Reducing the Risk of Parkinson's Disease By Combating Aromatic Molecules Through Air Filtration

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ABSTRACT

Paint and household cleaners are a common substance in the household and the workplace. These products contain molecules called xylene and toluene, which would have increased the risk of Parkinson's Disease; Dr. Hester's experiment on mice proved the disease's relationship with Toluene, while Dr. Goldman proved the link with xylene. In order to help reduce the number of people with the disease, we needed to greatly reduce the exposure of toluene and xylene not only in the household but offices and other locations as well. The specific mechanism was analyzed to observe how substances contribute to neuron damage therefore identifying the targets for our solution. In order to reduce the presence of those substances, we designed a filtration device that collects those molecules and stores them in an easily disposable container. This device works by radicalizing xylene/toluene and then pulling them out of the air with a powerful magnet.

BACKGROUND

Parkinson's disease (PD) is a progressive neurodegenerative condition, which is characterized by neurons failing and consequently dying. The predominant cause of PD is when nerve cells in the brain do not produce enough of the neurotransmitter dopamine. There are four different forms of neurodegeneration (ND) in PD: dopaminergic, cholinergic, adrenergic, and serotonergic. Most people often associate Parkinson's with uncontrolled tremors and this is caused by dopaminergic ND. Cholinergic, adrenergic, serotonergic ND cause the much less known non-motor issues, such as olfactory and memory issues, sleep abnormalities, depression, and gastrointestinal complications. Parkinson's targets a variety of areas of the brain, but the origin of the disease is mainly from the substantia nigra, the primary motor complex, and both parts of the midbrain.

METHODOLOGY

Upon air inflow, gases such as oxygen and carbon dioxide are likely to rise to the top, while aromatics tend to fall to the bottom due to a large weight difference. Under appropriate conditions of light and heat, the aromatics form stable benzylic radicals when reacted with excess bromine. Since they are radicals, they are paramagnetic and are attracted by the electromagnet's negative field (the radical has a positive spin) into the replaceable collection container below. The positively charged magnet repels vapor and ensures the vapor cannot leave the collection container. Any excess bromine and aromatics that escape in the outflow vent are cooled to room temperature, where they return to a liquid state and slide back into the container.

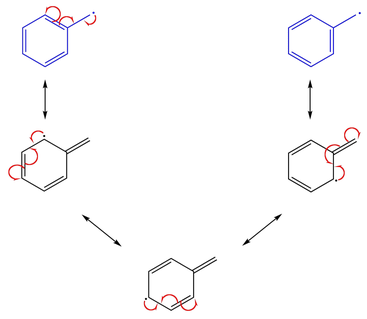

Figure 1: Benzylic radical resonance

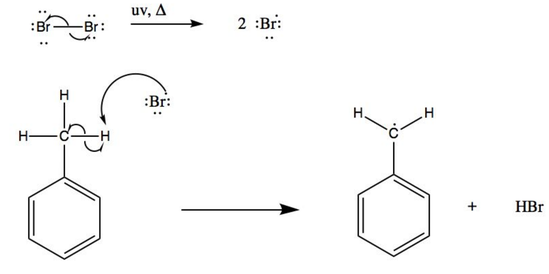

Figure 3: Bromination to form a radical

SOLUTION

Our solution is an air filter that is meant to be installed in areas with a high concentration of the targeted compounds, toluene and xylene. This is most likely to be industrial areas, where extra precautions must be taken to protect workers from high amounts of toxic chemicals from a variety of sources. It will be attached to the current ventilation system so there is a steady inflow and outflow of air as shown in the diagram.

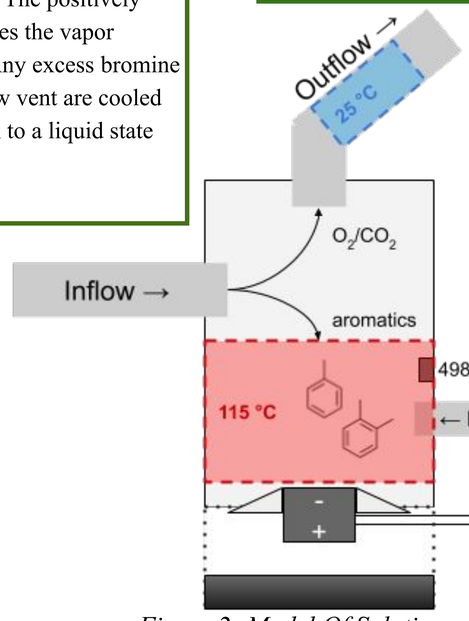

Figure 2: Model Of Solution - Air Filtration System

Figure 4: CAD Model of Air Filtration System

FUTURE DIRECTION

First, we want to be able to work with other experts in the field so they can provide their insight as to the feasibility of the solution. Here we can also determine how to add filters for other chemicals, if possible. Once we have completed that initial editing process, we would need to model it completely and run simulations (CAE) to make sure it can work as intended. With this design, we can prototype the device, and run real-life tests on the device's efficiency and effectiveness in achieving our goals. Using the data provided from the tests, we can make further tweaks to the design, and then continue that process of prototyping and testing. Once we deem it ready for the United States market, we can release it.

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