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# 23TH INTERNATIONAL ISTANBUL SCIENTIFIC RESEARCH CONGRESS ON LIFE, ENGINEERING, ARCHITECTURE, AND MATHEMATICAL SCIENCES PROCEEDINGS BOOK

**NOVEMBER 20-22, 2025**
**İSTANBUL, TÜRKİYE**



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**NOVEMBER 20-22, 2025**

**ONLINE & IN-PERSON PARTICIPATION**

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# CONGRESS PROCEEDINGS BOOK

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PROCEEDINGS BOOK

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*(FROM 27 DIFFERENT COUNTRIES)*

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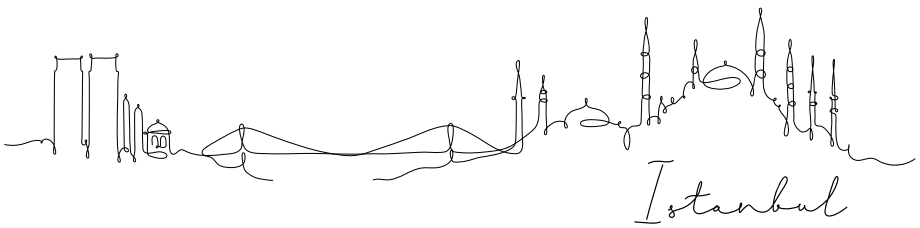


# 23TH INTERNATIONAL ISTANBUL SCIENTIFIC RESEARCH CONGRESS ON LIFE, ENGINEERING, ARCHITECTURE AND MATHEMATICAL SCIENCES

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**NOVEMBER 22, 2025**
**DAY 3 | CONGRESS OPENING PROGRAM**



# 23TH INTERNATIONAL ISTANBUL SCIENTIFIC RESEARCH CONGRESSES ON LIFE, ENGINEERING, ARCHITECTURE, AND MATHEMATICAL SCIENCES

**GÜN 1 / DAY 1 – NOVEMBER 20, 2025 / 20 KASIM 2025**
**GÜN 2 / DAY 2 – NOVEMBER 21, 2025 / 21 KASIM 2025**
**GÜN 3 / DAY 3 – NOVEMBER 22, 2025 / 22 KASIM 2025**

**1. OTURUM | SESSION 1 (13.00-19.00)**
**2. OTURUM | SESSION 2 (13.00-19.00)**
**3. OTURUM | SESSION 3 (10.00-19.00)**

November 20-22, 2025 | 20-22 Kasım 2025
Istanbul, TURKIYE

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Online (with Video Conference) Presentation

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**DAY 3 | GÜN 3**
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**MEETING ID: 873 1410 5281**
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| | 20.11.2025 | Time: 13$^{00}$-16$^{15}$ (Turkey Local time GMT+3) | MODERATOR & HEAD OF SESSION: *Nigar EMECEN EZGİN* |
|---|---|---|---|
| | **Authors** | **Affiliation** | **Topic title** |
| 13$^{00}$-13$^{15}$ | Şükrü EFLANİLİ | *Yıldız Technical University, Türkiye* | EVALUATION OF NOISE CONTROL AND REVERBERATION TIME IN EDUCATIONAL SPACES |
| 13$^{15}$-13$^{30}$ | İnci Damla KÖROĞLU<br>Demet ARSLANBAŞ | *Kocaeli University, Türkiye* | PLASTIC POLLUTION IN SOIL |
| 13$^{30}$-13$^{45}$ | İrem Nisa EKİZ<br>Demet ARSLANBAŞ | *Kocaeli University, Türkiye* | ASSESSMENT OF PHTHALATE POLLUTION IN STREET DUST |
| 13$^{45}$-14$^{00}$ | Seren ACARER ARAT | *Istanbul Technical University, Türkiye* | APPLICATION OF THE HANSEN SOLUBILITY PARAMETERS APPROACH FOR SELECTING SINGLE AND BINARY SOLVENTS IN POLYMERIC MEMBRANE PRODUCTION: ASSESSMENT OF POLYMER–SOLVENT COMPATIBILITY |
| 14$^{00}$-14$^{15}$ | Tuğba AYDOĞAN AKCALI<br>Esra CAN DOĞAN | *Kocaeli University, Türkiye* | EVALUATION OF WASTEWATER TREATMENT AND WATER RECLAMATION TECHNOLOGIES BASED ON COUNTRIES DEVELOPMENT LEVELS |
| 14$^{15}$-14$^{30}$ | Zeynep KAN<br>Esra CAN DOĞAN | *Kocaeli University, Türkiye* | WASTEWATER MANAGEMENT WITHIN THE SCOPE OF BEST AVAILABLE TECHNIQUES (BAT) IN DETERGENT MANUFACTURING PROCESSES |
| 14$^{30}$-14$^{45}$ | Işıl ÇELİK SAĞLAM<br>Çiğdem BALÇIK<br>Banu ÇETİN | *Gebze Technical University, Türkiye* | DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS FORMED IN POTATOES AND OILS DURING DEEP-FRYING USING DIFFERENT VEGETABLE OILS |
| 14$^{45}$-15$^{00}$ | Ceyhun AKARSU<br>Nüket SİVRİ | *Istanbul University-Cerrahpasa, Türkiye* | ENVIRONMENTAL LOAD ESTIMATION OF PERSONEL CARE PRODDUCT-DERIVED MICROPLASTICS IN URBAN WASTEWATER: A CASE STUDY OF ISTANBUL |
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# DISTRIBUTION OF PHTHALATE ESTERS IN SETTLED DUST ACROSS ACADEMIC INDOOR ENVIRONMENTS

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## ABSTRACT

Phthalate esters (PAEs) are widely used plasticizers that readily migrate from consumer products into surrounding environmental matrices. Among these, indoor dust serves as a significant reservoir due to its ability to accumulate semi-volatile organic compounds over time. University campuses encompass a variety of indoor microenvironments, such as offices, classrooms, and laboratories, that differ in their use of plasticized materials, yet the distribution of PAEs across these settings remains underexplored. In this study, the concentrations of selected PAEs were measured in settled dust collected from three different microenvironments within a university campus: offices, classrooms, and laboratories. Target PAEs were quantified using gas chromatography–mass spectrometry (GC–MS). Total PAE concentrations varied among environments, with the highest levels observed in classrooms (54.55 µg/g and 62.66 µg/g), followed by laboratories (33.32 and 41.68 µg/g) and offices (24.61 µg/g and 27.78 µg/g). The most abundant compounds were di-(2-ethylhexyl) phthalate (DEHP) and benzyl butyl phtlate (BBP), which together accounted for the majority of the total PAE burden (73%-89%). These differences are likely influenced by differences in material composition, number of occupants, and ventilation duration among the microenvironments. The findings provide a reference point for phthalate levels in university indoor environments and highlight the need for more comprehensive evaluations that incorporate both dust and gas-phase sampling, as well as ventilation assessments. While the concentrations measured in this study were substantially lower than those reported in early childhood settings, the presence of toxic PAEs,suggests that exposure in densely populated academic indoor spaces should not be overlooked.

**Keywords:** Phthalate esters (PAEs), indoor dust, clasrrom, office

## INTRODUCTION

Phthalate esters (PAEs) are synthetic organic compounds commonly added to polymeric materials such as polyvinyl chloride (PVC), polyethylene, polypropylene, polyurethanes and other plastic products to enhance flexibility, softness, and durability (Zaman et al., 2005; Wenjuan, 2025). These compounds are incorporated into a diverse range of commercial products, including floor coverings, adhesives, paints, plastic wires, food packaging, medical supplies, cosmetics, and personal care items (Arrigo et al., 2023;

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Urmi et al., 2023a, 2023b). Global production of PAEs has increased significantly in recent years, from 8 million tons in 2016 (Weizhen et al., 2020) to over 10.6 million tons (Dueñas-Moreno et al., 2022).

Many PAE-containing materials are prevalent in indoor spaces such as classrooms, laboratories, and offices. These include vinyl flooring, laminated furniture, plastic tubing, and lab equipment, which are frequently used in academic environments (Urmi et al., 2023). Additionally, external urban sources like vehicular emissions, industrial activity, and ambient air pollution may contribute to indoor PAE levels through resuspension or infiltration (Zaman et al., 2025). Classrooms often contain synthetic surfaces, high occupant turnover, and minimal air filtration, all of which increase the relevance of evaluating phthalate exposure in these settings. Therefore, assessing PAE concentrations in university microenvironments is an essential step toward understanding potential exposure pathways and identifying effective mitigation strategies

Because PAEs are not chemically bound to polymer matrices, they readily migrate into the surrounding environment over time (Paluselli & Kim, 2020). Indoor dust, with its high surface area and ability to accumulate semi-volatile organic compounds (SVOCs), serves as a major reservoir for PAEs (Besis & Samara, 2012). Indoor environments represent the primary microenvironments for human exposure, as individuals spend more than 90% of their time indoors (Vardoulakis et al., 2020).

PAE exposure has been linked to endocrine disruption, reproductive toxicity, developmental impairment, respiratory effects, and cognitive impacts, especially among children (Callesen et al., 2014; Kang et al., 2021; Kashyap & Agarwal, 2018). As a result, several PAEs are considered substances of concern by international authorities. For example, the European Union restricts DEHP, DBP, BBP and DIBP under REACH Annex XVII due to their reproductive toxicity classification, while the US Environmental Protection Agency has listed a group of eight phthalates for further risk evaluation because of their potential toxicity and exposure concerns (EU, 2018; USPEA, 2012)

University campuses consist of diverse indoor microenvironments such as ffices, classrooms, and laboratories in which each characterized by different building materials, cleaning frequencies, and usage patterns. Despite this diversity, limited research has assessed the variability of PAE accumulation across campus facilities (Qu et al., 2021; Duan et al., 2022; Meng et al., 2020)). This study aims to evaluate the distribution of 13 target PAEs in settled dust collected from offices, classrooms, and laboratories located within an engineering faculty, and to explore potential emission sources associated with each microenvironment.

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## MATERIALS AND METHODS

### *Sample Collection*

Dust samples were collected from indoor surfaces in three types of microenvironments within the engineering faculty of Kocaeli University: offices (n = 2), classrooms (n = 2), and laboratories (n = 2). Sampling was conducted during regular working hours using pre cleaned brush, targeting settled dust on floors and accessible surfaces.. After collection, the dust was transferred into pre-cleaned amber glass containers, sealed with Teflon-lined caps, and stored at 4 °C until extraction and instrumental analysis. Information regarding the room function, surface materials (e.g., PVC or ceramic flooring), and occupancy characteristics was also recorded to support the interpretation of potential PAE sources.

### *Extraction and Instrumental Analysis*

Approximately 0.5–1.0 grams of homogenized dust were weighed and spiked with 5 ng of surrogate standards including dibenzyl phthalate, diphenyl isophthalate, and diphenyl phthalate. Extraction was performed using 20 mL of a 1:1 (v/v) acetone:n-hexane solution. Samples were subjected to ultrasonication for 60 minutes followed by centrifugation at 3000 rpm for 15 minutes. The supernatant was collected, and the residue was re-extracted twice using fresh solvent to maximize recovery. Combined extracts were reduced to approximately 1 mL using a rotary evaporator and nitrogen blowdown.

The concentrated extract was purified via solid-phase extraction (SPE) using Mega Bond Elut BE-SI (5 g, 20 mL Agilent) silica cartridges, preconditioned with 15 mL n-hexane. Elution was carried out with 30 mL acetone, and the eluate was again reduced to 1 mL prior to analysis.

Quantification of target PAEs was performed using an Agilent 6890N gas chromatograph coupled to a 5973 inert mass selective detector (MSD) operating in electron impact (EI) mode. The chromatographic separation was achieved using an HP5-MS capillary column (30 m × 0.25 mm i.d., 0.25 µm film thickness). The PAEs were detected in the system with the following oven temperature program: 60 °C for 1 min, increased to 220 °C with 20 °C/min ramp and held for 1 min, finally increased to 290 °C with 5 °C/min and waited for 12 min. Injection port, ion source, and quadrupole temperatures were set to 270 °C, 295 °C, and 280 °C, respectively. External calibration curves ($R^2 \geq 0.99$) were generated for each congener Retention times and selected ions (quantifier and qualifiers) used for identification are detailed in Table 1.

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**Table 1:** The retention times, m/z ions of quantifier and qualifier ions

| PAEs | Retention Times (min) | Quantifier/ Qualifier Ions | LOD/LOQ (ng /g dust) |
|---|---|---|---|
| DMP | 7.68 | 163 | 0.12 |
| DEP | 8.54 | 149/ 177 | 1.72 |
| DiBP | 10.29 | 149/ 223 | 1.85 |
| DnBP | 11.01 | 149 | 1.45 |
| DEEP | 11.10 | 59/ 58 | 0.17 |
| DMEP | 12.50 | 72/149 | 1.11 |
| DPP | 12.92 | 149 | 0.12 |
| DHP | 15.13 | 149/ 57 | 0.10 |
| BBP | 15.25 | 149/ 91 | 0.29 |
| DBEP | 16.73 | 57/ 56 | 1.11 |
| DcHP | 17.41 | 149/ 167 | 0.10 |
| DEHP | 17.57 | 149/ 167 | 2.21 |
| DnOP | 20.17 | 149 | 0.15 |

### Quality Assurance and Detection Limits

To control for potential contamination during sampling and analysis, two field blanks and two laboratory blanks were analyzed. Pre-treated sodium sulfate ($Na_2SO_4$), heated at 550 °C, was placed in clean glass jars and briefly exposed to sampling environments (field blanks) or kept sealed in the lab (lab blanks).

DEP, DiBP, DnBP, DBEP, and DEHP were detected in field blanks, and measured concentrations were corrected accordingly. A five-point calibration curve was established for each compound with strong linearity ($R^2 > 0.99$). Surrogate recoveries were within acceptable limits: 96.6% for diphenyl isophthalate, 101.4% for diphenyl phthalate, and 104.9% for dibenzyl phthalate.

Method detection limits (MDLs), calculated based on the lowest standard and a signal-to-noise ratio of 3, ranged from 0.1 ng/g (DcHP) to 2.21 ng/g (DEHP). Details on retention times and quantification ions are provided in Table S2 (Supplementary Material).

## RESULTS AND DISCUSSION

The sum of phthalate esters ($\sum_{13}$PAE) in settled dust varied among three types of university microenvironments.The PAEs concentrations measured in all microenvironemnts were given in Table 2. Classrooms exhibited the highest $\Sigma_{13}$PAE (54.45 µg/g-62.66 µg/g), followed by laboratories (33.32 µg/g and 41.68 µg/g) and offices (24.61 µg/g and 27.78 µg/g). This spatial pattern aligns with the

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functional characteristics and material composition of each setting: classrooms were high-traffic areas with PVC flooring; offices were low-occupancy spaces with limited footfall; and laboratories featured ceramic flooring and specialized plastic-containing equipment, contributing variably to phthalate presence. This ordering is consistent with other reports: for example, Liu et al. (2022) found median total phthalate concentrations in Chinese school dust were orders of magnitude higher than in office dust. Likewise, Lv et al. (2025) observed that Beijing office dust contained significantly lower ΣPAEs than dust from dormitories and other campus locations. These comparisons suggest that high occupancy as well as plasting flooring in classrooms elevate indoor phthalate load, while sparsely-furnished offices tend to accumulate less dust-bound PAEs.

Table2: PAEs concentrations measured in all microenvironemnts (ng/g)

| | | classroom 1 | classroom 2 | laboratory 1 | laboratory 2 | office 1 | office 2 |
|---|---|---|---|---|---|---|---|
| Di methyl phthalate | DMP | 0.34 | 0.48 | 0.85 | 0.59 | 0.04 | 0.05 |
| Di ethyl phthalate | DEP | 0.58 | 1.85 | 3.77 | 0.41 | 0.25 | 0.73 |
| Di isobuthyl phtlate | DiBP | 1.63 | 1.80 | 2.27 | 0.40 | 0.69 | 0.83 |
| Di n butyl phthalate | DnBP | 4.39 | 5.43 | 5.77 | 1.67 | 1.77 | 2.31 |
| Diethoxyethyl phthalate | DEEP | 0.28 | 0.01 | 0.35 | 0.00 | 0.00 | 0.00 |
| Dimethoxyethyl phthalate | DMEP | 0.01 | 0.00 | 0.06 | 0.02 | 0.02 | 0.04 |
| Di pentyl phthalate_ | DPP | 0.03 | 0.03 | 0.23 | 0.01 | 0.01 | 0.04 |
| di hexyl phthalate | DHP | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Benzyl butyl phtlate | BBP | 8.70 | 8.06 | 7.69 | 3.28 | 5.60 | 5.41 |
| Dibutoxyethyl phthalate | DBEP | 0.56 | 1.09 | 0.07 | 3.89 | 0.00 | 2.41 |
| Di cyclohexy phtlate | DcHP | 2.31 | 2.09 | 0.00 | 0.51 | 0.20 | 0.28 |
| Di 2ethyhexyl phtlate | DEHP | 41.89 | 32.45 | 20.47 | 22.12 | 19.08 | 12.48 |
| Di n octy phthalate | DnOP | 1.95 | 1.23 | 0.15 | 0.42 | 0.11 | 0.05 |
| **Total PAEs** | **$\Sigma_{13}$PAEs** | 62.66 | 54.55 | 41.68 | 33.32 | 27.78 | 24.61 |

The percent distribution of PAE congeners is presented in Figure 1.Among all detected congeners, DEHP dominated in all microenvironments, with concentrations ranging from 12.48 µg/g (office 2) to 41.89 µg/g (classroom 1), accounting for 50% to 69% of the total PAE burden. Following DEHP, BBP was generally the second most abundant in offices and classrooms, while DiBP and DBP varied by room type.

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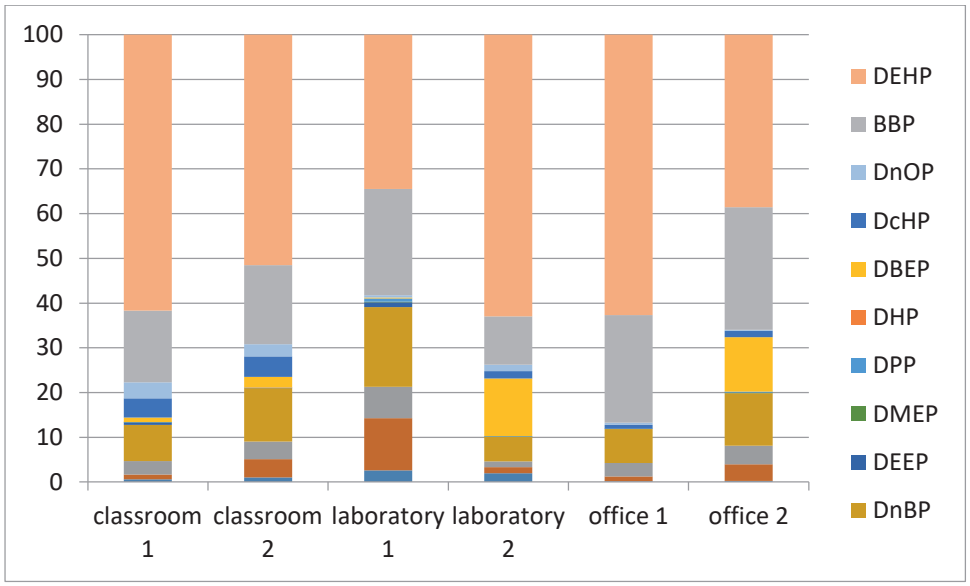



Figure 1: Percent distriubiron of PAE congeners.

Dust from offices was dominated by DEHP (24.61µg/g and 27.78 µg/g) and, in one case, unusually high BBP (5.60 µg/g and 5.41 µg/g) and DnBP (1.77 µg/g and 2.31 µg/g). Overall, DEHP and BBP together accounted for most ΣPAE in offices. These compounds likely derive from building materials and personal items: DEHP is common in vinyl flooring and PVC-based furniture, The relatively low dust levels of low-molecular-weight PAEs (DMP, DEP) in offices (0.04 -0.74 µg/g) suggest minimal contribution from cleaners or fresh emissions. In the literature, DEHP and DnBP are frequently reported as dominant indoor dust PAEs in office-like settings (Liu *et al.* 2022). The high BBP in one office might reflect specific materials (e.g. vinyl tiles or tile adhesives), consistent with reports that BBP can spike in enclosed microenvironments with PVC surfaces (Zhang et al., 2022).

Classrooms had the highest phthalate levels, with DEHP (32.45 µg/g and 41.89 µg/g) markedly dominating, followed by BBP (8.06 µg/g and 8.70 µg/g), DnBP (4.39 µg/g and 5.43 µg/g), and DnOP (1.23 µg/g and 1.95 µg/g) (Table 1). The large DEHP fractions (≈60 and 67% of ΣPAE) are consistent with extensive PVC flooring and wall coverings in classrooms. A similar dominance of DEHP is seen in school dust globally (Liu *et al.* 2022). High DiBP and DnBP likely stem from students' belongings (plastic backpacks, stationery) and building materials (plasticizers in paints or binders). Notably, our classroom dust also contained substantial DcHP (2.09 µg/g and 2.31 µg/g), which may come from rubber or plastic tubing in classroom equipment. In prior studies of children's rooms and schools, DEHP and DBP (DnBP) were similarly the largest contributors (Luongo and Östman 2016; Fromme *et al.* 2013). The elevated ΣPAE in classrooms thus reflects both flooring and heavy occupant traffic (high resuspension of settled dust), as expected given their use of PVC materials and high occupancy.

Laboratory dust levels were intermediate (30.23 µg/g- 32.38 µg/g). DEHP was again substantial (20.47 µg/g and 22.12 µg/g), followed by BBP (3.28 µg/g and 7.69 µg/g)Lab-1 showed higher DiBP (0.40 µg/g and 2.27 µg/g) and DnBP(1.67µg/g and 5.77 µg/g), likely from equipment or different solvent used in the laboratory. These variations could arise from differences in lab activities and contents: ceramic floors (used in our labs) reduce PVC sources, but plastic-coated equipment, tubing, and furniture (e.g. MDF benches, as suggested by Zhang *et al.* (2024) for dormitory furniture) still emit phthalates. The presence of DiBP and DnBP may also reflect spesific solvents used in lab.. Overall, lab dust profiles resembled those reported in institutional or workplace studies, where DEHP often remains high but DiBP/BBP can make up a significant fraction.

### *3.2. Comparison with literature*

Table 3 compares our median PAE concentrations of all measured indoor environments. At the individual-congener level, DEHP was overwhelmingly dominan, This agrees with many studies: for instance, Basaran et al. (2020) found DEHP as the most abundant PAE in Turkish indoor dustlink.springer.com, and Qu et al. (2021) similarly reported DEHP proportions of ~67–73% in Beijing classroom and dormitory dustpubmed.ncbi.nlm.nih.gov. By contrast, other phthalates showed more variable patterns. BBP (butyl benzyl phthalate) was the next most abundant in classroom and office dust (~8–13% of ΣPAEs), whereas laboratories had relatively lower BBzP. This too mirrors prior work: Basaran et al. noted BBzP often ranked third in homes after DEHP and DBPlink.springer.com. DiBP and DnBP contributed only a few percent of ΣPAEs in our samples, though they were still among the top congeners; Qu et al. also identified DnBP and DiBP as the other major dust phthalates in schools and dormspubmed.ncbi.nlm.nih.gov.

Qualitatively, our findings match reported differences across environments. For example, Liu et al. (2022) showed that Chinese schools (analogous to our classrooms) had much higher dust phthalate levels than officespubmed.ncbi.nlm.nih.gov, and their review confirms DEHP, DnBP, and DiBP as the principal phthalates. In another campus study, Lv et al. (2025) found ΔPAE levels in dormitories and shops far exceeded those in office areas, with DEHP, DBP and DiBP composing over 90% of total PAEspubmed.ncbi.nlm.nih.gov. Likewise, Al Qasmi et al. (2019) reported that university laboratories contained extremely high DEHP and DINP levels compared to homespubmed.ncbi.nlm.nih.gov – a pattern analogous to our elevated DEHP in high-use classrooms and labs. Together, these comparisons reinforce that room use and furnishing strongly influence PAE profiles: classrooms and labs, with many plastic items and students, tend to have higher ΣPAEs and distinctive congener patterns relative to quieter, sparsely furnished officespubmed.ncbi.nlm.nih.govpubmed.ncbi.nlm.nih.gov

PAE levels measured in this study were substantially lower than those reported in international studies. Research from Turkey also identified DEHP as the predominant congener in indoor dust (Basaran et al., 2020). Studies conducted in China, Taiwan, Iran, and Greece have documented DEHP levels exceeding

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several hundred µg/g in school environments ( Wang et al ., 2020; Huang et al., 2019; Abdi et al ., 2021 ; Besis et al ., 2023 ).

*Table 3. Comparison of typical phthalate concentrations in indoor dust (median values) from this study and selected literature reports (µg/g) (revised from Sofuoglu et al., 2024).*

| City/Country | Indoor Type | Dust Diameter (µm) | n | DMP | DEP | DIBP | DBP | BBP | DEHP | DNOP | Kaynaklar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kocaeli | Class, office, lab. | 63 | 6 | 0.41 | 0.65 | 1.23 | 3.35 | 6.65 | 21.30 | 0.28 | This study |
| **ASIA** | | | | | | | | | | | |
| 7 regions/China | dormitory | 74 | 21 | 0,12 | 0,09 | 9,0 | 12 | 0,05 | 35 | 0,13 | Li et al..,2021 |
| Beijing China | kindergarden | 250 | 45 | | | 166±251 | 124±102 | | 333±432 | | Wang et al.., 2020 |
| Şangay/China | dormitory | | | 0,16 (nd-0,46) | 0,11 (nd-0,25) | | 106 (3-330) | | 271 (2-585) | | He et al.., 2016 |
| Hangzhou /China | dormitory | | | 0,33 (nd-2,78) | 4,13 (nd-2,31) | 5,68 (0,1-23) | 6,55 (0,4-23) | | 107 (75-380) | | Huang et al.., 2014 |
| Beijing China | kindergarden | | | | | 94,8 (15-2830) | 31 (7-473) | | 202 (17-3910) | | Wang et al.., 2017 |
| Taiwan | school | 300 | 21 | ND | ND | ND | 7,8* | 2* | 867* | 212* | Huang et al..,2019 |
| | kindergarden | 300 | 25 | ND | ND | 3,6* | 9,2* | ND | 572* | 181* | |
| Seul/Kore | school | | 21 | | ND | | 181 | 50 | 418 | | Kim et al., 2009 |
| | kindergarden | | 19 | | ND | | 216 | 299 | 591 | | |
| Tahran/İran | school | 1400 | 21 | 0,99±0,35 | 0,22±0,38 | | 6,89±4,04 | 0,29 | 304±334 | 5,96±4,87 | Abdi et al..,2021 |
| **EUROPE** | | | | | | | | | | | |
| Selanik/Greece | School and kindergarden | 1000 | 20 | 2,8±2 | 3,2±2 | 15±18 | 54±77 | 92±181 | 238±15 | 13±7,7 | Besis et al.., 2023 |
| Denmark | school | | 15 | | | | | | 3214 | | Clausen et al. 2003 |
| Fransa | School and kindergarden | | 30 | 0,3* | 2,9* | 52,6* | 38,2* | 105* | 1430* | | Raffy et al., 2016 |
| **USA** | | | | | | | | | | | |
| 7 state US | kindergarden | 1400 | 12 | 0,1±0,05 | 3,9±5,1 | 26±37 | 9,0±7,4 | 458±862 | 422±570 | 163±172 | Subedi et al.., 2017 |

The comparatively lower levels in this study are likely associated with frequent cleaning (every two days), absence of toys or soft plastic materials, and limited furniture diversity. Previous studies confirm that cleaning frequency substantially reduces dust-bound phthalate concentrations (Raffy et al., 2016; Subedi et al., 2017).

## CONCLUSION

This study evaluated the concentrations of 13 phthalate esters (PAEs) in settled dust from classrooms, laboratories, and offices within a university engineering faculty. Among the investigated environments, classrooms showed the highest total PAE levels, followed by laboratories and offices. DEHP was the most dominant compound across all sites, comprising 49%–69% of the total PAE burden, while BBP, DBP, and DiBP were detected in variable amounts depending on room type.

Compared to existing literature, the phthalate concentrations measured in this study were relatively low. A key reason is the difference in sampling environments: most comparative studies were conducted in kindergartens, elementary schools, or student dormitorie ssettings that often contain toys, soft furnishings, and diverse plastic materials that increase phthalate release. In contrast, the classrooms, labs, and offices in this study had fewer phthalate sources beyond the primary building materials (e.g., flooring, furniture). Classrooms lacked secondary materials such as toys, teaching aids, or decorative items, which are common in preschool environments. Additionally, all rooms in this study were subject to regular cleaning every two days, further minimizing dust accumulation and associated PAE content.

These findings highlight the influence of space usage, occupant behavior, and material diversity on indoor phthalate contamination. The results provide a valuable baseline for university settings and emphasize the importance of environment-specific risk assessments for indoor chemical exposure.

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# CERTIFICATE OF PARTICIPATION

This is to certify that

## MİHRİBAN CİVAN

participated in the 23th International Istanbul Scientific Research Congress on Life, Engineering, Architecture, and Mathematical Sciences during November 20-22, 2025 in Istanbul, Turkiye, orally & technical presented the paper entitled

**“DISTRIBUTION OF PHTHALATE ESTERS IN SETTLED DUST ACROSS ACADEMIC INDOOR ENVIRONMENTS”**

Prof. Ceyran MAHMUDOVA
*Organization Committee Member*

Given this on November 20-22, 2025 in Istanbul, Turkiye.