

VEREIN FÜR BEWEGUNGSFORSCHUNG e.V. INSTITUT FÜR STRÖMUNGSWISSENSCHAFTEN

HERRISCHRIED IM SÜDSCHWARZWALD

Conditions for analysis of water samples using algae

Preliminary remark

Algae are used today in toxicology and, although less frequently, in drinking water management as indicators of water quality.¹ As a supplement to chemical-analytical test methods, living organisms show an overall picture of the effect of a water sample on the living. At the Institute of Flow Sciences, water analysis includes algae that have been adapted and expanded to comply with standards set out below. Thus, in addition to the conventional growth parameters, the changes in morphology as well as the reproduction cycle are also used for an assessment, through which even weak influences on the water quality can be detected.

Experimental conditions

Culture conditions and culture medium follow the instructions of an EU directive with the modifications described (see below).² *Pediastrum duplex* (*p. duplex*) of the collection of algal cultures of the University of Göttingen, SAG No. 28.83, is used as experimental organism. For culture, 30 ml of the water sample is used in 3 parallel cultures in 100 ml glass vessels with the addition of the mineral salts as specified in the EU Directive. The solutions and equipment are sterile, but the water samples remain untreated, i.e. they are not sterilised. Further work is carried out under sterile conditions in each case. An Overview of the culture conditions is shown in Table 1.

Lighting	6 Philips TL-D 58W-865 tubes, colour temperature 6500 K Light / dark rhythm of 16 / 8 h
Illuminance	143 ± 4,4 µE / m ² s, corresponding to about 8000 lx
Determination of growth	photometrically at 446 nm
Pre-culture	several weeks with control of cell morphology
Cell density at start	OD ₄₄₆ = ~ 0,005 corresponding to about 5 • 10 ⁵ colonies / ml
Temperature	25 ± 0,1 °C
Further	gentle agitation at 110 rpm in the water bath of an Aquatron from Infors, Bottmingen, Switzerland

Table 1: Test parameters under standard conditions

Growth and pH value are continuously monitored within the experimental period. At the beginning of the experiment and when taking the cells for morphological evaluation, the oxygen content of the cultures is also measured. For morphological evaluation, cell suspensions of 1 ml solution are taken from each of three parallel cultures. An appropriate amount is microscoped and at least 100 algal cells / colonies are photographed from them. Based on the pictures, the cell number and size of the zoenobia are determined and these are assigned to the corresponding morphotype. Each water sample is analysed in triplicate at least.

According to the respective distribution of the morphological forms, the growth pattern or the respective deviations from it are shown in comparison to the reference (mostly the above

1 EC directive 92/69 EEC, EPA (2012), OECD (2011)

2 EC directive 92/69 EEC

conditions with A. dist. as sample solution, as far as not changed according to the research question). This can be used to assess the effect of a water sample on the algal species. Each experiment is limited in time, as the growth medium is altered by nutrient removal and the release of metabolic products in such a way that controlled growth conditions no longer exist. According to the standard, this time is set at 3 days. With a division duration of about 25 hours, this corresponds to three multiplication steps or doublings. Determination of the distribution and proportion of morphotypes within the cultures is carried out after about one and three doublings respectively (specified as 24 h and 72 h).

Limitations of the method

The result of the examination represents a one-time, selective view of the sample. It is recommended to extend this by further examinations carried out at different intervals and to extend the results by further methods for examining the sample.

Orders and Lab Dates

The Institute of Flow Sciences is a non-profit research institute, not a commercial service company for product test reports. However, we do accept examination orders and will be happy to advise you.

In order to be able to examine water samples as freshly as possible, it is necessary to arrange appointments for our capacities. We only carry out examinations after an order has been placed in writing on the basis of these analysis conditions, with an agreed date and payment on account. The agreed arrangements are binding for both parties.

Sampling and Containers

Type and timing of the samples and analyses must be agreed in advance. We provide the client with the required bottles complying with our laboratory standards, without which we cannot ensure comparability with other water samples. If, against our advice, the client insists on supplying samples in other bottles he or she is responsible for all resulting consequences including restricted applicability of the results. Please follow our Instructions for Taking and Sending Water Samples. The bottles and the accompanying delivery notes must be labelled according to those instructions. If the samples are to be treated specially in terms of packaging, storage, handling, etc. this must be stated in the order.

We conduct the investigations with the utmost of care, but without guarantee. We cannot be held responsible for deficiencies or damage caused by unsuitable filling and packaging, contamination of samples or improper transport.

Declaration of the samples

If the samples do not correspond to drinking water that is flawless from a hygienic and toxicological point of view, the client undertakes to state any deviations from this in the order. If the client provides coded water samples for analysis, this shall not release him from this obligation. The client shall be liable for all direct and indirect expenses, damages and their consequences incurred by us or our employees in handling undeclared substances or samples with false information. We reserve the right to refuse the examination in the event of concerns with regard to hygiene or toxicology or if there are doubts about the quality of the drinking water.

Prices

The price for the algae examination of a water sample delivered free to our premises is 480.00 € + VAT, including the provision of the sample bottles, a short consultation and the examination report. For further services, please contact us to arrange a separate agreement. Our prices are cost prices

and do not include the statutory value added tax (currently 19 %). The value added tax must also be charged for orders from abroad, as our services do not qualify as export of goods. We reserve the right to refuse the examination in the event of concerns with regard to hygiene or toxicology or if there are doubts about the quality of the drinking water.

Terms of payment

The client undertakes to pay a deposit of 30 per cent of the order amount after receipt of the order confirmation. If the order is cancelled up to two weeks before the agreed examination date, the deposit shall be refunded. The remaining payment shall be due upon issuance of the invoice. Payments are due within 30 days strictly net. Payments from abroad are to be made free of charges. Until payment of the remuneration, we reserve the right to retain the examination report.

Examination results

We supply a written lab report with the findings, photographs and an assessment of the samples (coded samples are assessed and analysed comparatively). The lab report is prepared within four weeks of the analysis. Statements in the report are made to the best of our knowledge and belief, and are in line with the latest research. They relate only to the received samples and allow no general conclusions. Water supplies are subject to fluctuations in quality depending on the time of sampling, so no conclusions about the long-term quality of the water or its origins can be drawn from the results of our investigations of samples. A generalization can only be made after investigation of a representative number of samples. More information on the possibilities and limits of the drop picture method can be found in the introduction above. Decoding of coded water samples should be made known to us by the client after receipt of the lab report.

Copyright

The text and any illustrations of the study report are intended for the client's personal orientation and internal use (e.g. in customer meetings). The copyrights are held by the Institute of Flow Sciences. Publication of the study results and illustrations requires a separate written agreement. This agreement must specify the scope, content and duration of the right of use to be granted as well as the remuneration to be paid for this. Our complete, unchanged study report may be passed on to third parties. Use for commercial advertising purposes is generally not permitted. In the event of misuse of these copyrights, we may demand injunctive relief and compensation for damages. This shall not affect any further claims for damages or claims based on statutory rights.

The Institute of Flow Sciences may use the investigation results for scientific publications as examples without naming them, unless otherwise agreed when the order is placed. The investigation report will not be passed on to third parties.

Storage and Return of Samples

Water samples and packaging will only be returned to the client if this is specifically requested and the costs are covered. They will be kept for one month after completion of the lab report.

Applicability and Jurisdiction

These Conditions for Analysis are part of the contract for every investigation. Any deviations or additions must be stated in writing when the order is made, and confirmed by us.

The law of the Federal Republic of Germany shall apply exclusively. The place of jurisdiction for disputes arising from this contract is Bad Säckingen.

Earlier versions of these Conditions for Analysis lose their validity upon publication of this version.

Literature

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