

$$Z = \frac{(X - \mu)}{\sigma}$$

LemnaTec BioStat statistics program

Any bio-test is meaningless without an interpretation of the derived data. This is irrespective of the later use of the results - the notification of plant protection agents or chemicals, the evaluation of wastewater and environmental samples or research. In all these cases a transparent and validated calculation of the raw data and the application of approved statistical evaluation methods is necessary especially within the scope of GLP.

BioStat provides the possibility to record all data necessary for an extensive test protocol employing the help of a clearly-structured user interface. Calculation steps are displayed as graphics and tables and approved statistical methods are used especially for the evaluation of the concentration-response relations. All raw data and results can be printed directly as test protocols and with high level layout. Tables may be exported for the further data processing to spreadsheet programs. Charts may be imported conveniently into your own reports.

The program supplies test protocols for a growing number of standardised bio-tests e.g. growth inhibition tests (duckweed, algae). It is applicable as stand-alone program but far more efficient together with the LemnaTec Scanalyzer.

The data of other bio-tests can efficiently be put to disposal for the calculation of dose-response relations to LemnaTec BioStat.

With BioStat it is possible to perform formerly time-consuming, recurrent steps of data-calculation on the spot in the laboratory in a transparent way without specialized knowledge of statistics and to make the results available for further evaluation in detail. Immediately after collecting the raw data charts and EC-values are available to appear in the test protocol. So you save money and time. Follow-up test series may be prepared faster on the firm basis of the results won.

Data entry

All data necessary for a comprehensive test protocol and reports compliant to standards - OECD, ISO, DIN, ASTM in particular - can be entered the program. Any information concerning sample characterisation, clients, pre-treatment of the sample and test surroundings are filed and saved in a template test concept.

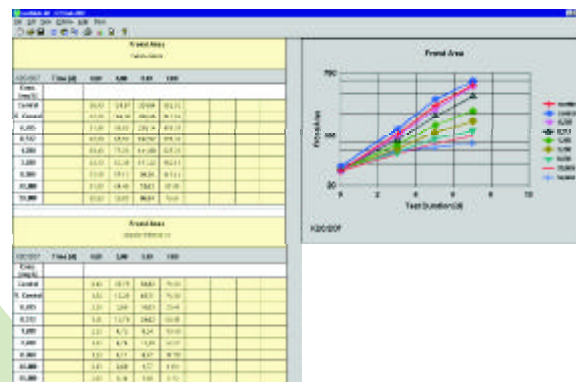
The values measured and the necessary comments about the test are registered chronologically in an electronic laboratory journal. Later on this can be printed out with a clear layout without the need of reformatting. Tables and page breaks adapt automatically to the test-design used (number of controls, solvent control, test concentrations and replicate numbers, number of measurement). Using the measured values mean values, standard deviations and coefficients of variation are calculated immediately. Data used can be taken from the LemnaTec Scanalyzer measuring system, imported as spreadsheets or entered manually.

Data calculation and presentation

All tables and calculation procedures automatically adapt to changes in the test design. If the complete data-set - covering all times of measurement and all observation parameters - is entered only a single touch of a button is necessary to start the complete calculation. Lasting adaptation and revalidation of all calculation processes as needed in conventional spread sheet analysis is not more necessary. The data are now tabulated after observation parameters (e. g. frond number, frond area, chlorophyll, dry weight). The respective mean

values of all times of measurement and test concentrations and observation parameters are displayed as growth curves. These may be shown in linear and log-linear mode.

After the definition of the reference (medium control or solvent control) the inhibition values are calculated and displayed for all three standardised calculation parameters (average specific growth rate, area under the growth curve, final biomass). The easy and fast calculation of the inhibition values of all parameters of observation applying all standardised methods of evaluation enables a flexible adaptation of the result to standards and customer requests. A flexible and editable set of charts allows to illustrate the three most important inhibition values derived from up to four observation parameter.



All data are displayed in tables and charts, ready to print and export.

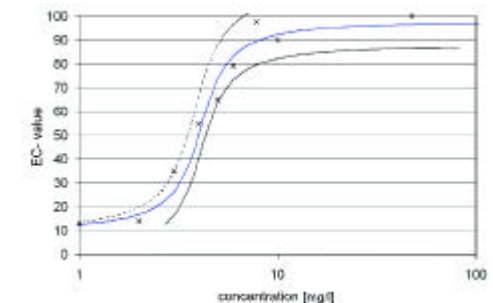
Even additional informative calculation parameters as the sectional growth rate are calculated and can be displayed. All charts in the report may be displayed in colour or monochrome. They can be edited easily with the help of an assistant. While the tables are exportable to spreadsheet programs for specific calculations, the charts may be imported directly to all common office applications. Despite this high flexibility of the statistical calculation all calculation procedures are strictly coherent without any possibility of unwanted change and, of course, validated. This guarantees a transparent and permanently accurate calculation of the raw data as it is necessary especially for calculations under GLP.

Statistical evaluation

In statistical evaluations with BioStat great emphasis is put on a concept enabling the user to calculate validated EC-values with maximum data transparency without specialised knowledge in statistics. Repeated calculation of EC-values on the basis of control or solvent control, a possible exclusion of outliers and a wide range of fitting methods for the concentration-response-relation permits a flexible adaptation of the statistics to the data. Results retrieved by different statistical methods are easily compared. At the same time the user holds full control of the calculations and may adapt them to the requirements of different standards and his experience. From the concentration-response-relation of inhibition growth tests EC-values are calculated on the basis of following fitting methods:

- 1) Probit (modification according to Nyholm)
- 2) Two parameters logistic and Weibull fit
- 3) Four parameters nonlinear fit

Other fit methods are added appropriate to the actual state of research and standards. The important confidence intervals (95% and 99%) are calculated, tabled and displayed graphically. The program is validated in cooperation with **Dr. habil. Toni Ratte** (Technical University of Aachen/Germany). Intensive communication with scientists, users and standardisation bodies guarantees the up-to-date estate of the LemnaTec BioStat software.



To get a fast idea of the validity of the data measured and the chosen fitting method, a single look at the EC-values and their confidence intervals is generally sufficient.

Report

The flexibly edited report summarises all data that are necessary for a test in compliance with standards and guidelines ready for documentation. Saving all data and calculation operations even in case of repeated data analysis ensures compliance to GLP. A flexible and highly valid statistical evaluation of bio-tests may be interesting not only for the known growth inhibition test of duckweed or algae but for many other test systems as well. Please ask for the newest state of development of the LemnaTec BioStat software.