Development and Implementation of a Bio-based Filter to Mitigate the Effusion of Harmful Pollutants from Internal Combustion Engines and Combustion Processes

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Emissions of internal combustion engines (ICEs) and general combustion processes (GCPs) are extremely harmful to our ecosphere, as they harm organisms, form smog, and accelerate climate change alarmingly, among many other detrimental-effects. Coupled with the widespread use of ICEs and GCPs, emissions are a prominent issue that must be addressed immediately. I endeavored to mitigate the harmful emissions of ICEs (with a gasoline engine as the model) through physical, chemical, and biological processes, hypothesizing that I could. The main engineering goals set before drafting apparatus ideas was to decrease the amount of nitrogen-oxides(NOx), carbon-dioxide(CO2), hydrocarbons(HC), and carbon-monoxide(CO), while increasing the amount of oxygen (O2). After research, I decided on my modes to mitigation, and drafted different engineering designs of combining it together in an apparatus, consulting with my teachers. Once a design was selected, construction began using traditional methods, as well as 3D-printing. 54 trials were run using a 5-gas emissions tester, 27 at idle engine (600-RPM), and 27 at 1200 RPM to simulate city-driving. The apparatus had a profound impact on both trial sets (all T-tests had $p<.05$), with large deceases in CO2, NOx, and CO, and increase in O2 and HCs, on average. In conclusion, my apparatus was partially successful. Everything worked well except for increased HC, due to a component that generated some itself. Moving forward, I'm going to make the apparatus more compact and efficient. This project also serves as a proof-of-concept, allowing the next-steps of scaling to larger applications (e.g. industrial/factorial) to be taken.

Awards Won:

Florida Institute of Technology: Full Tuition Presidential Scholarship

NC State College of Engineering: Award to attend NC State Engineering Summer Camp