Pura Aerem: A Five-Stage Extension to Catalytic Converters Designed to Purify the Gasses and Pollutants Exiting Gas-Powered Vehicles

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Ambient air pollution contributes to a 7-million annual mortality rate, with gas-powered vehicles among the leading contributors. The current technology being used within gas-powered vehicles is the catalytic converter, converting gasses such as CO, HC, and NOX into CO2, H2O, N2, and other trace pollutants. The goal of this study was to improve catalytic converters, making the outputs less toxic. Pura Aerem was developed as a five-stage extension to catalytic converters designed to purify exhaust gasses exiting gas-powered vehicles. Pura Aerem uses diffusion-interception capture methods to reduce levels of particulate matter (PM), photoelectrochemical oxidation (PECO) technology to destroy trace gasses and pollutants, such as VOCs and O3, C60 Multi-Walled Buckypaper (MWBP) screening used to encapsulate CO2 particles, and an electrolysis chamber paired with a hydrogen fuel cell to utilize H2O for an alternative energy source. This study measured the levels of various gasses and pollutants in given samples over a 5-minute period from four environments. Altogether, Pura Aerem reduces Fine PM (FPM) and Coarse PM (CPM) by 99.275% and 99.587% (respectively), reduces CO2 by a minimum of 92.844%, reduces CO by nearly 100%, and increases O2 levels by approximately 744.444%. Chi-square tests were conducted, indicating that there was a significant FPM and CPM reduction correlated to the use of Pura Aerem ($p=2.54\times10^{-11}$, $p=3.31\times10^{-11}$–significance level of 0.05–respectively). Pura Aerem is a promising solution for future applications within internal combustion engines to reduce carbon emissions.

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