>1</sup>, L Scripcariu<sup>2</sup>, RM Diaconescu<sup>3</sup>, A Grigoriu<sup>1</sup>*

1. Technical University "Gh. Asachi", Faculty of Textile Leather and Industrial Management, 53, D. Mangeron Blvd., 700050, Iași, România
2. Technical University "Gh. Asachi", Faculty of Electronics, Telecommunications and Information Technology, 22 Copou Blvd., 700506, Iași, România
3. Technical University "Gh. Asachi", Faculty of Chemical Engineering and Environment Protection, 71A, D. Mangeron Blvd., 700050, Iași, România

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### Abstract

**Background:** Biocides for prolonging the shelf life of a large variety of materials have been extensively used over the last decades. It has estimated that the worldwide biocide consumption to be about 12.4 billion dollars in 2011, and is expected to increase in 2012. As biocides are substances we get in contact with in our everyday lives, access to this type of information is of paramount importance in order to ensure an appropriate living environment. Consequently, a database where information may be quickly processed, sorted, and easily accessed, according to different search criteria, is the most desirable solution. The main aim of this work was to design and implement a relational database with complete information about biocides used in public health management to improve the quality of life.

**Methods:** Design and implementation of a relational database for biocides, by using the software "phpMyAdmin".

**Results:** A database, which allows for an efficient collection, storage, and management of information including chemical properties and applications of a large quantity of biocides, as well as its adequate dissemination into the public health environment.

**Conclusion:** The information contained in the database herein presented promotes an adequate use of biocides, by means of information technologies, which in consequence may help achieve important improvement in our quality of life.

**Keywords:** Database, Biocides, Public health, Management, Information technology

### Introduction

The number of biocides used in public health has considerably increased over the last years. It has been estimated the global biocide consumption to be about 12.4 billion dollars in 2011, and it is expected to increase in 2012 (1). Biocides are substances used to prevent the development of microorganisms (bacteria, mold and fungi), which leads to the materials deterioration (2-5). So, the

main roles of biocides used in the public health care are: a) to prevent and control the infections caused by pathogenic microorganisms on food, drugs, cosmetics, clothes, etc.; b) to maintain the quality of those products for a longer period of time (6).

Information on biocides may be of extreme importance when ensuring an appropriate living en-

vironment. We get in contact with them in our everyday lives (for example, in products we ingest or those we use for cleaning). Regardless of how they are used, biocides affect our environment to a certain extent. An adequate knowledge on their chemical properties and risks for the environment and living organisms may result in minimizing unwanted side effects, by selecting that substance which fulfils the requirements demanded for a certain application. On the other hand, the employ of technologies in the management and access to information is being highly demanded by society. On these grounds, a database where information may be quickly processed and sorted, and easily accessed to, is the most desirable solution for both goods producers and final consumers (7). The elaboration of a specialized database to permit the distribution, through the internet, of information on the physico-chemical properties and antimicrobial activity of biocides to different local public health-related institutions would be very welcome (8-11).

A database (hereinafter referred to as DB) stands for an ensemble integrated of records or files, reunited and structured in a logical way, which has been designed to satisfy the information demands of an organization or a group of users (12-15). Nowadays, there are a large number of databases available on the most varied topics, each of them designed as a unique resource to be used by multiple users at same time. However, not much work has been carried out on chemical substances with antimicrobial activity. Furthermore, current databases have a limited number of search criteria, which very often do not totally meet the users' requirements.

This work proposes a DB with the following characteristics: a) it constitutes a promising alternative to the current sources of information available; b) it presents 10 different search criteria which permit a more practical and efficient access to the information by users groups with different backgrounds; c) for every substance, a PDF file including updated information on physico-chemical properties and the environmental risks derived from its inadequate use may be download.

## Materials and Methods

The biocides database proposed was elaborated with the software "phpMyAdmin", the most mature and widely used database management system on-line, by means of MySQL, which is a very fast, robust, multiuser and multithreaded server using SQL (Structured Query Language) (16). "phpMyAdmin" application provides the ability to store collections of information grouped by area of interest and allows for its updating through specific operations: input data, delete or update a file, improve the database structure (by creating new tables to formulate new queries or to get answers to a heterogeneous range of questions on biocides), etc. (17).

A relational DB, like this, is a collection of data items organized as a set of tables. With the aim to analyze the information needs for a basic research of a specific substance and so, to elaborate the DB, the following sequence of steps must be followed:

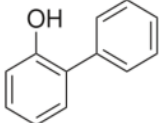
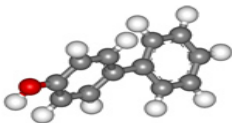
- a) To define the entities (tables);
- b) To identify the attributes for tables;
- c) To define relationships between the records of tables (Table 1).

At the moment, the number of biocides included in the database is over 400, which have been classified into 23 classes of substances among which we mention the most important: alcohols, aldehydes, phenols, acids, amides, azoles, organometallic compounds and others. All the information available, which was collected from a large number of specialized and recently published resources, can be easily updated periodically by the database administrator in accordance with the latest findings.

In consequence, this proposal processes a large quantity of information on biocides and ensures abstraction, integration, integrity, security, sharing, and independence of data.



**Table 1:** Specific elements of a relational database for active biocidal substances (18)

Entity	Attributes	Achievements (Values)
Chemical substance	Chemical_name	2-Biphenylol
	Class_of_substances	Biphenylols
	Molecular_formula	C <sub>12</sub> H <sub>10</sub> O
	Structural_formula	 
	Product_codes	CAS-No.: 90-43-7; 201-993-5; CEE-no. 7; EINECS-No.: 201-993-5; E-No.: E231, toxic (do not use more than 10 mg/kg citrus fruit, 2-Biphenylol), banned in the U.S. and Australia; EPA-FDA: The product is approved for antimicrobial applications.
	Toxicity	Causes severe eye irritation and possible burns. Causes moderate skin irritation. Laboratory experiments have resulted in mutagenic effects.
	Eco-toxicity	The product is ready biodegradable.
Applications	In agriculture, food, leather and textile industries, paper auxiliaries, ceramic glazes etc. important active ingredient in disinfectants for hospitals, public buildings etc. fungicidal, germicidal, synthetic intermediate.	
Antimicrobial_activity	2-Biphenylol is a broad-spectrum microbiocide and because of its favorable toxicity became one of the most important biocides used in many applications, although in some countries is prohibited.	

## Results

We present a novel database on chemical substances with antimicrobial activity, which may constitute a crucial point as a part of a programme in the public health care and, consequently, in improving the quality of life. The DB we have created provides a wide range of information on biocides: chemical and physical properties, antimicrobial action, application areas, data on toxicity etc. We have also included warnings on substances, which might promote risks of pollution, poisoning or lethal at certain doses of living nature.

Our DB has a public character, being accessible online for anyone wishing to obtain specialized and complete information about these substances and the effects they may have on the environment and living organisms, particularly humans. The essential condition to access all the information contained in the database is to create a user account and log in. The information required to

validate registration in the DB is username, password, e-mail, and institution.

With regards to its use, this DB presents an easy to handle interface (Fig. 1) which allows the users to access all the information, sorted into 23 classes of biocides (according to their main functional groups), by using the menu "Display substances". Once in, the list of substances associated to a specific class will be displayed by clicking on its corresponding name. On the other hand, for a more quickly search of a specific substance, users can select the option "Find substances". Additionally, the database offers the opportunity to access all the most recent information (and updating date), by using the "New issues" option. In case the user wants to save the information for a specific biocide, a data sheet PDF format can be downloaded. Interestingly, the selection of information according to specific search criteria (properties, antimicrobial action, toxicity, eco-toxicity, applications,

etc.) may be conducted by clicking on the menu "Advanced search". For example, *Escherichia coli* is known to cause serious infections and diseases through a massive multiplication. In that sense, we may be interested in finding possible biocides, which lead to the destruction of this bacterium, as well as to know the minimum inhibition concen-

tration or the effects on living organisms (19, 20). Our DB provides the answer to these questions by using the criterion of "substance with antimicrobial action on specified organism". After this query, we obtained, as a result, a list with over one hundred substances, which match the search criterion (Fig. 2 for some selected results).

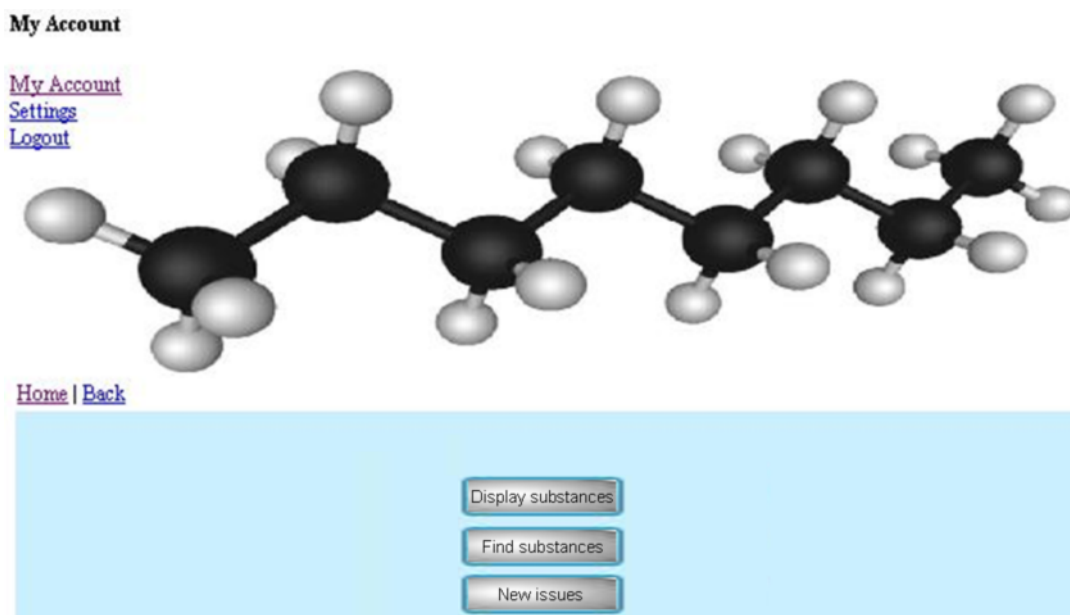


Fig. 1: Search interface of biocides introduced into the database

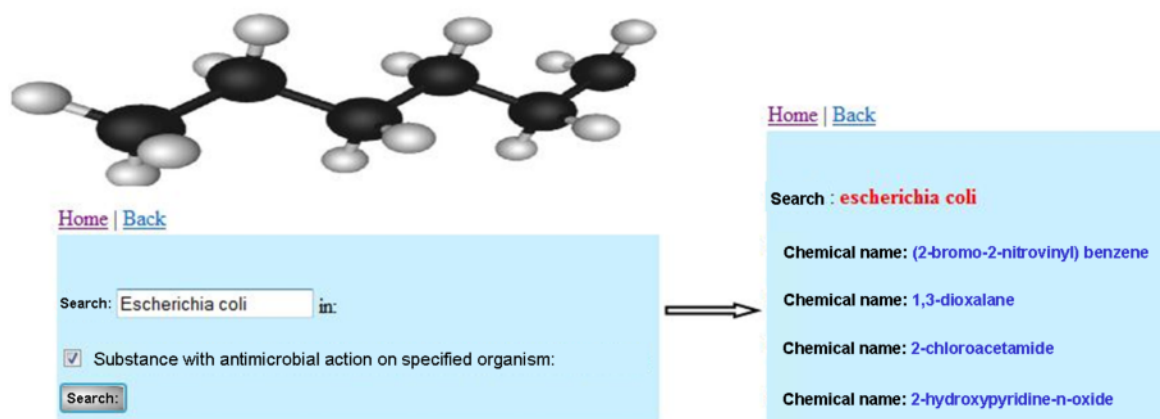


Fig. 2: Interface for the "Advanced search" option and some selected results

## Discussion

It is well known that the use of biocides on a large scale in a variety of industries around the world is increasing every day. Therefore, there should be a rational balance between the use of these products and the impact they might exert on the environment and living organisms. For that reason, this DB may represent an efficient and effective way to give support to both goods producers and final consumers on this issue.

People are currently encouraged to make an extensive use of the information technologies in their everyday lives. Hence, a proposal like this becomes a very adequate tool in public health care, as it allows for the management and processing of large volumes of information (over 400 biocides presented as sheets containing at least 15 fields with specific properties). Furthermore, it facilitates the access to useful and up-to-dated information: physical and chemical properties, data on the toxicity/ eco-toxicity, antimicrobial action, application areas, etc.

Through this work, we emphasize the importance of biocides in improving our quality of life, as well as the need for carrying out a convenient use of them.

## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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