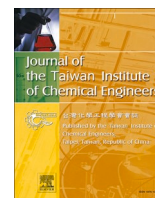




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## Advanced adsorptions of non-steroidal anti-inflammatory drugs from environmental waters in improving offline and online preconcentration techniques: An analytical review

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## ABSTRACT

**Background:** Humans and animals frequently utilize nonsteroidal anti-inflammatory drugs (NSAIDs) as analgesics for various conditions. The ubiquitous use of NSAIDs has resulted in their widespread presence in environmental waters (concentrations detected in water (Malaysia) ranging from  $1.40 \times 10^{-1}$  to  $9.72 \times 10^{-2}$  mg L<sup>-1</sup>), which may threaten human health. Consequentially, continuous vigilance and resolve are indispensable for preventing any catastrophe. Numerous preconcentration techniques have been developed in response to the rising demand for a rapid, sensitive, and robust method capable of producing a dependable result (relative recoveries (RR) > 70% and limit of detection (LOD) 0.1 ng mL<sup>-1</sup>).

**Methods:** This review aims to summarize the advancement of pre-concentration techniques using advanced adsorptive materials in quantifying NSAIDs from water mediums. Different univariate and multivariate optimization approaches for offline and online preconcentration are discussed in detail.

**Significant findings:** The multivariate approach is more promising compared to conventional approach for developing an offline preconcentration technique. The analytical performance of online and offline preconcentration is comparable, but online preconcentration utilizes less solvent, aligning with the Green Analytical Chemistry initiative.

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