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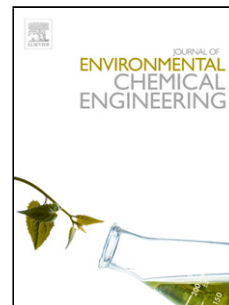
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Saline Produced Water Treatment Using Gas Hydrates

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Highlights

- Using gas hydrate for produced water desalination.
- Finding the maximum salinity of produced water to which hydrate method is applicable.
- With a three-stage hydrate process, 82-89.2% of dissolved minerals will be removed.
- The desalinated water can be used for farm domestic and livestock uses.
- CO₂ hydrate can be formed in a produced water with up to 160,000 mg/L TDS
- The removal efficiency of alkaline earth metals is more than that of alkali metals.

Abstract:

Formation of gas hydrate can be considered as a suitable method of produced water desalination. In this study, CO₂ hydrate formation experiments with different produced water samples were conducted at approximately 3.5 MPa and 274.2 K. After hydrate formation, the concentrated salty water was extracted from the reactor and the formed hydrate was washed with a suitable amount of fresh water to improve salt removal effectively and finally hydrate was dissociated to produce fresh water. Removal efficiency for dissolved mineral components in the produced water samples was also examined. It was concluded that with a three-stage hydrate process, 82-89.2% of dissolved minerals will be excluded. This study illustrated that the CO₂ hydrate -based desalination can be used for produced waters with total dissolved solids less than 160,000 mg/L.

Keywords: Produced Water; Desalination; Gas Hydrate; Total Dissolved Solids

Nomenclature

C_A: Ion concentration (mg/L)

n: the number of moles (mol)

P: Pressure (MPa)

ΔP: Pressure drop (MPa)

R: Universal gas constant (8.314 j/mol/K)

T: Temperature (°K)

t: time (hr)

V: volume (cm³)

Z: Gas compressibility factor

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