Phytoplankton colony propagation in the frame of piecewise linear model

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The mathematical model of an infiltrative tumor is regulated to the mechanism of phytoplankton propagation in a channel filled with nutrients. This model consists of reaction-diffusion equations for phytoplankton concentration and nutrient concentration, in which biological interactions are approximated by piecewise linear functions. Within the framework of the one-dimensional approximation, a stable autowave solution is obtained, which moves with a certain critical minimum velocity $u_{\min}$. It is shown numerically that in an unperturbed medium, a phytoplankton wave moving at a velocity $u > u_{\min}$ tends to a stable state with a velocity of $u_{\min}$. The properties of the propagating wave of a phytoplankton colony are compared with the solution of the Fisher equation. The main purpose of the work is to study the features of the propagation of the front of the phytoplankton population in the presence of vortex flow. For this purpose, the nature of the distribution of the phytoplankton colony is studied in a chain of two-dimensional vortices described by the Taylor–Green solution. It is shown that there are three different modes of propagation of the population wave, depending on the intensity of the vortex flow field. The present work was supported by the Ministry of Science and Higher Education of the Russian Federation (project No. 075-15-2019-1878) and the Russian Foundation for Basic Research (project No. 19-01-00768).