Coastal and marine ecosystems, biology and ecology

Phytoplankton Chlorophyll, Biomass, Inactive Matter

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Chlorophyll content of plankton was initially deemed to be the principal indicator of phytoplankton biomass. Willing to specify the estimation of biomass by chlorophyll we had, for the first time, established dependence of chlorophyll “A” (Chl A) content in the cells of different species, cultivated under similar conditions, on their volume and weight expressed in carbon (C), and, afterwards, we suggested a test method to determine C/Chl A ratio in experiment. Information accumulated as for cultivation of different microalgae under various conditions of lightning, temperature and inorganic nutrition was colligated in the scientific literature in the form of equations, which allow calculating expected C/Chl A ratio for particular phytoplankton communities under the given conditions. However, there should be noted a substantial difference between populations functioning within natural communities and populations of particular species cultivated in the artificial environments. As a rule, algae cultures are maintained in the log growth phase and thus, all researches of cultures can be referred to the primary phase of development of the populations. Whereas populations within natural communities go through all stages of development: from the log growth phase at the beginning to the period of stagnation and dying. Presence of significant amount of dying and even dead cells in the natural communities was found whilst using luminescence microscopy. Therefore, while studying C/Chl A ratio of natural phytoplankton communities, age of population of dominant species at the moment of measurement can be determinative. In this respect, we set a task to analyze fluctuation of C/Chl A ratio in phytoplankton communities in the coastal region of the Black Sea near Sevastopol and possible influence on it of all aggregate factors, taking into account supposed age of population, where amount of its biomass may be considered as a relative index. As a result, it was established that with the increase of natural phytoplankton communities biomass, relative content of Chl A in them decreases. It proves hypothesis about ageing of population within their composition and allows us to consider amount of biomass as an indirect index of their age. Seasonal variation of phytoplankton development in the coastal area in general is determined by seasonal changes of environmental parameters. Regularly, minimum value of C/Chl A is typical for the periods of minimum temperature and light value. It defines peculiar “domed” form of distribution of C/Chl A ratio on the diagrams of seasonal variation, where it can be clearly traced not only through our data from 2009 and 2010, but also through the data from other authors gathered in 2000 – 2003. Using “domed”

distribution, we carried out rough estimate of content of inactive substance in the total biomass. Such estimate is based on the assumption that on the bottom edge of “dome” and underneath “dome” there are set the dates which correspond to the communities, which biomass is composed of young population with minimal index of C/Chl A ratio. According to this estimate “dead” matter content within total biomass of phytoplankton near the mouth of Sevastopol Bay falls inside the limits of 0 to 90% and grows along with the increase of biomass. The analysis performed shows that natural phytoplankton communities accumulate a considerable amount of physiologically inactive (old or, possibly, dead) cells with low content of chlorophyll. Significant concentration of such cells by separate massive populations in the areas of “blooming” creates maxima biomass of phytoplankton with the high C/Chl A ratio – up to 1000 and even more.