



LemnaTec Scanalyzer - Biotesting with Duckweed

Performance and tools



The LemnaTec Scanalyzer is an integrated system to perform the duckweed growth inhibition test.

Concept of the tool

LemnaTec works closely together with users of the duckweed-test in ecotoxicology, pesticide notification, waste water monitoring and screening of active ingredients. The different requirements of science, routine testing and standards are immediately integrated in the structure of the system.

The main goal of the LemnaTec Scanalyzer is the complete and reproducible analysis of all visible parameters of observation. Even coloured, tainted, dark and solid samples or their elutriates can be tested using our automatic image analysis.

The LemnaTec Scanalyzer adapts to different test facilities, so an approved testdesign can be maintained without changes and investments following.

The Scanalyzer is far beyond a mere instrument for measurement. It supports every step of the testing-routine, from preparation to statistics. The Scanalyzer is delivered ready to use. On demand, LemnaTec installs the unit and also instructs the users.

The system remains flexible. The user may freely design the test and configure many parameters of evaluation. He remains in total control of aim and style of his ecotoxicological research.

Details in function and structure of the LemnaTec Scanalyzer guarantee such comfortable working.

Features of the analytic software

Removing background objects

After analysing an image of the sample with all visible objects, only duckweed must remain. So the rim of the glass, reflections, roots or sediments are removed automatically by the software. If the result is not satisfying yet - maybe because a new type of glass is used - the parameters can be adapted and saved manually, using an easy software assistant, guiding through all steps of the process.

Detecting individual fronds

The LemnaTec Scanalyzer separates single fronds out of the complex structure of the different colonies of lemna spec. so they become accessible to analysis. The power and flexibility of the program guarantees that recognition and separation of the fronds is biologically correct. The methods of recognition are delivered ready to use with each Scanalyzer, but can be modified by the user. Besides, single mistakes of the analysis can be corrected manually using an easy drawingtool. This tool allows to exclude, include, merge and separate objects. After the analysis a set of detailed data is collected, describing number, area, colour and shape of the duckweed.

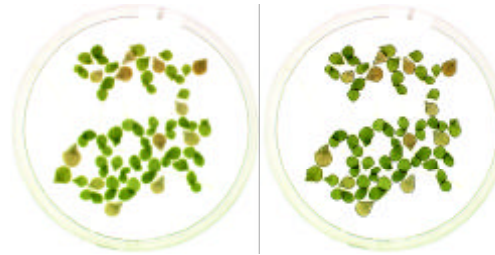
Classification of colour:

The user of the LemnaTec Scanalyzer may group colours into different classes, named either after their colour (dark-green, green, yellow, etc.) or after the severity of damage done to the frond (healthy, necrotic, chlorotic etc.). This assessment scheme may be saved for further analysis. The assessment of damage is then performed automatically and fast with high reproducibility.

The original image and the false-colour image with the classified colours are shown side by side. So alternatives in the arrangement of the classes can be optimised immediately. In this way the visual impression

and the assessment of damage of the expert are transferred to the Scanalyzer under his complete control. The assessment scheme may be changed or further optimised at any time and reanalysis of all data guarantees homogeneous data sets.

Every test is analysed using this colour classification and delivers biological valid findings, describing each single frond as well as all the fronds in the sample and in a whole series of tests.



The original image of a duckweed sample with healthy and necrotic fronds. The LemnaTec Scanalyzer recognises all fronds and marks them in the borderlineimage.



On the basis of the borderline-image and the chosen classification of colour a false-colour image is generated to improve the assessment of effects.

Single image analysis

In research it is often valuable to analyse a single image out of a series of tests. Of course, this option is available with the LemnaTec Scanalyzer.

After the analysis each frond is known with its particular area and colour classification. Besides the information about number and total frond area in the sample, the distribution of colours in the different sizes of fronds gives a fine and compact view of the samples's state. Because some substances influence the sizes of the fronds, the distribution of size in the number of fronds shows very accurately the reaction of duckweed towards toxicants. A combination of colour analysis and distribution of size shows physiological biomarkers such as the death of larger fronds very easily and absolutely objective.

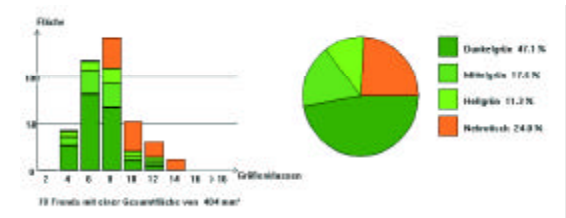
Managing testseries

In general the LemnaTec Scanalyzer is used in a routine of larger scale series of tests. According to international standards these test-series have to be analysed several times and be thoroughly documented. All

steps of the whole test are supported by the LemnaTec Scanalyzer. All data can be printed or exported to other programs. A special software assistant helps to find the right steps of dilution and suggests coded names to all samples in a test. The images of the samples then can be taken without following a prescribed sequence. A barcode scanner can be applied to make identification of the samples even easier.

Preview diagrams are shown. The tabled results of each observation parameter are then ready to be exported for further analysis.

The most convenient method for data calculation and report is LemnaStat. This validated tool automatically performs all calculations and statistics (inhibition, EC-values, NOEC) necessary for a report, compliant to various standards and guidelines. LemnaStat is also available as stand-alone version without the Scanalyzer. Please ask for further information.



The vast amount of data is condensed in clear diagrams and printed in the report. Data only accessible by advanced image analysis like frond area distribution in combination with colour classification give comprehensive and easy to catch information about the test results.

Documentation

All images and data are stored and saved. So they can easily be traced, reconstructed and reanalysed at a later time. Highest control of quality according to GLP is so guaranteed.

Perspectives

Quantifying shape, colour and area of biologic objects is a key issue in many widely used biological tests. Please ask for the actual state of development.