

Abstract:

There are many electronic nicotine delivery device (ENDS) and e-liquid manufacturers, largely in China, Europe and the US, but these products are not manufactured along typical standards and there is a variation in quality control. Therefore, little is known what kind of flavorings is used in ENDS and there is no guarantee that the flavorings are of a pure grade and free of impurities or toxic elements. There is lack of evidence how various product characteristics affects flavorings stability and their transfer from e-liquid to inhalable vapors. Also unknown is the extent to which vaporization of flavoring compounds creates cytotoxic effects at the levels of exposure encountered by ENDS; currently there are very limited data on inhalation toxicity of flavorings used in ENDS. Physiologically-relevant in vitro model systems, in which human lung cells can be exposed to appropriate doses of ENDS vapors may provide useful tools to interpret their cytotoxic effects.

The proposed study will investigate the potential toxicity of several of the most popular flavorings in the US. This study will assess not only the concentration, emission, and potential degradation of flavorings from storage or heating, but also the cytotoxic effects of different flavorings in vapors. We will obtain novel data validating the effect of flavorings in vapor generated in laboratory condition on various cells and cell lines, including cancerous subtypes. In proposed study we will: 1) determine flavoring type and amounts in disposable ENDS, cartridges and refill solutions, and inter-brand and intra-brand variability in flavorings; 2) determine stability of flavorings in ENDS under various storage conditions; 3) determine flavoring yields in vapors from various types of ENDS under laboratory conditions; 4) explore various product characteristics to determine their effect on flavoring levels delivered to the vapors; 5) evaluate the cellular effects of various flavoring used in ENDS; and 6) establish an evidence base for evaluating their potential harm to users.

This study is novel in that it will assess not only the concentration, emission, and potential degradation of flavorings from storage or heating, but also the cytotoxic effects of different flavorings in vapors. The data in our study will be novel also in that we will compare cytotoxic effects of flavored vapors from ENDS with tobacco smoke from reference cigarettes. The findings of our project can inform FDA on developing and implementing standard quality assessment procedures and testing methods for flavored ENDS. Additionally, the results of our proposed studies should also provide an evidence base for future clinical research. If flavored ENDS appear not to be cytotoxic, researchers will be more comfortable in conducting clinical trials to evaluate their efficacy as exposure reduction or smoking cessation aids.