EnviroInfo 2005 (Brno)
Informatics for Environmental Protection - Networking Environmental Information
 ISBN: 80-210-3780-6

Interactive Information System for Ecotoxicological Tests – DATEST 2.0

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Abstract

There are many on-line databases available on the internet today that can be useful when solving Ecological Risk Assessment (EcoRA) issues. Most o[1]f these databases provide information on toxicology data, hazardous chemicals, chemical and physical properties, hazard identification, dose-response assessment, bioavailability etc. In general, available internet databases concern on properties of chemical substances, and many of these databases are very well developed and provide extensive and valuable information in this area. The test results here can be often incomparable due to different methodology used to acquire results.

The aim of this article is to inform about efforts to provide a tool that can parametrically describe and store information about various ecotoxicological tests and can be used to quickly find relevant tests for given situation and therefore support the decision-making process. The system and its current content is further described here and proposed changes and possible collaboration is outlined.

1. Introduction

The EcoRA process involves (among other steps) selection and usage of ecotoxicological tests. Selection depends largely on the problem being solved and wide range of other criteria has to be taken into consideration. The decision has to be made over hundreds of existing tests useful for different situations and the decision-maker must have very good grasp of this scientific area. However, there seems to be no simple way of finding consistent information about ecotoxicological tests on the Internet.

DATEST software is a database of ecotoxicological tests capable of storing parametric data about different tests, citations, authors and web links (URLs) in the form of hierarchical database structure. In this form, the system supports making queries over the data in relatively easy way, filtering the tests using different criteria and viewing the results.

2. Description of the system

DATEST software is designed as a parametric database of ecotoxicological tests, citations and web links. Two basic types of records are distinguished, (1) ecotoxicological laboratory test (2) bioindicative methods (markers) for in situ indication of stress influence. Each record is exactly marked according to degree of standardization, usage potential and normative background. That is why the database consists of standardized tests (ISO, OECD,...) and simultaneously it is opened for evaluation of experimental or novel methods. The principal features of the system include the possibility to search for existing tests in the database that match any combination of selected parameters and keywords. Searched tests could be organ-

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ized in batteries according to rules derived from standard ecological risk assessment methodology. The content of the database can be further expressed using graphs.

In present, the basic database contains 97 ecotoxicological tests from different scientific areas. All the records in the database have clearly defined structure and parameters.

2.1 Record structure of the database

Basic overview:
Data model of the database is rich in identification parameters for each recorded item (citations, normative guidelines, sources of experience with test usage, user's comments ...), parameters describing used end-point of the test, usage potential in different exposure situations.

Test parameters can be divided into several categories as follows:

1. **General information** – Name of test, citation, comment, time, financial and instrumental demands
2. **Legislative** – ISO, OECD, EPA and the CR standardization of the test
3. **Test characteristics** – test place, biological systems involved, design categories, exposition duration, examined effect, trophic level, taxonomic level, media type, tested matrix
4. **EcoRA assessment** – usability of test for each of existing EcoRA scenarios.

Each category consists of subsequent group of parameters. In other words, the information about each test is deeply parameterized while keeping the possibility to describe each test and some of its parameters in free (plain) text. This solution assures that the test can be easily found when searching for its parameters and at the same time the test can be precisely described once it has been found.

Moreover, users can get quick overview about different test characteristics in the database. Different test characteristics can be viewed for selected group of tests using graphical expression. For example, user wants to know financial demands of ecotoxicological tests on algae. The software displays column chart showing numbers of tests on algae for different groups of *Financial demands* parameter. User can double-click on any column to view corresponding tests for each group.

Using this feature, the software can be well used for educational purposes providing the user with an easily accessible overview of tests from different points of view.

2.2 Parameters in detail view

a) General information

Test name (free text)
Citations (unlimited list)
Comment (free text)
Test description (free text)
Time demands incl. Exposition (less than 1 day, less than one week, more than one week)
Equipment requirements (general laboratory, equipped lab., specialized lab.)
Financial demands (10s Euro, 100s Euro, 1000s Euro)

b) Legislative (for each citation)

Required in EU
EPA standard
ISO standard
OECD Standard
Other standard
Required in CR

CSN standard
Other citation

c) Test characteristics

Testing process (in situ, laboratory)
Tested biological system (original, artificial, other)
Origin of biological system (fresh water, salt water, terrestric, soil, other)
Test complexity (sub-cell, cell, tissue, organ, organ set, individual, population, coenosis, other)
Design of test – temporality (retrospective, prospective, accident, other)
Design of test – species number (single-specied, multiple specied)
Design of test – interpretation (screening, prescreening, definitive test, other)
Observed biological process (free text)
Effect duration (acute, chronic, replicated, other)
Type of effect – group (lethal, sub-lethal, reproduction toxicity, endocrine toxicity, mutagenity, carcinogenity, effect on populations, effect on coenoses, ecosystem damage)
Type of effect (free text)
Trophic level of biological system in the test (producer, primary consumer, secondary consumer, decomposer, other)
Trophic level – interpretation of test (producer, primary consumer, secondary consumer, decomposer, other)
Taxonomic level of biological system (Receptor identification) (viruses, bacteria, anabaena, algae, vascular plants, thallobionta, fungi, protozoa, worms, crustacea, mollusca, insect, fish, birds, mammals, other)
Sample type (clear solid preparation, clear dissolved preparation, complex matrix, extract from complex matrix, other)
Sample type specification (free text)
Tested matrix (clear preparation, environment sample, wastes (communal, industrial, mixed, special))

d) EcoRA assessment

Suitability for scenarios 1 – 7 (required test; recommended test, increases information value; optional test, alternative; only if no alternative available (question of cost, time); test has no meaning for scenario; test should not be used for scenario)

2.3 Technologies being used

Currently, the system exists as a standalone application executable on MS Windows platform that works over data in underlying Borland Interbase database server.

The database server can be placed either on local computer (standalone installation) or on local network (intranet installation)

2.4 Standalone installation

In this case, the whole database is placed on a personal computer of the user and the data are not shared with anyone. The computer does not have to be connected neither to the network nor to the internet.

2.5 Intranet installation

In this mode, collaboration between several users over one database is assumed. This version is primarily designed for a smaller group of users in the same workplace but in general it can be run over the Internet as well. The data are stored on selected computer (server) that distributes the data to all clients on demand and stores the changes. Each client (user) has the client part of the program installed on his local computer. The client part works directly with the data from the server. Changes made by particular user are instantly visible to all other users. (adding new tests, etc.) Te user's computer has to be connected to the network in this case.

The software is written in C++ programming language.

3. Results and discussion

In this article we have introduced a database system for storing and searching data about ecotoxicological tests. The system is intended to be used in Ecological Risk Assessment (EcoRA) process but its idea and aims can be developed much further.

In practice, this software is intended for use by Environmental management offices, laboratories working in this scientific area, various companies solving environmental issues, etc…

The software can help these subjects for quick and clear resolution and decision which ecological tests are appropriate for a situation they may be actually facing. Furthermore, it can help to assemble various batteries of tests when creating directives for different problems. Last but not least, users can use it for educational purposes in various lectures with environmental and ecotoxicology subjects.

3.1 Collaboration appeal

Presented system in its current state is freely redistributable at no charge and enables its users to work with currently available database of tests that is included it the release. The database remains open for entering new data and editing existing so that users can update it by their own according to their needs. According to feedback of users in the web discussion forum accessible from the software, our team can tune the parameter list in future versions to be even more versatile.

However, the most important attribute of such a database is the amount and validity of data it contains. Our team has tried to include the most of standard and ordinarily used tests available today but still a lot of work has to be done to make the database more wide-oriented.

We appeal on other teams that deal with ecological testing **to contribute to the database** and send us their databases back (Currently, it is just one small and well-compressible file on the disk that can be sent by e-mail). This way we can update our central database and issue new versions of the database back to public. The new versions will be freely available for accepted contributors to the database. The process of releasing new versions will be much simpler in the future as we are now working on entirely new design of the project – a **web-based database** – that is standard for this kind of databases. Users will have immediate access to newly entered tests and will have the opportunity to send us new tests directly on-line. New tests will than be approved by our team and put in the public database. This will ensure the stable quality of the database, quick incorporation of new features and easy feedback from the users.

3.2 Establishing the Board of Experts

As the ecological risk assessment field is very broad, research teams are typically focused on more narrow areas with different stratification, such as spring water ecotoxicology, soil ecotoxicology, vertebrates, etc... There no single team is able to guarantee the quality of entered tests from all areas of ecotoxicology testing. Therefore it is necessary to **establish a virtual board of experts** that would cover different research areas and that could assess the quality of data on broad level. Members of this board will cover different areas of ecotoxicology research and will be able to edit, accept or delete new tests send by regular users. Contributors will send new tests to the database; these tests will queue aside from the "accepted" tests and wait for the acceptance from the board member. Only members of the board will have the privilege to integrate queued tests to the main set of tests. Not all new tests will be directed to all board members; only the tests from particular research area will be directed to a member or members of this area. This way the board member will be aware only of the tests he can assess while not being burdened with any others. Members will be noticed by mail that a new test has arrived and is waiting for their assessment. Nothing more than a web browser will be necessary to view, edit or accept the new test.This scheme will assure the integrity and correctness of the database as a whole. Our team already has good experiences with similar schemas in database management from different areas (clinical databases for our clients; for detailed information please visit http://www.cba.muni.cz). The Board of Experts is an easy-to-use and practical answer to issues related to content management of diverse or wide-spread databases.

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