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Need of a Dedicated Programme on Short-Lived Climate Pollutants (SLCP) in South Asia

UMESH CHANDRA KULSHRESTHA

School of Environmental Sciences Jawaharlal Nehru University New Delhi, India.

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The Short-Lived Climate Pollutants (SLCPs) such as black carbon (BC), tropospheric ozone, methane and hydrofluorocarbons (HFCs) play very important role in climate change (UNEP-WMO, 2011). Due to their relatively shorter lifetime in the atmosphere, these are termed as Short-Lived Pollutants. For example black carbon and tropospheric ozone have lifetime of few weeks, methane and HFCs last around two decades. SLCPs adversely impact air quality and can accelerate global warming, sea level rise and other climate change related phenomenon.

Black carbon, also known as soot, is emitted from incomplete combustion of fossil fuels, biomass and biofuels. It causes dimming and contributes to positive radiative forcing (Satheesh and Ramanathan, 2000). The BC forms a significant fraction of $PM_{2.5}$ and PM_{10} aerosols having human health effects too. Every year 7 million deaths occur due to air pollution (https://www.ccacoalition.org/en/slcps/black-carbon). Major sources of ozone precursors in the urban areas include automobile and industrial emissions whereas methane is mainly emitted by paddy fields, livestock production, sewage and wetlands. Methane is a greenhouse gas having global warming potential 25 times higher than the carbon dioxide. HFCs are used in air conditioning and refrigeration etc. Their global warming potential is several times greater than other greenhouse gases. South Asian region is among one of the most densely populated regions around the world. The region is vulnerable to the impacts of black carbon (USEPA, 2012, Kim *et al*., 2021). The BC levels in the region pose a major challenge for tackling climate change. Extensive use of various fuels such as biomass, woods, cow dung cake for domestic cooking and tyre burning and other waste burning for wintertime heating purposes along with adulterated fuels and unchecked vehicular pollution emit huge quantities of BC or soot which degrades the air quality and result in hazy atmosphere, further having significant climate change and human health impacts (USEPA, 2011, Mishra and Kulshrestha, 2021). The BC also interacts with atmospheric dust

CONTACT Umesh Chandra Kulshrestha umeshkulshrestha@gmail.com School of Environmental Sciences Jawaharlal Nehru University New Delhi, India.

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forming carbon-dust composites which are deposited on the surfaces and foliage affecting plants, buildings and waterbodies BC levels have been reported eight times higher in urban atmospheric dust as compared to its corresponding soil (Mishra and Kulshrestha, 2016). Soft approaches involving mindset change can help in reducing BC emissions (Verma and Kulshrestha, 2021).

Furthermore, the tropospheric ozone is a greenhouse gas and contributes to climate change. Generally, it is formed by the reaction of volatile hydrocarbons and nitrogen oxides. Tropospheric ozone is also considered as phytotoxic and affects grassland and tree species (Dentener *et al*., 2020; Emberson, 2020, Agarwal *et al*., 2003). Recently, ozone levels have been reported higher during COVID 19 pandemic (CSE, 2020). However, during pre-pandemic period (summers of 2019) also, ozone levels were reported higher at the industrial sites in NCR Delhi. This has been explained due to action taken by the Environmental Pollution Control Authority (EPCA) through an implementation of the total ban on plastic burning and closure of illegal tire oil units in Delhi (Kulshrestha, 2020). This led to reduction in emissions of chlorine and hydrochloric acid which in turn helped in reduced levels of ozone. However, this needs comprehensive investigation across south Asia as the plastic burning activities are common in the region.

Therefore, monitoring based mitigation solutions of SLCPs are required worldwide as well as on regional scale. Promotion of best practices and showcasing the successful global and regional level efforts are also needed. The UNEP has suggested 16 key measures to reduce methane and BC emissions, and has started a Climate and Clean Air Coalition (CCAC) programme (https://www.ccacoalition.org/en). In order to achieve goals of the UNEP-CCAC by 2030, SLCP networking is much needed in south Asian region (CCAC, 2021) which can focus upon the following objectives-

1. To provide a systematic network of SLCP measurements with required QA/QC.
2. To provide research-based policy development for adaptation and mitigation of SLCPs in the south Asia.
3. To develop co-ordination and collaboration among the regional researchers and institutions.
4. To develop capacity building in the region.

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