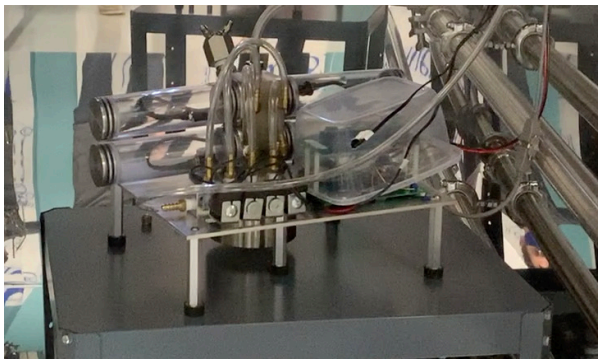
TECHNICAL BRIEF

Chemical Insights
An Institute of Underwriters Laboratories Inc.

A Strategic Research Initiative on Physiochemical and Toxicological Assessment of Electronic Nicotine Delivery System

Introduction

Usage of electronic nicotine delivery systems (ENDS) has increased dramatically in the United States in the last decade, particularly among adolescents and young adults. Many cultural and behavioral factors have contributed to this increase, notably the perception that ENDS are a safer alternative to cigarettes and other traditional tobacco products. ENDS emissions may contain lower concentrations of toxic or carcinogenic compounds such as combustion-derived polycyclic hydrocarbons (PAHs), nicotine-derived nitrosamine ketone (NNK), or acrolein. On the other hand, ENDS aerosols also contain metal contaminants derived from components of the heating element as well as potentially toxic organic compounds, including VOCs, that can originate from the numerous liquids available for use. Product safety testing for ENDS lags far behind their increasing market share, and little is known about the complex mixture of particle and chemical vapors resulting from ENDS use.



The ENDS aerosol generator is shown above in the environmental exposure chamber.

The research will result in the development of a mechanical puff generator that will include realistic puff topography and scientific study in a specialized exposure chamber. Using a range of different, and available generation models with a range of E- liquids, exposure data will be measured for chemicals and particles. Individual chemicals will be identified and quantified and particles will be assessed by particle sizes and levels.

Samples will also be collected for toxicological assessments using in vitro cell, oxidative stress, cytotoxicity, DNS damage, and phenotypic transition protocols.

Study Objectives

- Characterize the physicochemical properties of ENDS aerosols. This includes understanding how changes in ENDS characteristics like atomizer aging can influence the size, shape and chemical composition of emitted aerosols.
- Measure the biological activity and genotoxicity of ENDS aerosols. This objective will explore potential disease pathways and establish potential biomarkers for DNA damage and phenotypic cellular changes.
- Characterize the complex chemical and particle vapors resulting from ENDS use.

Science Outcomes

- Fill in knowledge gaps like how changes in ENDS product design may affect aerosol emissions amount and content.
- Determine what pathways and biomarkers of harm may be linked to ENDS emissions.
- Characterize the complex mixture of particles, volatile organic compounds (VOCs), and semi volatile organic compounds (SVOCs) in ENDS emissions.
- Develop analytical measurement technologies for determining human exposure risks to particles and chemicals resulting from ENDS use.

Research Partners

- Georgia State University
- University of Wisconsin
- Georgia Institute of Technology

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