Enhancing Black Carbon Capture: A Novel Approach Using Modified Cyclone And Zeolite Sieve Technology

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Abstract

The world is facing global warming, the earth's temperature is rising, and if the temperature rises by 1.5 degrees, many glaciers in the world either disappear completely or lose most of their mass (IPCC 2022). If it continues; we will be facing an unpredictable situation. The main cause of this global warming is due to natural and anthropogenic emissions, mainly CO2 and carbon soot particles. In India, especially in the Indo-Gangetic plains, the sources of anthropogenic emissions are industrial emissions from various sources, such as based coal-based power plants, brick kilns, and vehicular emissions. To overcome the problem of global warming and estimate CO2 and carbon particles, we propose to capture concentrations of black carbon which has short-lived air pollutants that contribute significantly to aerosol radiative forcing and global climate change. The knowledge of the spatial and temporal distribution of black carbon especially in rural and urban environments over one of the highly polluted areas, the Indo-Gangetic plains (IGP) in the northern parts of India is very important. The IGP region is home to 900 million people who suffer from poor air quality and highly atmospheric polluted regions over the whole year, summer and winter. The poor air quality and atmospheric polluted IGP are health threats to people living in the region. The present study addresses the measurement of black carbon concentration using real-time mobile and ambient monitoring in traffic areas. The mean ambient black carbon concentration was found to be 1.041±1.032 μg/m³ varying between 0.5 and 4.0 μg/m³. The much higher average value of 16.1 ± 16.5 μg/m³ was measured through conveyance obtained in real traffic conditions on the road. Many parts of the city show black carbon particle concentrations of more than 20 μg/m³. The contiguous distribution of black carbon particle concentrations shows that vehicle emissions and traffic jams are the factors that mostly affect black carbon particle concentrations. There are four strategies to tackle global warming, named as (a) directly reducing greenhouse gas emissions, (b) or indirectly expanding renewable energy employment, (c) more efficient use of energy, and (d) or a wide range of climate policies, as per the bibliometric analysis reports of direct carbon dioxide emission reduction through carbon capture. The research trends in carbon capture within the three main types of technologies, namely pre-combustion, post-combustion, and oxy-fuel combustion. Post-combustion capture is the most refined carbon capture technology with about 80.9% of total publications retrieved, and oxyfuel ranks the lowest with (3.4%) of publications. In our research post-combustion method is used to capture black carbon particles from pollutants. About 80-90% of black carbon can be captured and the rest gas will be released into the air through filtration by activating a carbon filter. Using a modified cyclone separator to capture black carbon particles soot and with the help of adsorbent property in which zeolite molecular sieve will play the role of the adsorbent surface, we will achieve the purpose. Control of black carbon, according to many scientists particularly from fossil fuel sources could be the fastest method of slowing global warming soon.

Figures used in the abstract

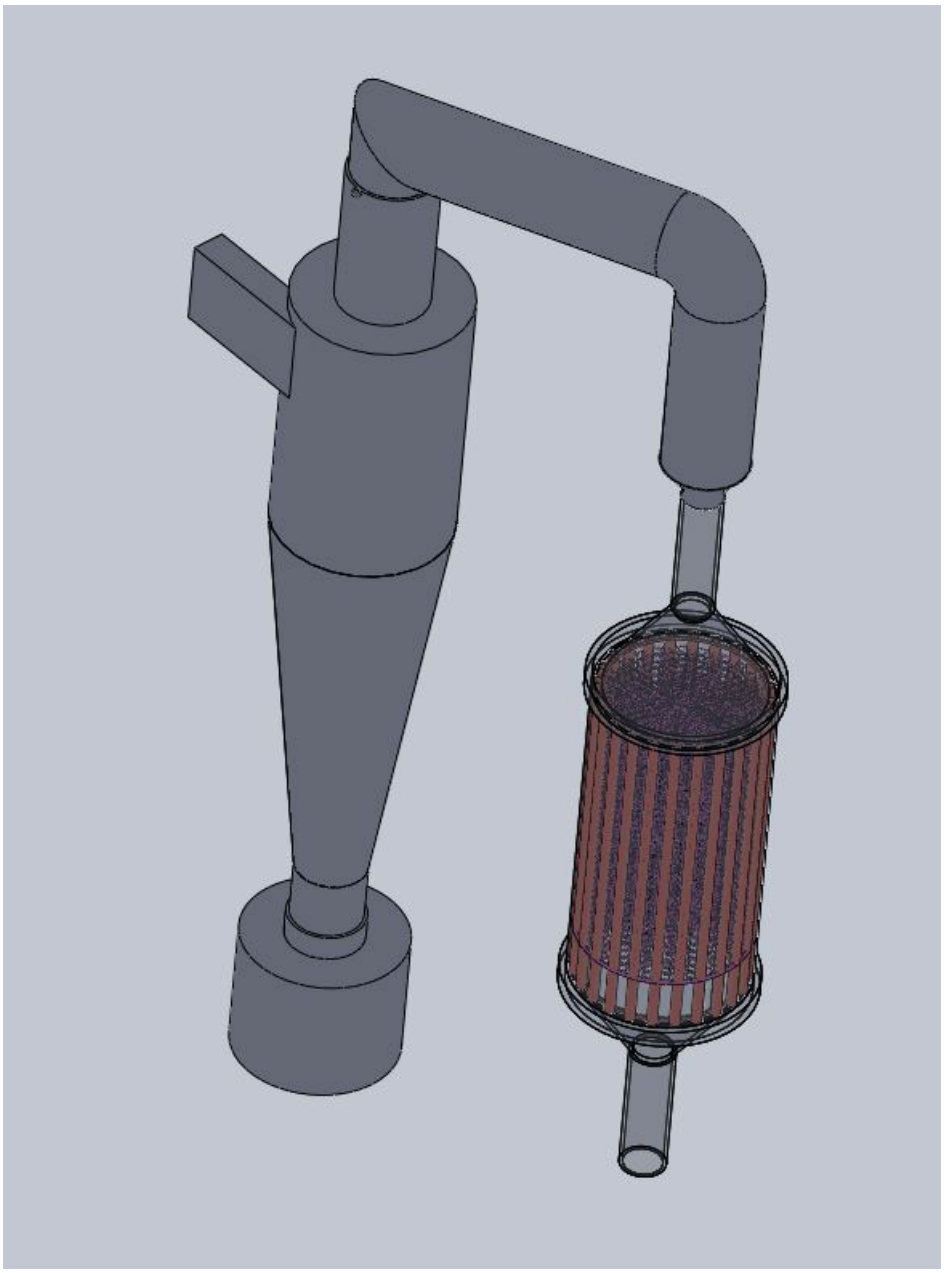

Figure 1 : Modified Cyclone Separator: Feature: modified cyclone separator specifically designed for capturing Black Carbon emissions. Benefit: The modified cyclone separator ensures efficient and effective trapping of Black Carbon particles, minimizing their rele

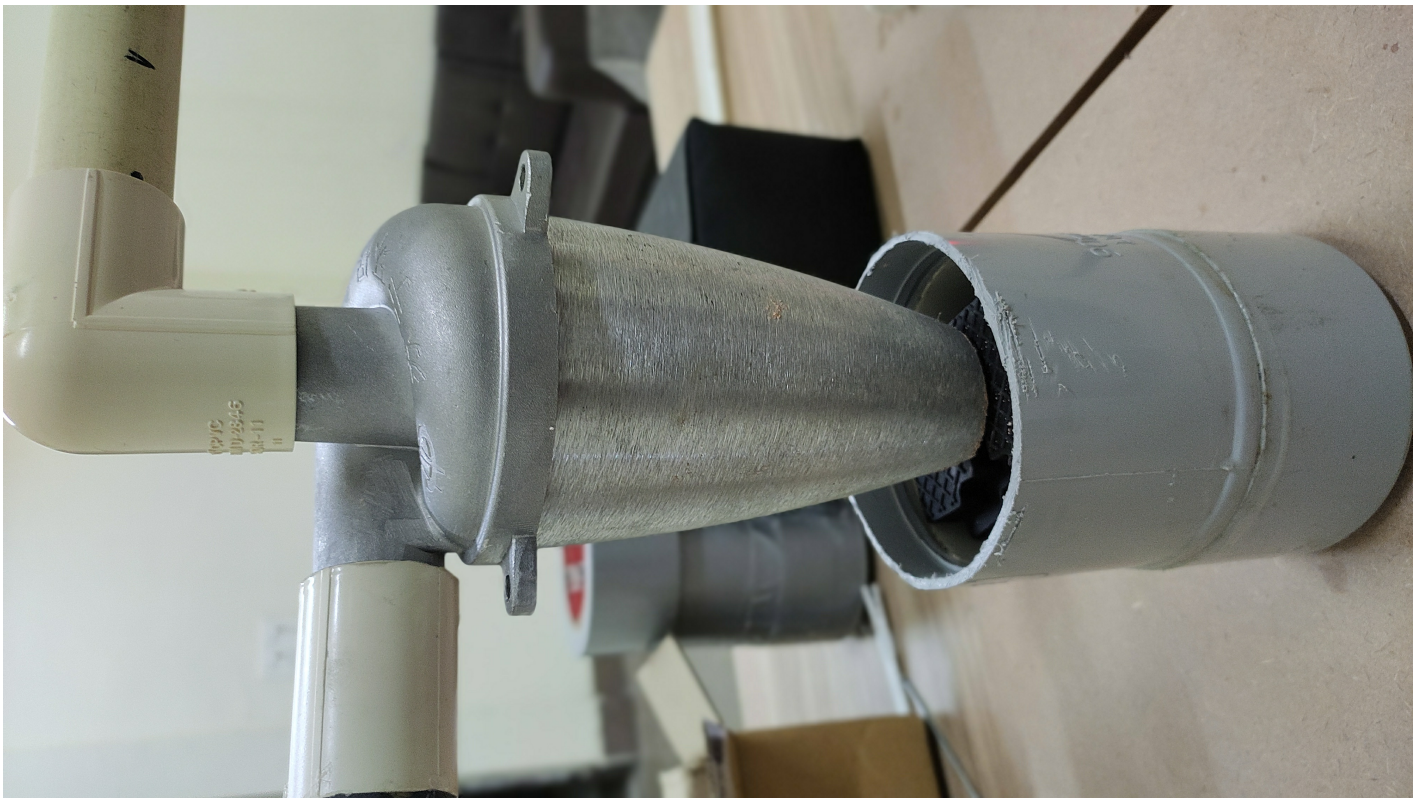

Figure 2 : Retrofitting Capability: Feature: Our product is designed for retrofitting existing brick kilns and kitchen chimneys. Benefit: Retrofitting offers a cost-effective and practical solution, avoiding the need for complete replacement of kilns and chimneys.