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CO_2 separation using dense polymeric supported ionic liquid membranes (DPSILMs)

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The concept of DPSILMs has been demonstrated here using polysulfone as the polymeric matrix. Four types of ionic liquids (ILs) were blended with polysulfone (PSF) to produce functional dense polymeric-supported ionic liquid membranes (DPSILMs). The prepared DPSILMs have been characterized using FT-IR and SEM, and both techniques showed that the selected ILs were successfully impregnated into the PSF and formed effective DPSILMs that can be treated like other dense membranes. It was also found that DPSILMs prepared in our lab were useful for the selective separation of CO_2 at high pressures and gave promising results for CO_2 separation from N_2 and CH_4 streams. The highest CO_2 permeabilities (with CO_2/N_2 separation measurements) obtained with each IL were 19, 13.6, 10.8, and 8.9 barrer with PSF-25 wt% [N_{4441}][formate], PSF-5 wt% [p_{4441}][formate], PSF-0.5 wt% [DIP- C_4mim][NTf_2], and PSF-5 wt% [C_4mim][NTf_2] respectively. However with CO_2/CH_4 separation measurements, the highest CO_2 permeabilities were 17.3, 13.8, 12.5, and 11.5 barrer with PSF-12.5 wt% [P_{4441}][formate], PSF-2.5 wt% [DIP-C_4mim][NTf_2], PSF-0.5 wt% [N_{4441}][formate], and PSF-2.5 wt% [C_4mim][NTf_2] respectively. Stability measurements of the synthesized DPSILMs were conducted regarding ILs loss. Stability results showed that DPSILMs with 5 wt% [P_{4441}][formate] and [N_{4441}][formate] showed about 30% and 20% ILs loss respectively at 10 bar after 12 hours; while no loss of [DIP-C_4mim][NTf_2] and [C_4mim][NTf_2] was observed.

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Electrocoagulation for the treatment in Qatari produced water

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Management and treatment of produced water still represent a challenge and have cost implications to the oil and gas companies. The area of produced water deserves further research and study. According to statistics, 3 barrels of associated water are produced for each oil barrel bringing the produced water production globally of around 250 million barrels per day; water to oil ratio that is expected to worsen with aging reservoirs. Furthermore, it is well known that Qatar is one of the poorer and most water stressed countries in the world with relatively very limited freshwater resources. In addition, the vast hydrocarbon industry (oil, gas and petrochemicals) production demands the use of water in the industrial processes putting further emphasis on water use and resources and making treatment strategies for the produced water of relevant value. Recently, attention has been given to electrocoagulation as a way of treating water especially with respect to the shale oil production in the USA. Effective treatment or re-use of PW can help in mitigating the effects of scarcity of freshwater especially in arid areas like Qatar, which relies fully in desalination of seawater for its freshwater use. The project aims to investigate and assess the potential of the electrocoagulation as a viable option for the treatment of Qatari oil and gas produced water with respect to a number of major experimental conditions. The feasibility of creating a multistage treatment options tailor-made for the Qatari oil and gas-produced water will be investigated in order to lower the environmental impact of such industries on the sources of fresh water and help achieve the zero discharge aims set in Qatar.

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