Do Suspended Particles Influence the Accuracy of Wastewater Epidemiology?

Chích Chòe

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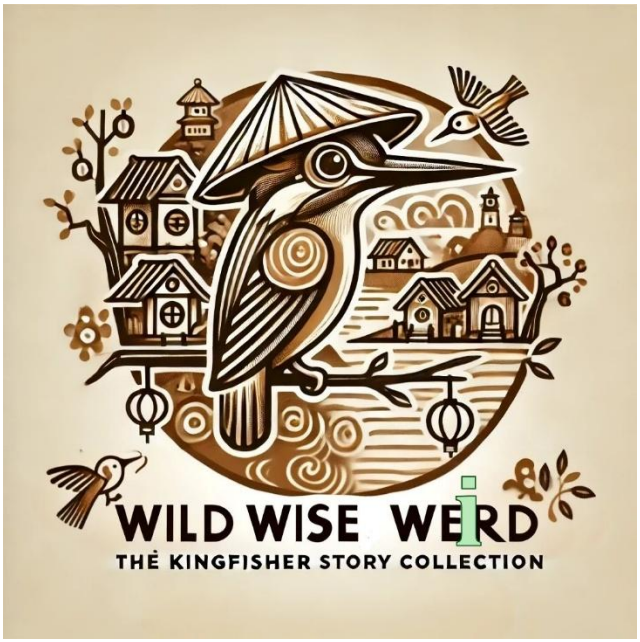

“Even the sound of their disorderly singing is good.

Nonetheless, the lack of discipline still affects the overall quality of the music show.”

In “Conductor”; *Wild Wise Weird* [1]

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Wastewater-based epidemiology (WBE) has emerged as a powerful tool for public health surveillance, enabling researchers to monitor patterns of drug use, lifestyle behaviors, and disease prevalence by analyzing biomarkers excreted by human populations into wastewater. Yet, a critical question has remained largely unexplored: to what extent do these biomarkers adhere to suspended particulate matter (SPM) within wastewater, potentially causing underestimations when only the liquid fraction is analyzed?

Addressing this gap, Bernier-Turpin and colleagues [2] conducted an extensive six-month study, systematically monitoring 54 WBE markers in raw wastewater from the Paris metropolitan area. Their investigation encompassed a wide spectrum of compounds, including pharmaceuticals, illicit drugs, and lifestyle indicators such as caffeine and nicotine. By separately quantifying biomarker concentrations in both the dissolved phase and the particulate fraction, the researchers gained valuable insight into the role of suspended particles in shaping WBE outcomes.

The results are reassuring for most WBE applications. Common biomarkers—including those related to caffeine consumption, nicotine use, and artificial sweeteners—exhibited minimal sorption to SPM, with less than 5% of their total load associated with particles. This finding supports the validity of conventional WBE protocols, which typically focus on the dissolved phase. However, the study also identified notable exceptions. Certain pharmaceuticals (e.g., fluoxetine) and drug metabolites (e.g., THC–COOH, methadone) displayed substantial sorption, with up to 60% of their total mass found in the particulate phase. This previously "hidden load" could lead to significant underestimations in WBE assessments if not properly accounted for.

Interestingly, the study also found that rain events—frequent in cities with combined sewer systems—slightly increased the tendency of certain compounds to bind to suspended particles. This shift was not driven by changes in the overall organic matter content of the wastewater but is likely linked to the mobilization of in-sewer deposits and the enhanced presence of metals during wet weather conditions [3,4].

Overall, the research reinforces WBE as a powerful and generally reliable approach for monitoring community health. However, it also cautions that for certain substances with a marked affinity for suspended particles, standard methods may underestimate their true presence. More broadly, the study underscores the intricate connections between urban infrastructure, environmental processes, and human behavior. As WBE continues to expand to track emerging pollutants and biological agents such as pathogens, a deeper understanding of particle dynamics will be critical to maintaining the accuracy and public health value of this promising method [5].

References

[1] Vuong QH. (2024). *Wild Wise Weird*. https://www.amazon.com/dp/B0BG2NNHY6/

[2] Bernier-Turpin G, et al. (2025). Do suspended particles matter for wastewater-based epidemiology? *Water Research*, 280, 123543. https://doi.org/10.1016/j.watres.2025.123543

[3] Li J, et al. (2020). Evaluation and development of models for estimating the sorption behaviour of pharmaceuticals in soils. *Journal of Hazardous Materials*, 392, 122469. https://doi.org/10.1016/j.jhazmat.2020.122469

[4] Gasperi J, et al. (2010). Contributions of wastewater, runoff and sewer deposit erosion to wet weather pollutant loads in combined sewer systems. *Water Research*, 44, 5875–5886. https://doi.org/10.1016/j.watres.2010.07.008

[5] Nguyen MH. (2024). How can satirical fables offer us a vision for sustainability? *Visions for Sustainability*. https://ojs.unito.it/index.php/visions/article/view/11267