Advances in Wastewater Research

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Wastewater Monitoring and Management by Advanced Approaches

Springer

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ISSN 3004-9725 ISSN 3004-9733 (electronic)
Advances in Wastewater Research
ISBN 978-981-95-2600-0 ISBN 978-981-95-2601-7 (eBook)
https://doi.org/10.1007/978-981-95-2601-7

Contents

Chapter 6
Microfluidic Devices: Harnessing the Power of Tiny Devices in Analysing Wastewater Quality

Zeba Sadia, Syed Sadiq Abbas, Saimah Khan, and Jamal Akhtar Ansari

Abstract The reduction in aquatic biodiversity and the growing water shortage are caused by habitat degradation and water pollution. Over the previous few decades, freshwater availability has decreased. Monitoring contaminants in wastewater effluents is essential to identifying areas of water contamination that require treatment. Multiple hazardous components in wastewater can be difficult to trace using conventional detection methods since they vary over time and come from different sources. There is increasing interest in making microfluidic apparatuses because of their phenomenal responsiveness, ease, dynamic response, negligible cost, constancy, and selectivity. Depicted by their ability to control small volumes of fluids through microchannels, they are emerging as moderate devices in normal checking, particularly in analysing wastewater quality. These miniature apparatuses furnish significant opportunities over the conventional approach, including reduced sample volume, faster processing times, high sensitivity, and the potential for on-site real-time analysis. Additionally, these systems can combine several analytical tasks into a single, small instrument, including sample preparation, segregation, identification, and quantification. Microfluidic devices can accurately measure contaminants like heavy metals, organic pollutants, pathogens, and nutrient levels. This chapter explores the applications of microfluidic technology in wastewater analysis, emphasizing its impact on improving water quality management and environmental protection.

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A. M. Yatoo et al. (eds.), *Wastewater Monitoring and Management by Advanced Approaches*, Advances in Wastewater Research,
https://doi.org/10.1007/978-981-95-2601-7_6

Weng X, Kang Y, Guo Q, Peng B, Jiang H (2019) Recent advances in thread-based microfluidics for diagnostic applications. Biosens Bioelectr 132:171–185. https://doi.org/10.1016/j.bios.2019.03.009

Xia J, Khaliliazar S, Hamedi MM, Sonkusale S (2021) Thread-based wearable devices. MRS Bull 46(6):502–511. https://doi.org/10.1557/s43577-021-00116-1

Xiao G, He J, Chen X, Qiao Y, Wang F, Xia Q et al (2019) A wearable, cotton thread/paper-based microfluidic device coupled with smartphone for sweat glucose sensing. Cellulose 26:4553–4562. https://doi.org/10.1007/s10570-019-02396-y

Yan X, Li H, Su X (2018) Review of optical sensors for pesticides. TrAC Trends Anal Chem 103:1–20

Yuan Y, Jia H, Xu D, Wang J (2023) Novel method in emerging environmental contaminants detection: fiber optic sensors based on microfluidic chips. Sci Total Environ 857:159563

Zhang Z, Ma X, Jia M, Li B, Rong J, Yang X (2019) Deposition of CdTe quantum dot on microfluidic paper chips for rapid fluorescence detection of pesticide 2, 4-D. Analyst 144(4):1282–1291. https://doi.org/10.1039/c8an02051e

Zhang Y, Li J, Jiao S, Li Y, Zhou Y, Zhang X et al (2024) Microfluidic sensors for the detection of emerging contaminants in water: a review. Sci Total Environ 34:172734

Zhao WW, Xu JJ, Chen HY (2015) Photoelectrochemical bioanalysis: the state of the art. Chem Soc Rev 44(3):729–741

Zheng L, Liu Y, Zhang C (2021) A sample-to-answer, wearable cloth-based electrochemical sensor (WCECS) for point-of-care detection of glucose in sweat. Sens Actuat B Chem 343:130131. https://doi.org/10.1016/j.snb.2021.130131