

Introduction

Nano- and microplastics (NMPs) are increasingly recognized as global contaminants that pollute air, water, and soils. These particles, often originating from the breakdown of packaging and other synthetic materials, can disperse widely in the environment and enter food chains. Of particular concern is the **PM_{2.5} fraction** ($\leq 2.5 \mu\text{m}$), which penetrates deep into the respiratory system and has been linked to inflammation, metabolic disruption, and long-term health risks such as neurotoxicity and cancer. Understanding the occurrence of NMPs in urban air is therefore critical, especially in rapidly growing cities where pollution levels are already a major public health issue.

Objective

To determine whether five common polymers—PE, PP, PS, PVC, and PET—are present in PM_{2.5} collected from urban sites in **Dhaka, Bangladesh** using FT-IR as a rapid, non-destructive screen.

Sampling

The study was conducted in **Dhaka, Bangladesh**, a megacity known for severe winter air pollution episodes. To capture this peak season, PM_{2.5} samples were collected between **15 December 2024 and 13 February 2025** using 90 mm quartz filters. A median-volume sampler equipped with a **PM_{2.5} inlet (Model TH-150H, China)** operated at a flow rate of **70 L min⁻¹** for consecutive 48-hour runs (09:00–09:00). In total, **nine valid samples** were obtained, each representing approximately **201.6 m³ of air**, providing material for FT-IR analysis of airborne nano- and microplastics.

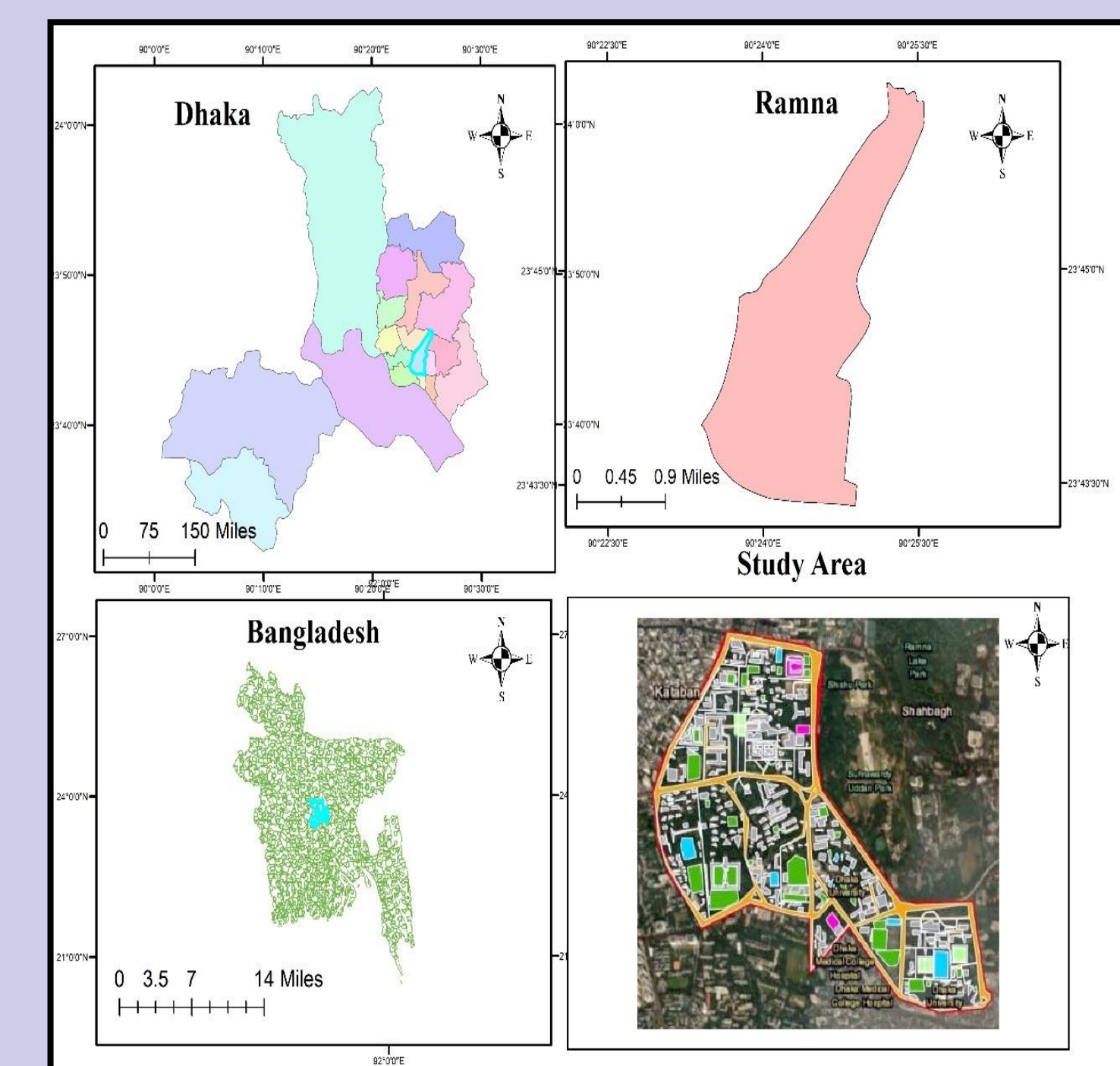


Figure: Quartz filter (a) before sampling (b) after sampling

Workflow

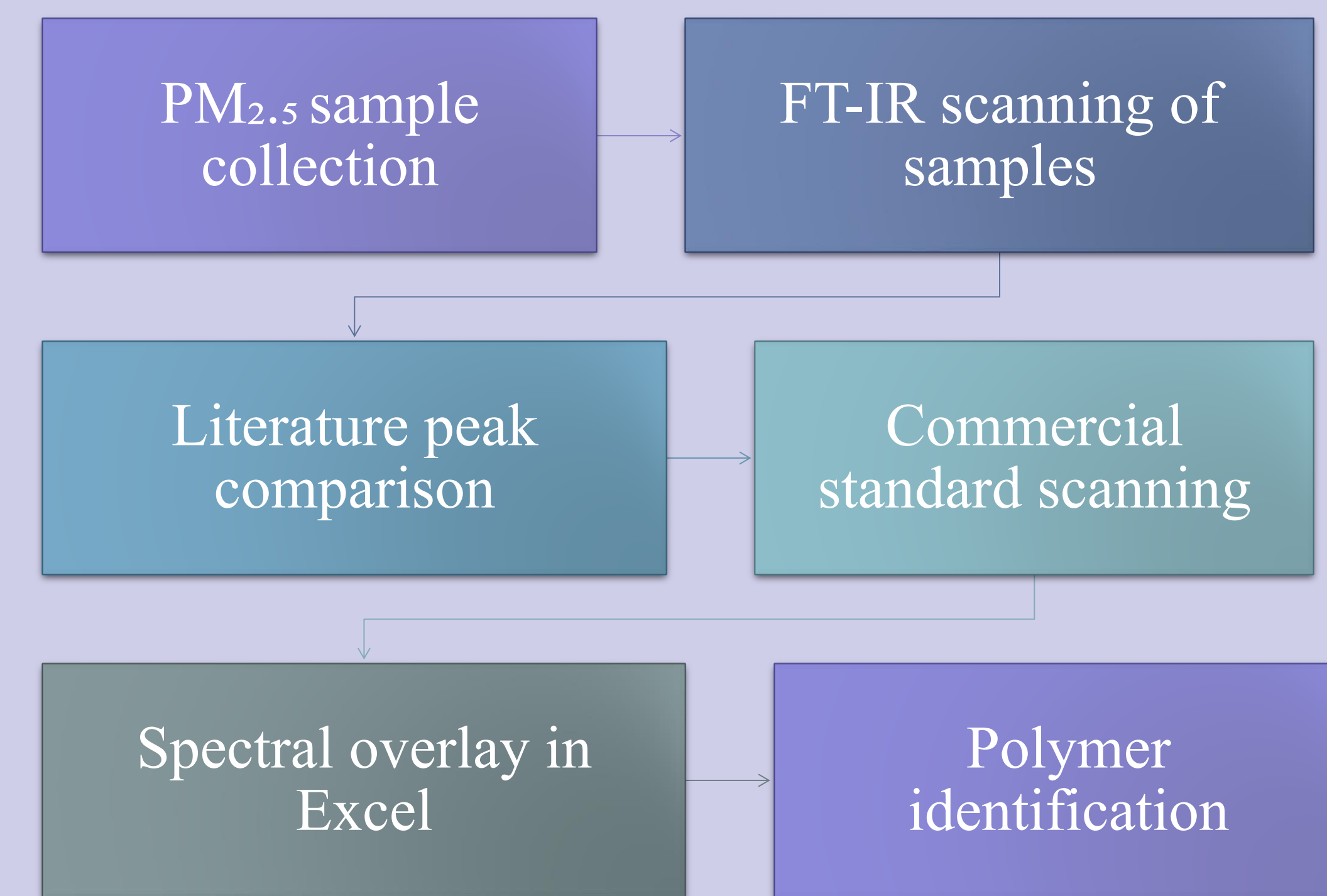


Table: Considered main peaks for the identification of the microplastics

Functional group and mode of vibration	Peak position (cm ⁻¹)	Corresponding Polymer
C-Cl stretching	~615	PVC
C=C (of aromatic ring) stretching	~1500, ~1600	PET, PS
C=O stretching	~1720	PET
C-O stretching	~1100, ~1245	PET
Monosubstituted aromatic ring bending	~760	PS
CH ₂ rocking	~720, ~730	PE
CH ₃ bending	~1375	Polypropylene



Figure: Used instruments in the study: (a) Fourier transform infrared (FTIR) spectrophotometer (b) TH-150H air sampler

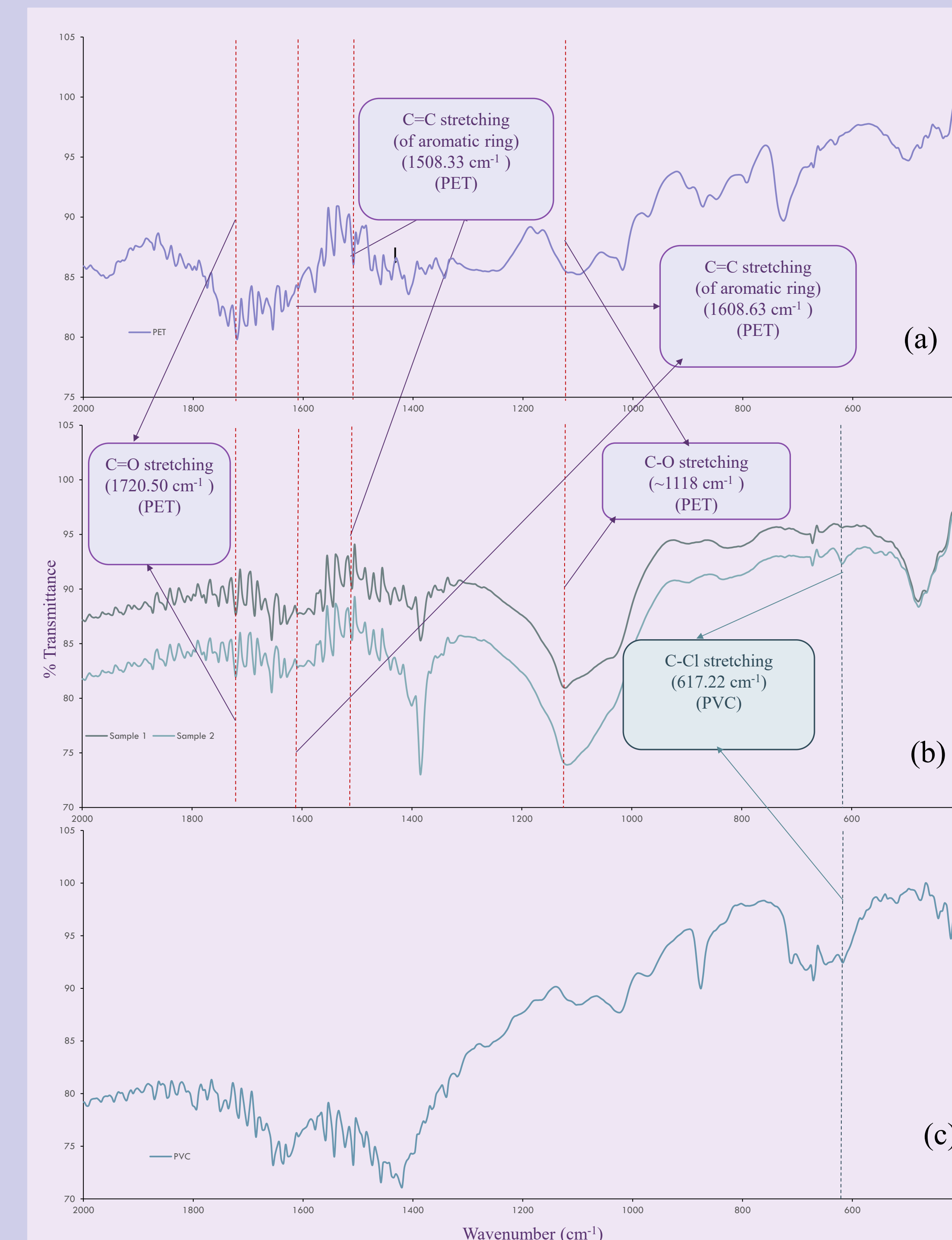


Figure: Comparison among spectra of two samples (a) to that of commercial PET (b) and PVC (c) in the range of 400–2000 cm⁻¹

Spectral Evidence

The PM_{2.5} sample spectra showed a clear **PVC C–Cl stretch at 617.22 cm⁻¹**, indicating PVC. For PET, the **C=O stretch at 1720.50 cm⁻¹**, **aromatic C=C stretch at 1508 cm⁻¹ and 1608 cm⁻¹**, and **C–O stretch at ~1100 cm⁻¹** were present despite a weak ~1245 cm⁻¹ band, supporting PET assignment. Although aromatic C=C peaks could arise from **PS**, the typical ~760 cm⁻¹ PS band for monosubstituted aromatic ring bending was not observed. **PE/PP** indicators (for PE CH₂ rocking ~720 cm⁻¹ and ~730 cm⁻¹; for PP CH₃ bend ~1375 cm⁻¹) were weak.

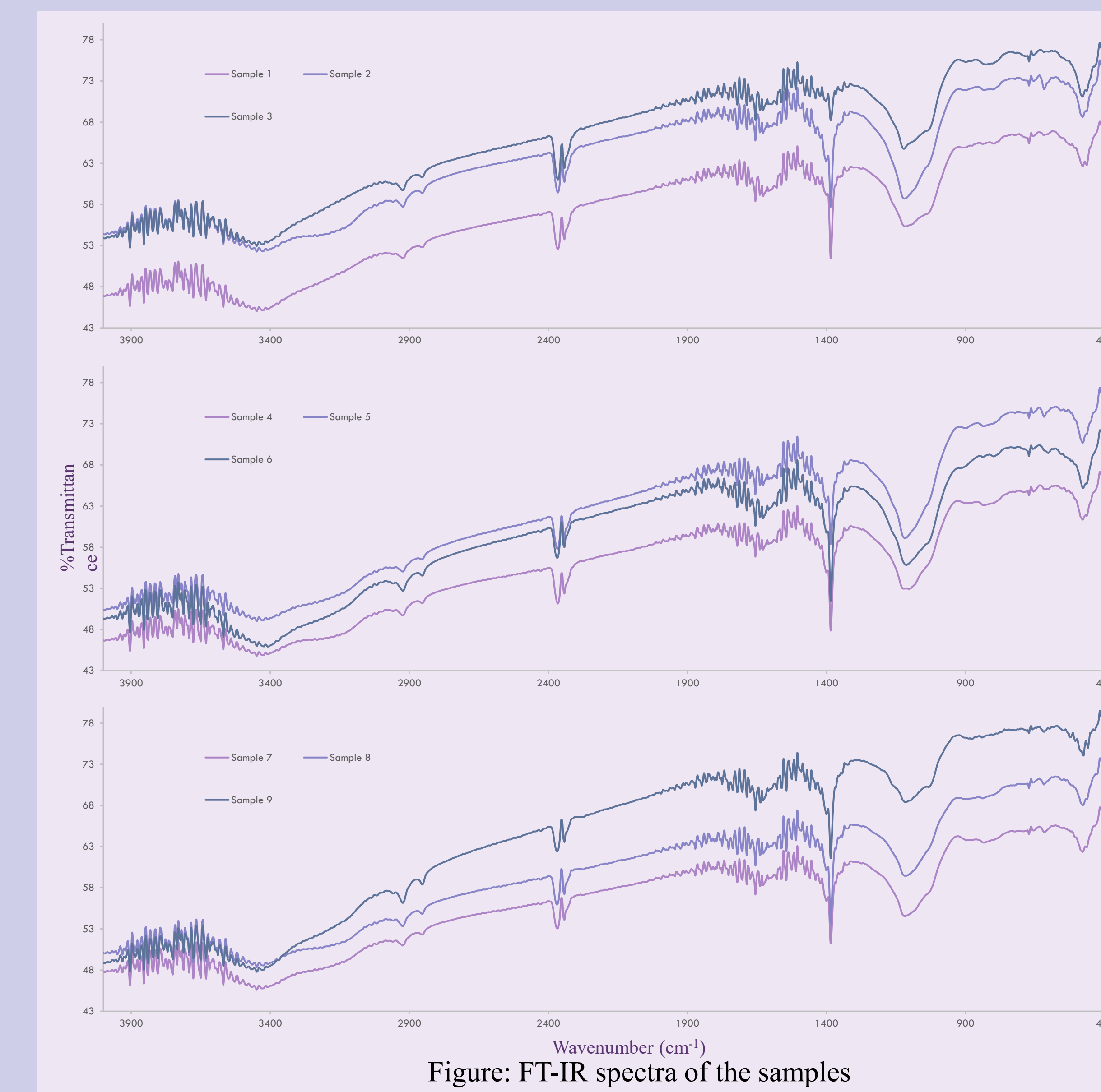


Figure: FT-IR spectra of the samples

Results

Overall, the spectra show consistency with the presence of **PVC and PET** in PM_{2.5} of Dhaka during the study. **PS, PE, and PP** signals were **not prominent**, suggesting **low contribution** under these conditions.

References

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