

SiC membrane performances for marine scrubber water treatment

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Abstract:

In January 2020, the International Maritime Organisation announced a reduction of a factor 7 sulphur oxide (SO_x) concentration in atmospheric rejection in global areas. In this context and to reduce the SO_x emission shipyard must react. Among compliant options proposed, installation of exhaust gas cleaning system for atmospheric rejection compliance is the most interesting and sustainable one.

Exhaust gas cleaning system is a gas-liquid absorption column also known as scrubber unit where alkaline water is used to remove SO_x compounds from gas phases. The vapor phase purified, goes out from the top to the atmosphere. According to the scrubber configuration (open or closed loop), the wash water is discharged to natural environment or recirculated to continue the treatment. During closed loop running, an accumulation of pollutants in washwater appears, the suspension is sent to a membrane water treatment unit before seawater discharged.

Scrubber water is treated by ultrafiltration with silicon carbide membrane at constant flow rate. Backwashing is applied to limit the fouling phenomenon. The objective of this study is to define the sustainable conditions for the different cases encountered (engine power, closed or open loop, recovery rate water, etc..). Real feed water coming from different vessels are used. Operating parameters such as permeate flux, backwash frequency, backwash duration are modified to characterize the membrane behavior performances throughout the filtration time. Sustainable settings for on board applications respecting all marine constraints are defined.

First filtration results show a great variability of membrane performances depending on feed water quality, permeate flux and backwash conditions. It has been possible to define operating parameters fitting to water quality (from high to low fouling). For instance, for a high-fouling fluid, a low permeates flux must be applied (60 L h⁻¹ m⁻²) with frequent but rapid backflush actions (1BF 5s/20min) to maintain a good filtration.

Keywords: exhaust gas desulfurization, ultrafiltration, marine applications, SiC membrane, backwashes actions,