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Phase behaviour prediction and pressure decline of high pressure condensate systems using Peng Robinson's equation of state

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Gas condensates are hydrocarbons found to be in the gaseous phase while in the reservoir but as production is carried out, liquid begins to form out of the gas as a result of pressure drop below the dew point. Formation of gas condensates has a negative impact on the deliverability of gas from a gas well. Condensates block the pores of the formation impeding flow of gas and it also blocks the perforations that were made specifically for gas. Peng Robinson equation of state is chosen for this study because of its numerously recorded accuracy of values of pressure, liquid density, etc. Peng Robinson postulated an equation of state but did not account for pressure drop. That is what this project sets out to obtain i.e. incorporating pressure drop into the Peng Robinson equation of state. This is done by relating the Peng Robinson equation of state with Darcy's law taking into account two phase flow. Results obtained from the modification of the Peng Robinson equation of state are compared with the original Peng Robinson equation of state and also the Soave-Redlick-Kwong equation of state. Plots of pressure against flow rate for all three equations are done and the same trend of decrease in flow rate with pressure decline was observed. The modified Peng Robinson's equation follows the same trend as the Soave-Redlich-Kwong equation of state and the Peng Robinson's equation of state. That shows that the modification is valid. In addition, the newly modified Peng Robinson's equation of state helps to account for other parameters like relative permeability, effective permeability, viscosity, area and length can also be considered when calculating for reservoir pressure or pressure drop. These parameters can be useful especially for gas condensate reservoirs. Mobility is the ratio of permeability to viscosity. Therefore mobility of gas and oil can also be calculated as the modified Peng Robinson's equation of state contains this ratio of effective permeability of gas and oil to viscosity of gas and oil respectively.

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