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Enhanced peroxymonosulfate activation for naproxen degradation using CNST@Sep embedded chitosan/poly (vinyl alcohol) mixed matrix membrane

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Naproxen (NPX), a widely used nonsteroidal anti-inflammatory drug (NSAID), has been frequently detected in aquatic environments due to its extensive use and incomplete removal in conventional wastewater treatment plants. The persistent presence of NPX in water bodies poses significant risks to both ecosystems and human health. Thus, it is crucial to develop efficient decontamination strategies to eliminate NPX from wastewater. In this study, a CNST@Sep embedded chitosan/poly (vinyl alcohol) mixed matrix membrane (MMM) was fabricated by blending sepiolite, g-C_3N_5, and $SrTiO_3$ into a chitosan-poly (vinyl alcohol) matrix, followed by oven curing for crosslinking to enhance peroxymonosulfate (PMS) activation for NPX degradation. The physicochemical properties of the synthesized MMM were systematically analyzed using FTIR, XRD, SEM, XPS, TEM, and BET techniques. Furthermore, the influence of operational parameters, including PMS concentration, initial NPX concentration, solution pH, co-ions, and reaction time, on the catalytic degradation efficiency were comprehensively investigated. The developed CNST@Sep MMM demonstrated an outstanding NPX degradation efficiency of 98%, by PMS activation during 60 min of reaction. Moreover, the CNST@Sep MMM exhibited excellent recyclability and structural stability, maintaining high degradation performance after multiple reuse cycles. Mechanistic studies revealed that sulfate and hydroxyl radicals played a dominant role in the oxidative degradation of NPX. The results of this study offer a promising approach for pharmaceutical pollutant removal, contributing to environmental sustainability and water purification technologies.