

## **A Method for Rapid Characterization the Algae Size with Laser Granulometer**

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### **Abstract**

The particle size analysis of algae community determined using laser granulometer was the main aims of this study. Experiment has been carried since March 2006 and whereas this period of time changes in algae sizes were observed. The results of particle size analysis and preliminary assessment of this test is presented in this work.

### **1. Introduction**

Control of environmental processes has a great importance for keeping water ecosystems in balance. Human activity strongly effects on waste materials production. Organic materials, phosphorus, nitrogen, and other pollutants are removed from surface waters because of their natural purification. However natural purification capacity is limited and waste materials accumulated in excessive cannot be easily removed. Due to constantly flow, rivers and streams have more opportunity to discharge waste materials than reservoirs. Hence several negative consequences for aquatic reservoir may occur. One of them is algae blooming.

Algae, the most spread organisms occur in all ecosystems, are associated with reservoir waters degradation. Due to law regulations, control of algae community in surface waters is required. Quantity of algae can be measured as their volume occurred in water unit. Volume calculations are estimated on the base of earlier prepared formula containing their cells dimensions (Hutorowicz, 2005; Kawecka and Eloranta, 1994). Microscopically technique using for this purpose may possess several problems connected with formula misconception or its lack in case new not identified species. Yet we do not find enough repeatability and fast method for changeability states, especially in reservoir, describing. Microscopically techniques are time-consuming and fatigue. Consequently, practice and new technique are definitely required to overcome this problem.

A laser granulometer analysis has been used as a new technique in many researches before for particle size assessments (Kizil, Peterson and English, 2000; Robens et al., 2002; Syroeshkin et al., 2005). Current studies have shown individual advantages and disadvantages this method for different materials. This device can give operators new standard of information. Measurement is easy and fast, it refers directly to particle sizes. Assembled data can be generate in different ways. Laser granulometer gives repeatability outcome in table and graphic form as well. Information are simultaneously collected and can be freely used. Elaboration of laser granulometer utility for algae size analysis is the main aim of this study. Laser granulometer is tested to be or not to be appropriate device for this purpose.

### **2. Method**

Experiment with algae increase has been carried since March 2006. The algae use for this propose were taken from aquarium located in Department of Building and Infrastructure laboratory. The aquarium is carried on with control to abiotic parameters (light, temperature, nourishment) and without control in

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refer to biotic parameters (concurrency). In order to observe changes in time samples were measured almost once a week. The algae were examined using laser granulometer Mastersizer 2000 – Malvern Instruments Ltd. The device determines the disperse composition of suspensions in range 0,01 – 2000  $\mu\text{m}$  based on the presumption of a spherical particle [5]. This technique is based on *Low Angle Laser Light Scattering*. Mastersizer allows calculating distributions of suspended algae in terms of volume, number and length percentage.

### 3. Results

A limited number of tests were conducted for algal species describing. The structure of the algal has been observed through scanning electron microscopy.

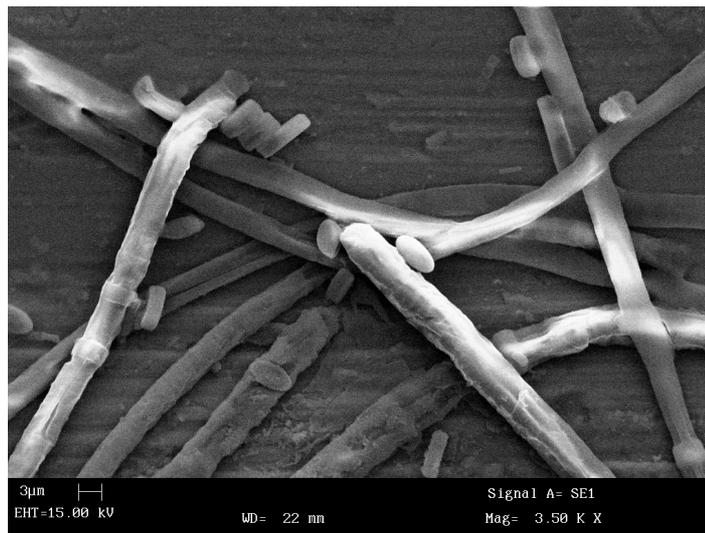


Figure 1: Original scanning microscopically observations of algae

Microscopically observations show algae structure but provide no useful data when it goes about their amount investigations. Describing algae amounts in sample 600 ml capacity using only manual image review is a hard task. Volume calculations of all algae forms in such sample, on the base of earlier prepared formula, are almost impracticable. Using Mastersizer it takes only a minute to evaluate results. Optical observations shown that algae may appear as agglomerated particles and for that reason measurements with stirring were needed.

Results of algae size changeability in time are presented on figure 2. At first results were oscillating between particle sizes. However within the time passing by balance in population came. As can easily be seen, after six months, algae sizes gradual increase for size range 100 – 2000  $\mu\text{m}$  and decrease for sizes range 1 – 10  $\mu\text{m}$ . In contrary to this algae from sizes range 0 – 1  $\mu\text{m}$  are seen as the most stable for all period of time. Results show algae activity in time.

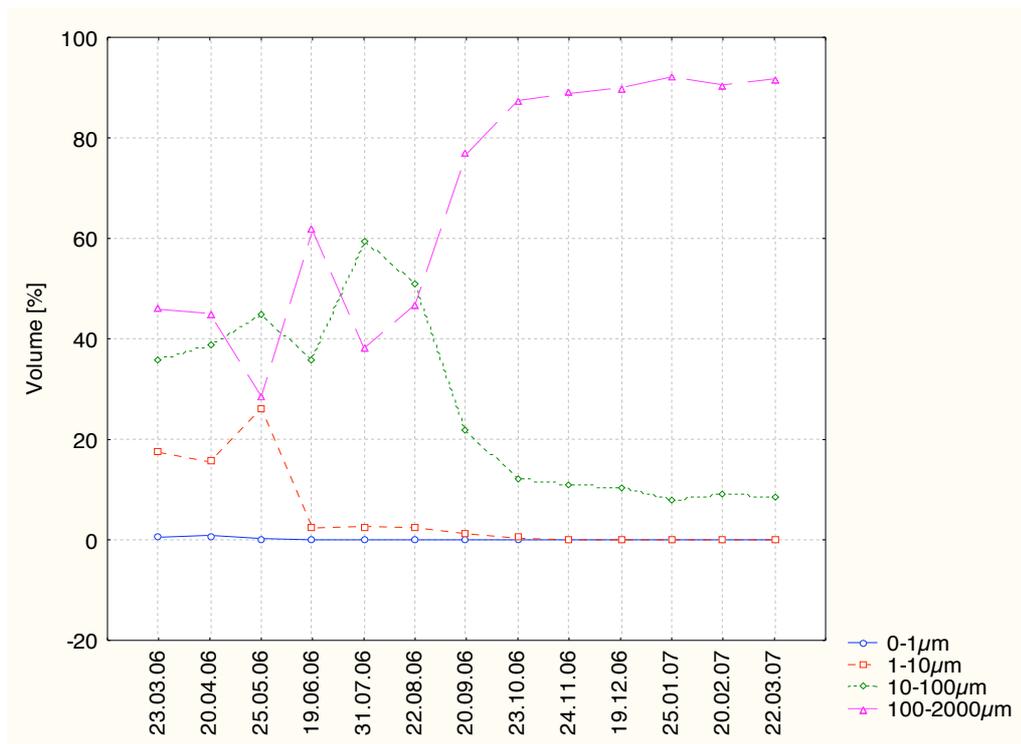


Figure 2: Changes in particle size distribution of algae registered in each day respectively

The granulometric distribution on figure 3 presents results obtained in volume of each fraction. Volume distribution of algae size causes changeable main mode values. Mode indicates the most frequent occurred size in population. Conducted research shown constantly increasing populations because of growth mode values. Experiment results were not clear with refer to data obtained for first months, however situation changed since September. Obtained results for seven months are presented in Table 1.

Table 1:  
Mean values of algae calculated from the size distribution

Date	Mode value
20.09.06	431,427
10.10.06	438,348
15.11.06	647,437
12.12.06	699,120
25.01.07	898,833
15.02.07	910,218
29.03.07	985,001

The another possibility gives us observations for number percentage changes. Particle number distribution indicates the most numerous particles size range. Volume is concentrate within large particle and number of particles not necessarily. Figure 4 shows changes in number percentage distribution during research time.

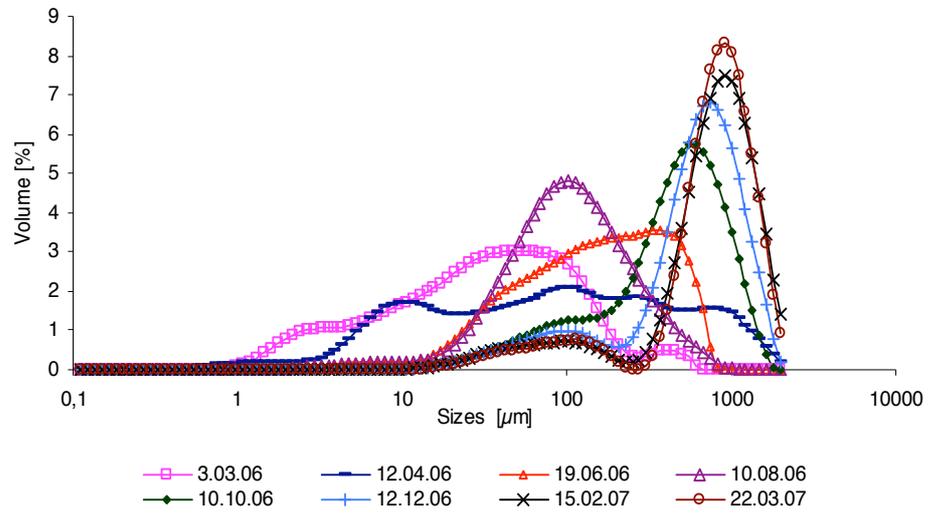


Figure 3: The granulometric distribution in volume of each day

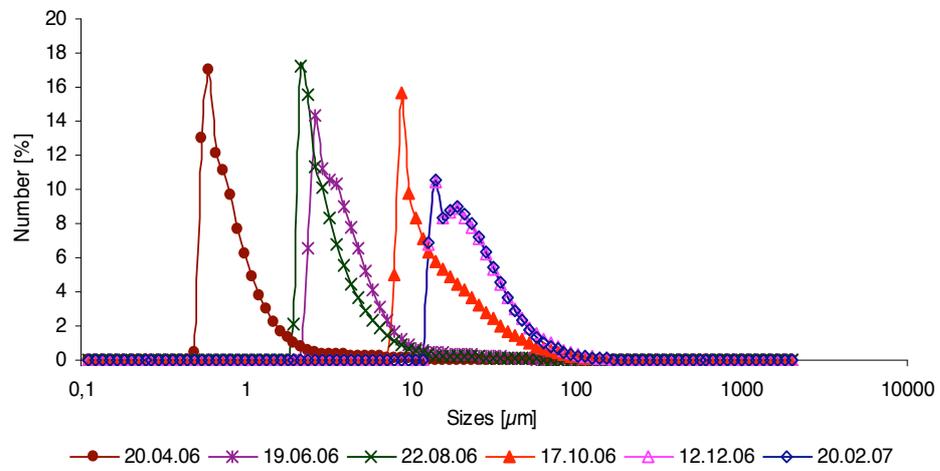


Figure 4: Changes in number of algae registered in each day respectively

A database consisted of weakly measurements still grown and is preserved as file list in digital form. Device information system is prepared for any obtained data processing. Numerous options for results introduction is undoubtedly one of advantages Mastersizer operation system.

#### **4. Discussion**

Current studies have shown that manual algae image review is to archaic to be sufficient nowadays when time counts the most. At the same time a new standards suppose to take place an old one. Consequently numbers of tests were conducted in order to laser granulometer technique recognizing. Mastersizer technique allows for satisfactorily algae size describing even if the measurement is based on the presumption of a spherical particle. This method does not allow for material observations and species description, however indicates algae changes reach in samples taken from laboratory. It is still question will it be possible for this investigations introduced into practice.

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