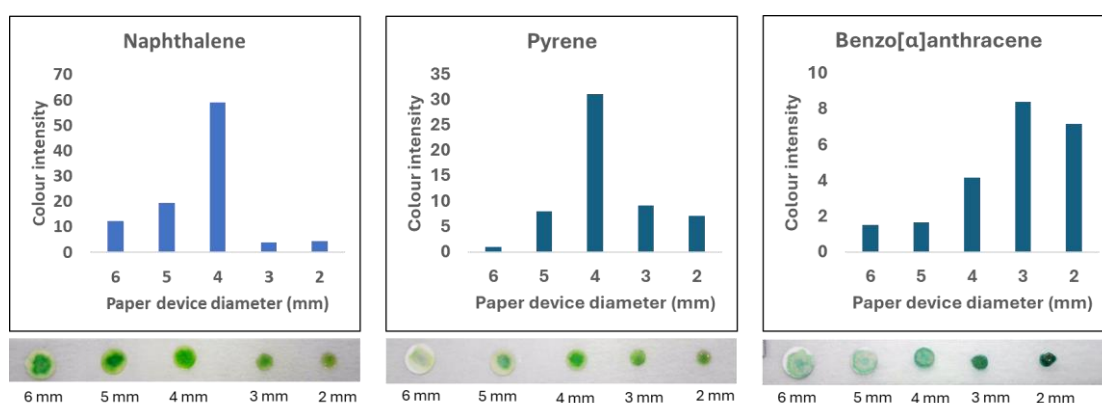


## Development of a Paper-Based Microfluidic Analytical Device for the Detection of Polycyclic Aromatic Hydrocarbons (PAH)

(Graduate School of Information Sciences, Hiroshima City University) ○Mohd Shafiq Bin Nasir, Akimitsu Kugimiya

**Keywords:** Chromogenic detection, Horseradish peroxidase, Paper-based microfluidic device, Polycyclic aromatic hydrocarbons, USB camera

Polycyclic aromatic hydrocarbons (PAHs) are environmental pollutants with carcinogenic potential, originating from both natural and anthropogenic sources<sup>1</sup>. Their detection is challenging due to their chemical stability, low vapor pressure, and complex mixtures in environmental samples<sup>2-3</sup>. This study presents the development of a paper-based microfluidic analytical device for the efficient detection of PAHs using horseradish peroxidase (HRP) and hydrogen peroxide as catalytic agents, coupled with 3,3',5,5'-tetramethylbenzidine as a chromogenic substrate using USB camera. The objectives include evaluating the effect of paper device diameter on reaction dispersion, determining the response to varying PAH concentrations, and assessing HRP enzymatic activity over time. Experimental results indicate that a 4 mm device diameter provides optimal reaction stability for naphthalene and pyrene, and 3 mm is the optimal diameter for benz[ $\alpha$ ]anthracene. Calibration curves were constructed for naphthalene (0–200 mM), pyrene (0–200 mM), and benz[ $\alpha$ ]anthracene (0–80 mM), with strong linear relationships between color intensity and concentration ( $R^2 > 0.91$ ). Enzymatic activity remained effective for up to 96 hours, demonstrating the sensor's robustness and stability. This cost-effective, portable device offers a promising approach for rapid and precise PAH detection in environmental monitoring.



- 1) B.H. Chen, B.S. Inbaraj, K.C. Hsu. *J. Food. Drug. Anal.* **2022**, 30, 494.
- 2) Y. Zhang, L. Yuan, S. He, H. Tao, W. Xie, X. Zhang, X. Ren, T. Jiang, L. Li, Z. Zhu. *Int. J. Environ. Res. Public Health.* **2022**, 19, 2790.
- 3) P.N. Zainal, S.A. Alang Ahmad, S.F. Abdul Aziz, N.Z. Rosly. *Crit. Rev. Anal. Chem.* **2022**, 52, 878.