Danish Offshore Technology Centre
Technology Conference 2022

Metal-organic frameworks as oxygen scavengers

P. Reichert[1] *(perreic@dtu.dk)*, A. A. Eftekhari[1], K. S. Pedersen[2] and S. I. Andersen[1] J. Sundberg[1]

[1]*Technical University of Denmark, Danish Offshore Technology Center, 2800 Kongens Lyngby, Denmark*
[2]*Technical University of Denmark, DTU Chemistry, 2800 Kongens Lyngby, Denmark*

Produced water reinjection is an important tool to reduce the environmental impact of offshore oil production sites by avoiding discharge. To maintain constant flow rates, produced water is mixed with seawater, which contains high levels of dissolved oxygen. Untreated this leads to well corrosion and bacterial growth. Cobalt based model complexes previously demonstrated the ability of binding dioxygen, either in the form of mononuclear superoxide ($L_nM\text{-}O{=}O$) or binuclear peroxide complexes ($L_nM\text{-}O\text{-}O\text{-}ML_n$). We aim to incorporate their O_2-binding ability in the development of new metal-organic frameworks (MOFs) for the chemisorption of oxygen from gas and aqueous phase. Metal-organic frameworks are porous coordination polymers that are formed by self-assembly of inorganic nodes, typically metal clusters and organic linkers. Their permanent porosity greatly facilitates adsorptive processes and rapid mass transfer.

Our newly proposed MOFs integrates O_2 binding within its metalated organic linkers. This shift of functionality from the nodes to the linkers will enable selective and reversible binding of dissolved oxygen. With their reusable properties, metal-organic frameworks are incredibly potent to increase eco-efficiency in the oxygen scavenging processes offshore and with that, are able to reduce the overall environmental impact factor (EIF) of offshore oil and gas production.

The MOF-based sorbent will be incorporated in a dual packed bed reactor setup. One bed is active (**1.**), while

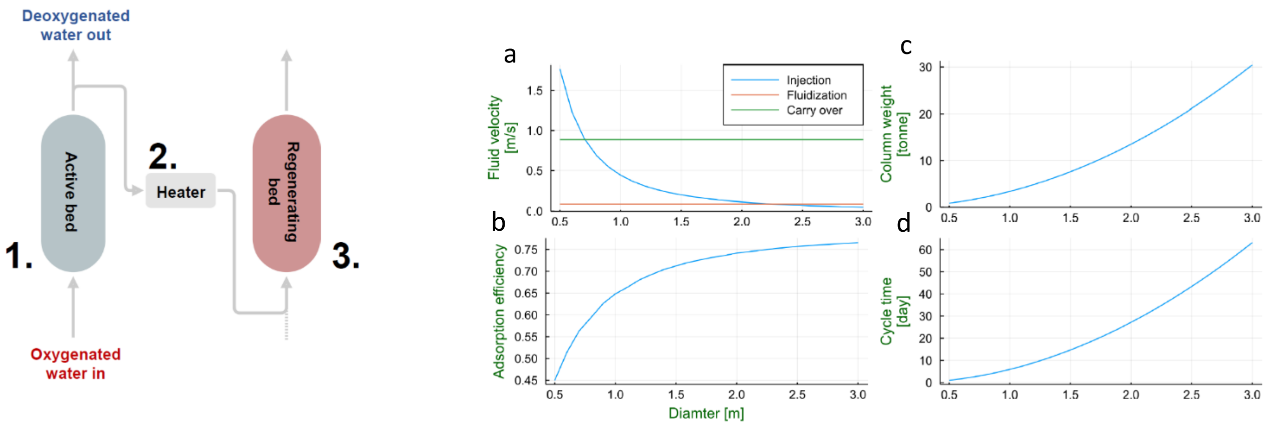

Fig. 1. Left: Dual packed bed reactor setup; right: Computational calculations for an experimental model developed to support the design of a pilot reactor leading to a full scale unit. Diagrams show the development of fluid velocity (**a**), column weight (**b**), absorption efficiency (**c**), cycle time (**d**) in regard to the diameter of the reactor.

AARHUS UNIVERSITY
UNIVERSITY OF COPENHAGEN
DTU
G E U S
AALBORG UNIVERSITY DENMARK

the other is regenerating. Regeneration is achieved by heating deoxygenated water above the critical temperature and passing through the saturated bed (**2./3.**). An experimental model has been developed to support the design of a pilot and full scale unit.

Acknowledgments

This research has received funding from the Danish Offshore Technology Centre (DTU Offshore).

References

[1] Cook et al., *Chem. Rev.*, **2013**, 113, 734 [2] James et al., *Chem. Soc. Rev.,* **2003**, 32, 276 [3] Yaghi et al.,*Chem. Rev.,* **2012**, 112