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Effects of dose and dose rate of γ radiation on catalytic activity of catalase

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Catalytic activity of catalase from bovine liver was studied using experimental device designed for kinetic measurements of hydrogen peroxide decomposition at constant temperature and pressure. The kinetics of the reaction was evaluated by measuring the volume of released oxygen. The measurement was performed at four temperatures in the range of 25 –45 °C. Rate constants of the reaction were estimated for all four temperatures. The values of apparent activation energy were obtained from their temperature dependence in Arrhenius coordinates. Reproducibility of both sample preparation and kinetics measurement was experimentally evaluated.

Solutions containing 1×10^{-3} - 5×10^{-6} g/mL of catalase in phosphate buffer were used for the study. γ irradiation was performed using ^{60}Co radionuclide source Gammacell 220 with two different dose rates 7 and 70 Gy/h and doses ranging from 350 to 1000 Gy.

It was confirmed that the observed reaction of catalase with hydrogen peroxide is of the first order in the whole measured interval. Irradiation significantly decreases catalytic activity of catalase. However, apparent activation energy does not depend on the dose of radiation indicating that the mechanism of the hydrogen peroxide degradation does not significantly change with the dose, either.

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