

Temporary abandonment of oil wells using polymer-based plug

Skowyra, M.M.^{1}, Echarri-Giacchi, M.^{1**}, Ivanova, Y.D.², Ravnkilde, K.M.²,
Frederiksen, C.H.², Skov, A.L.¹*

¹*Danish Polymer Centre, DTU Chemical and Biochemical Engineering, Technical University of Denmark (DTU)*

²*Danish Offshore Technology Centre, Technical University of Denmark (DTU)*

* magsk@dtu.dk, **maecgi@dtu.dk

Even though the North Sea is one of the world's largest oil and gas exploitation areas, many of the oil wells present there are reaching the end of their productive life. This means that a large number of them are expected to be plugged and abandoned (P&A) in the coming years to ensure that the remaining fluids are contained safely within the well and that the risk of environmental damage is reduced. Traditionally, cement has been used as the primary material for P&A applications, however, not without limitations such as operational issues, lack of resistance to certain chemicals (H₂S, hydrocarbons, etc.) or tendency to crack. As such, new materials are being developed to address these challenges.

Our novel approach is based on the development of a durable temporary polymer plug with a shelf life of up to 18 months. The goal is to reduce the pressure build-up in the oil well's pipeline and B-section and mitigate the risk for the rig entry prior to abandonment, simultaneously lowering the costs. The polymer's working time at room temperature is sufficiently long to allow for the pumping of the liquid solution down the well. After that, the free-radical cross-linking polymerization process is activated with high temperatures present at those depths, forming a rigid, solid polymer plug with low gas and water permeability. In addition, the material is designed to be environmentally friendly and able to withstand the extreme conditions of oil wells, such as high pressure and aggressive environments.

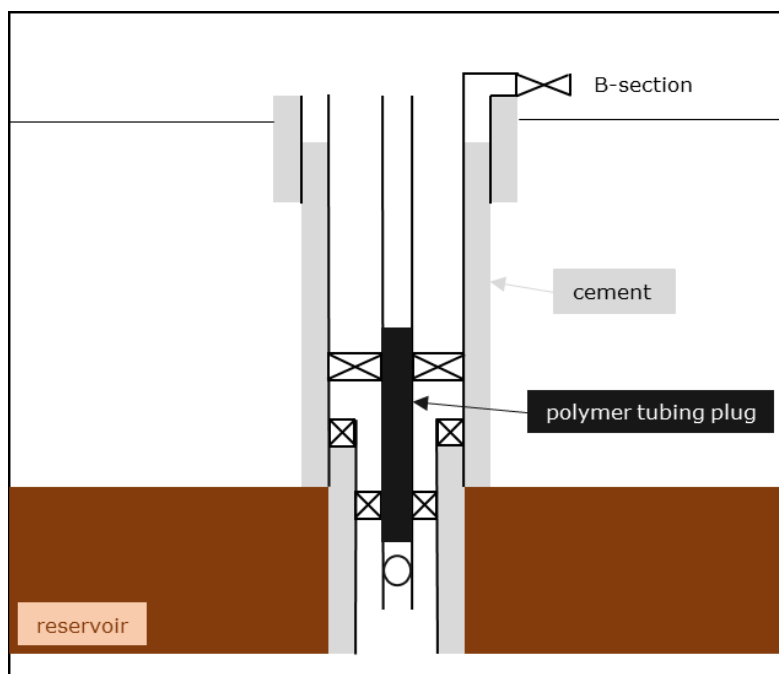


Figure: Schematic of a cross-linked polymer plug inside an oil well.

References:

1. Vrålstad, T.; Saasen, A.; Fjær, E.; Øia, T.; Ytrehus, J. D.; Khalifeh, M. Plug & abandonment of offshore wells: Ensuring long-term well integrity and cost-efficiency. *Journal of Petroleum Science and Engineering*, **2019**, *173*, 478-491.