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Persistent pharmaceutical occurrence in different lakes and rivers usually originates from live stocks, agriculture, aquaculture, households, and hospitals. The presence of these compounds in the ecosystems leads to fatal consequences. Pharmaceuticals can threaten microorganisms in the environment, either causing its deterioration or allowing pathogens to gain resistance against antibiotics and medical treatments.[1] These occurrences in the environment questions the ability of conventional treatment to remediate pharmaceutical wastewater.

To prevent the presence of these pharmaceuticals in the environment, membrane separation may be a good choice for water purification. Due to the adjustable parameters of the membrane process, the conditions for the treated water can be optimized.[2] Moreover, membrane modifications can overcome the limitations of the process. For example, surface grafting modification can improve membrane selectivity,[3] and bulk or material base modifications or material-base can prevent the membrane from fouling by degradation or by increasing porosity.[4] However, the membrane process generates concentrated pharmaceutical solutions which are not suitable for filtration. This concentrated solution causes more concern than the diluted one. Where there is a need need to combine the membrane process with a degradation process to treat the concentrated solution instead of the expensive incineration, the best choice to degrade concentrated solutions using catalytic wet air oxidation (CWAO). The degradation process was assessed on highly concentrated antibiotic solutions under soft conditions using a 1% Pt/CeZr catalyst. The results showed 89%, 60%, and 60% antibiotics removal during the $1^{st}$, $2^{nd}$, and $3^{rd}$ cycle, respectively. Moreover, thermal *ex-situ*s catalyst regeneration allows for a full initial activity recovery. Furthermore, the treated solutions were subjected to toxicity assessments, where the treated solution of tetracycline was revealed to be non-toxic.

To sum up, the hybrid process of combining membrane separation and CWAO has great potential for pharmaceutical wastewater treat-

ment. While the process is efficient for pollutant removal, it also avoids any chemical utilization, recovers all implemented catalysts, and is energy efficient. The membrane-oxidation hybrid process may be the key to sustainable wastewater treatment.

*References*


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