NCAP-COALESCE
CarbOnaceous AerosoL Emissions, Source apportionment & ClimatE impacts
*Understanding scientific complexities related to carbonaceous aerosols focussing on issues underlying their origin and fate, and their role as drivers of regional climate change over India.*

Research BRIEFS

# Evaluation of organic aerosol filter sampling artefacts and implications to gravimetric $PM_{2.5}$ mass at a COALESCE network site - Bhopal, India

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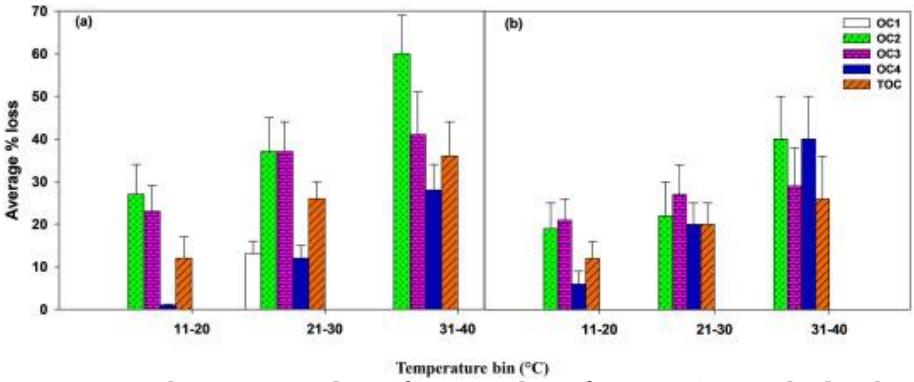


Figure 1. The average % loss of TOC and OC fractions (i.e.., volatilized OC from Teflon with reference to adsorption-corrected total particulate OC) in (a) 2019 [n=24] (b) and (b) 2020[n=26].

## *Key highlights:*

- Organic carbon sampling artefacts were estimated using multiple filter configurations.
- Adsorbed organics contributed 17% (2019) and 11% (2020) to the total particle OC.
- Organics volatilization from the Teflon filter ranged between 5% and 9% of $PM_{2.5}$ mass.
- Thermal fraction-wise, % OC and % TOC loss increased with ambient temperature.
- The number of $PM_{2.5}$ NAAQS exceedances increased on accounting for volatilized OC.

## *Summary of your Research:*

This study collected 24-h integrated PM2.5 samples over Bhopal, India, a COA-LESCE (CarbOnaceous AerosoL Emissions, Source apportionment and ClimatE impacts) site during 2019 and 2020, were used to estimate particulate organic carbon (OC) artefacts.

Total OC and its thermal fractions (OC1, OC2, OC3, and OC4) measured on 349 bare quartz (Q) and QbQ filters each, were used to determine OC positive artefacts on quartz filters. 50 QbT (Quartz behind Teflon) filters in conjunction with the simultaneous QbQ samples (a subset of the total QbQ) were used to estimate OC volatilization from Teflon filters.

On average, adsorbed gaseous OC contributed 17% and 11% to the measured total OC during 2019 and 2020, respectively. Further, the volatilization loss of organics from the Teflon filter (used to quantify $PM_{2.5}$ mass) ranged between 7%and 9% and 5% and 6% of the $PM_{2.5}$ mass during 2019 and 2020, respectively.

The results of this study provide the first systematic long-term evaluation of thermal carbon fraction-wise sampling artefacts, estimates of organic volatilization losses from Teflon filters, and their implications to $PM_{2.5}$ mass closure over a regional background location in India

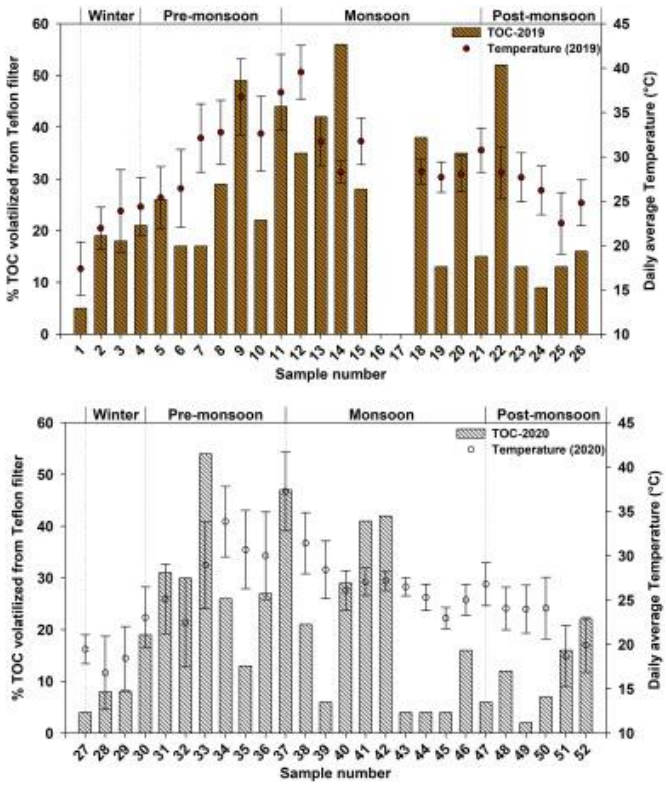


Figure 2. Seasonal variation of the % TOC loss from Teflon filters with reference to total particulate OC. Data are shown for the 50 samples collected during 2019 (upper panel) and 2020 (lower panel)

***Take away/conclusion :***

- The results provide the first systematic long-term (two annual cycles) evaluation of fraction-wise OC sampling artefacts and estimates of OM volatilization losses from Teflon filters, together with its implications to $PM_{2.5}$ mass closure, over Bhopal, Central India.
- It shows that organic volatilization artefacts from Teflon filters are likely to be substantial at most locations in India, where temperatures exceed 30 °C for most of the year, and should be accounted for mass closure.
- This work provides a framework for COALESCE network-wide organic artefact correction and possible extension to other locations in the country for gravimetric $PM_{2.5}$ mass corrections, even when OC is not measured.

Research Article citation


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