The Deleterious Effect of Vaping Additives on the Motility of Chlamydomonas reinhardtii

Hua, Cecilia (School: Oregon Episcopal School)
Papathanasopoulos, Marie (Mimi) (School: Oregon Episcopal School)

This project studied the impact of tocopheryl acetate and diacetyl on the motility of Chlamydomonas reinhardtii as a model for EVALI (E-Cigarette and Vaping Associated Lung Injury). This is important because of the current EVALI epidemic which caused 2,700 hospitalizations and 60 deaths in 2019. Vaping products can contain potentially harmful substances, including tocopheryl acetate (vitamin E oil) as a diluent, and diacetyl as a flavoring. The flagellated, single-cell alga C. reinhardtii was used as a model for the ciliated cells of the human respiratory tract. The independent variable was the concentration of tocopheryl acetate or diacetyl, and the dependent variable was the velocity of the C. reinhardtii. The data showed that the greater the concentration of either tocopheryl acetate or diacetyl, the lower the C. reinhardtii's speed. Velocity was reduced by two thirds at 50% concentration of tocopheryl acetate. Velocity was reduced to nil for diacetyl concentrations of 4% and above. The reduction in motility of C. reinhardtii would translate to an impairment of the cilia of the respiratory tract to clear mucus and pathogens from the lungs, leading to inflammation and pneumonia symptoms. The motility of C. reinhardtii is an inexpensive method to identify and gauge potentially harmful concentration levels of vaping additives. We developed this test in our school lab, reviving research from the 1950s on the motility of C. reinhardtii. We updated the concept with the use of software designed to measure the velocity of an object in motion. This method makes our test more time and cost-effective than other current tests. This testing could be used as a first-stage gateway when evaluating the safety of additives and diluents in vaping products.