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Testing a Vibrating Mesh Nebulizer as a Safer Alternative to Conventional E-Cigarettes

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Within the scientific and medical community, electronic nicotine delivery systems (ENDS), or e-cigarettes, are known to be a healthier alternative to traditional, combustible cigarettes in delivering nicotine to the user. However, recent research conducted by the lab of Dr. Jae Hong Park at Purdue University has uncovered that the metallic heater coil used to aerosolize "e-juice" nicotine solution in e-cigarettes can release a potentially hazardous stream of metallic nanoparticles when operated. To circumvent this issue, a vibrating mesh nebulizer (VMN), the type commonly used to administer respiratory medication, was tested to determine its potential as a viable e-cigarette alternative, as it does not use metallic coils or combustion.

A vibrating mesh nebulizer can lead to safer nicotine absorption, eliminating the threat of metallic nanoparticle consumption. (Images retrieved from vcstar.com and boundtree.com.)

In this study, four trials with the VMN containing commercially available "e-juice" diluted in deionized water at different concentrations were ran, followed by three trials using pure nicotine diluted in deionized water at different concentrations. The stream of aerosols produced from each trial was analyzed to determine the number concentration and size of the particles produced. This would ultimately inform researchers of how readily absorbable these particles would be by the human respiratory tract, with smaller particles more easily absorbed. Results demonstrated that the "e-juice" trials at lower concentrations produced the greatest number of aerosols, as well as aerosols of the smallest diameter, ranging from 30 to 100 nm. Considering that conventional e-cigarettes produce particles < 200 nm and combustible cigarettes 100–400 nm, the VMN shows promise as a viable e-cigarette alternative in the future.

Research advisor Jae Hong Park writes: "Alec evaluated the performance of the vibrating mesh nebulizer and found that it could be used as safer ENDS. He measured size distributions of nicotine droplets using the 'e-juices' and the nicotine solution. The method used in the study and results are very useful to develop safer and efficient ENDS."

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