

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 ($p=2.54 \times 10^{-11}$, $p=3.31 \times 10^{-11}$ —significance level of 0.05—respectively). Pura Aerem is a promising solution for future applications within internal combustion engines to reduce carbon emissions.