

**Title:**

**Effects of rGO introduction on photocatalytic activity and membrane performance for g-C<sub>3</sub>N<sub>4</sub>/HNB<sub>3</sub>O<sub>8</sub> nanosheet photocatalytic membranes**

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**Abstract:** (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

Membrane technology has been attracted attention as an energy-efficient water treatment strategy. However, a major problem in membrane-based water treatment is the degradation of performance due to fouling. The introduction of photocatalysts into membranes is one of the most effective ways to combat fouling [1]. Recently, nanosheets have shown promise as separation membranes due to their high specific surface area and unique structural properties. Our research group has reported that the composite of niobate (HNB<sub>3</sub>O<sub>8</sub>) nanosheets and graphitic carbon nitride (g-C<sub>3</sub>N<sub>4</sub>) nanosheets improves both membrane and photocatalytic performance [2]. In terms of membrane performance, the g-C<sub>3</sub>N<sub>4</sub> acts as a spacer for the HNB<sub>3</sub>O<sub>8</sub> nanosheets that form the dense membrane base, thereby improving water permeance. The photocatalytic performance is attributed to the charge transfer of g-C<sub>3</sub>N<sub>4</sub> due to the formation of heterojunction in the laminar structure. The charge transfer suppressed the deactivation of photocatalytic activity caused by the recombination of electrons on the g-C<sub>3</sub>N<sub>4</sub> [2]. In this study, we aim to further improve the performance by adding graphene oxide (GO) to the composite. GO has been reported to suppress electron recombination and accelerate electron transfer [3,4], and to accept electrons [3], therefore, enhancement of photocatalytic performance and improvement of separation performance are expected [4].

Composite membranes with different composite proportions were prepared by simple vacuum filtration using g-C<sub>3</sub>N<sub>4</sub>, HNB<sub>3</sub>O<sub>8</sub> and reduced GO (rGO) on support membrane. In terms of membrane, rejection performance was improved while keeping high water permeance when small amount of rGO was added. In terms of photocatalytic performance, when the optimal amount of rGO was added, the reaction rate constant (*k*) was 1.5 times higher than that of g-C<sub>3</sub>N<sub>4</sub>/HNB<sub>3</sub>O<sub>8</sub> composite membrane (Fig.1). Thus, we propose that the nanosheet-based composite membranes with photocatalytic activity have great potential in water treatment technology.

