A Novel Method for Biofiltration of Common Pollutants

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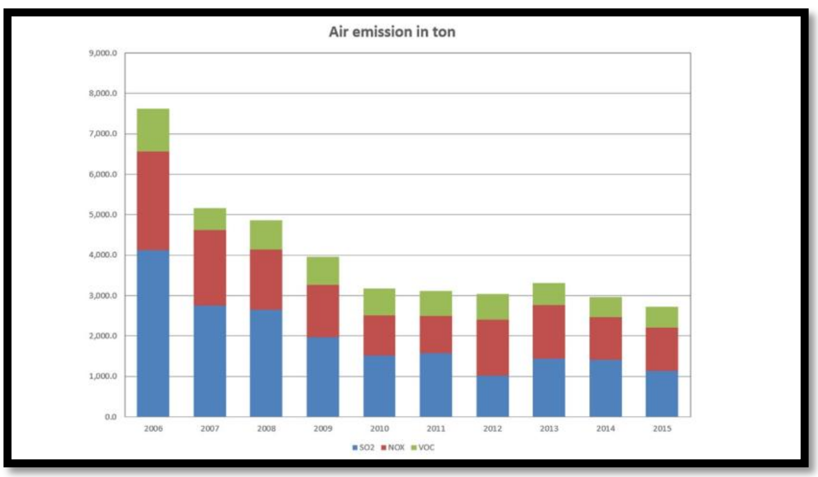
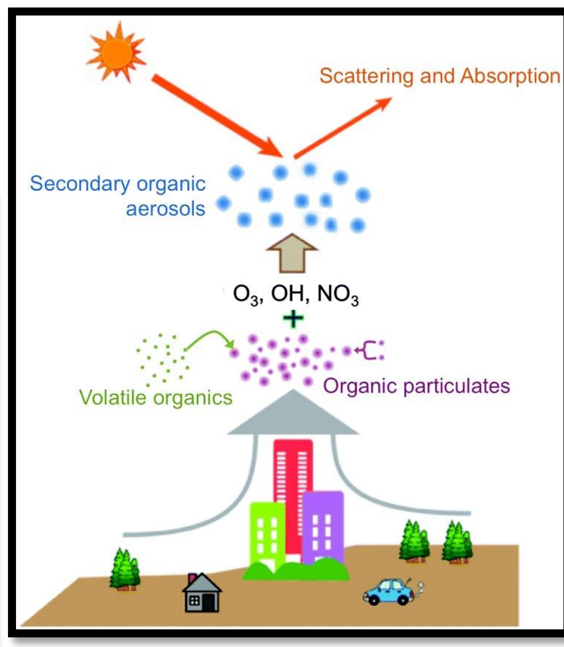
Air pollution has been cited as one of the leading environmental disasters affecting the United Arab Emirates. In this proposal,we aim to combat volatile organic compounds, a common hazardous pollutant. Volatile organic compounds are organic chemicals that react with sunlight and nitrogen oxides to form tropospheric ozone. The low boiling point causes a large number of molecules to evaporate or sublimate into the surrounding air at room temperature . In addition to being a precursor for the formation of PM2.5 particles, Organic compounds derived from petroleum, such as formaldehyde, benzene, ethylbenzene and dichlorobenzene, have been associated with asthma and reduced respiratory function. (Rumchev et al 2002, 2004; Elliott et al 2006). Numerous studies have also shown the harmful effects of long-term mediated exposure to VOCs.

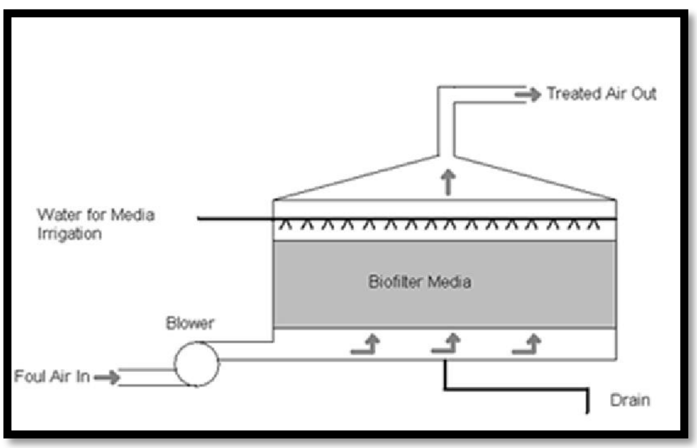




Given the countless immediate effects of these compounds on human health and the environment, is it possible to find a novel method for the synthesis of new, robust biological systems that are able to degrade pollutants in a cheap and efficient manner?

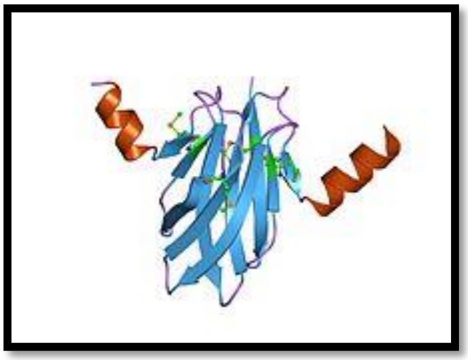
Our highlighted approach towards solving the problem includes using basic biological engineering to help combat the effect of VOCs in our surroundings. Given the wide range of common volatile organic compounds, we predict problems regarding a lack of specificity when targeting molecules. Therefore, we have opted for a general novel approach that involves creating a biofilter using biofilm from genetically engineered E.coli from a non-pathogenic K-12 lab strain. Previous studies have shown that through biofiltration, it is possible to degrade volatile organic compounds into harmless by-products (Previous research has shown that BLB21 E.coli have been able to remove 95% of methyl parathion, a common pollutant.)

Using our approach, the volatile organic compounds present in the air will diffuse into a biologically-active layer containing filler particles with bacteria that metabolize the VOCs, resulting in aerobic degradation of the compounds into simple byproducts. We plan on using a simple standardized biofiltration system consisting of an air blower, air distribution system, humidification system, and filter media. Specifically, we will focus on optimization of E.coli in the filter media, as pollutant elimination will



be limited by the biological activity in the film.

We plan on increasing and regulating the expression of biofilm synthesis using an RNA-binding global regulatory protein mutant called CsrA TRMG1655. Studies have shown that amongst other global regulatory proteins, CsrA in particular has a strong influence on biofilm development as both a repressor of biofilm formation and an activator of biofilm dispersal. We want to test our hypothesis of whether the increased production of biofilm as a result of modified CsrA TRMG1655 will lead to more robust biofiltration when compared to conventional biofilm filters. We plan on growing the E.coli culture for a period of two weeks, after which the film can be washed and used, so it can be compared to conventional biofilm filtration microbes.



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