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Pulverizing aeration as a method of lakes restoration

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The principal threat to lakes of the temperate zone is posed by factors accelerating their eutrophication and causing marked deoxygenation of the deeper layers of water, mainly the hypo- and metalimnion. Among their effects are frequent phytoplankton blooms, including those of blue-green algae, and general deterioration of water quality also affecting the abundance and health status of fish. The chief concern is a disturbed proportion between the amount of complex chemical compounds, especially organic, and the oxygen content of lake waters. Natural processes of water oxygenation are not too intensive, because they are practically limited to the epilimnion layer, connected as they are with the activity of aquatic plants of the littoral and sublittoral zone (which tends to disappear in contaminated lakes) and wind energy (the effect of waving). In summer conditions, with a relatively great chemical activity of bottom deposits, the intensity of those processes is usually inadequate. Hence, in 1995 a research was launched in the Institute of Agricultural Engineering of the Agricultural University in Poznań on an integrated lake restoration technology whose core was a self-powered aerator capable of oxygenating also the bottom layers of water (the hypolimnion) of deep lakes. The aerator uses energy obtained from a Savonius rotor mainly to diffuse gases: to release hydrogen sulphide, which usually saturates the hypolimnion water completely, and then to saturate this water with oxygen. Even early studies showed the constructed device to be highly efficient in improving oxygen conditions in the bottom zone. They also made it clear that it should be equipped with an autonomous system designed to inactivate phosphorus, one of the principal factors determining the rate of lake degradation. In 2003 the first wind-driven pulverising aerator equipped with such a system was installed in Town Lake in Chodzież. The aim of this work is to present the principles of operation of a wind-driven pulverising aerator with a phosphorus inactivation system, as well as its general technical characteristics and preliminary results of a study of its performance.