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Producing Oil from Dead Oil Wells Using injected LPG

G.A.R.Rassoul, and Omar M. Waheeb
Chemical Engineering Department-College of Engineering-Baghdad University

Abstract

In order to reduce hydrostatic pressure in oil wells and produce oil from dead oil wells, laboratory rig was constructed, by injecting LPG through pipe containing mixture of two to one part of East Baghdad crude oil and water. The used pressure of injection was 2.0 bar, which results the hydrostatic pressure reduction around 246 to 222 mbar and flow rate of 34.5 liter/hr fluid (oil-water), at 220 cm injection depth. Effects of other operating parameters were also studied on the behavior of two phase flow and on the production of oil from dead oil wells.

Keywords: Dead oil well, injecting LPG, vertical two phase flow, LPG-oil-water mixture.

Introduction

During oil production, oil water level rises in the reservoirs which increase water content in produced oil in the wells near oil water contact. This water together with declining reservoir pressure during life of producing wells, decreasing oil production. Increasing hydrostatic pressure will also decrease oil production.

It is not uncommon for the reservoir pressure in typical oil wells to be insufficient to cause a produced fluid to flow naturally from the well. In such situations, the produced fluid (usually a multi-phase fluid containing gas, oil and water) must be artificially raised to the surface, and the typical methods currently used to artificially raise the fluid are submersible or beam pump and gas-lift. Submersible and beam pumping as well as gas-lift are applicable to surface facility forms (onshore on platforms). Beam pumping is not applied to sub-surface well applications. In deep wells, beam pumping is not routinely used because the extensibility of sucker rods used for pumping deprives the pump of a sufficient stroke.

In such cases, gas-lift is often used when there is sufficient gas-lift gas available. In gas-lift methods of production, a production tubing string is installed within the cased opening. Production is attained through this production tubing. The annulus outside the production string, but within the cased hole, is used as the downward path for communication of gas, which is used by the gas-lift equipment. The process consists of forcing (compressing) gas under high pressure into the annulus. At the gas-lift equipment, gas is introduced into the production or tubing string to reduce the density of petroleum liquid produced from a deep formation so that the liquid will rise in the production tube. Hence, gas-lift valves located in side pocket mandrels are installed at various elevations within production tubing, and are adjusted in depth to reduce hydrostatic pressure. The lower the gas-lift valve the more liquid is lifted in the well (Edward, Marshall, and Dennis 2000).

The reducing of hydrostatic pressure depends upon the differences in the viscosity, density, and surface tension between the injected gas and water oil mixture. Solubility of injected fluid, and fluid miscibility and fluid compatibility affects oil-water production. Similarly the availability of the injected fluids and specially the fluids obtained from degassing stations near oil wells which are produced as a side product can also used to increase the oil production from unproducable wells or from dead oil wells.

The production of the oil from this process is (usually a multi-phase fluid containing gas, oil and water) and the

Type of vertical flow regime which can be specified by gas void fraction or backer chart is one of the following types (Bubble flow , slug flow, annular flow, and mist dispersed flow)

The aim of present study was to reduce hydrostatic pressure of crude oil and to estimate the suitable injection pressure and the depth of injection using LPG.

Experimental work

East Baghdad crude oil was supplied from Alduara refinery, tap water was supplied, and LPG gas cylinder was used as injected gas.

Laboratory rig was constructed which consists of three concentric pipes. The outer one is an oil reservoir of 15.24 cm in diameter and the second insider one is an oil producer of 10.16 cm in diameter and the center pipe is gas injection 2.54 cm which is attached to thirteen solenoids valve, top reservoir tank of 105 cm in diameter, digital control panel, two pressure transmitters, pressure gauge, two liquid flow meters, gas flow meter and gas source i.e. LPG gas cylinder

The made up oil reservoir consisted of two parts East Baghdad crude oil mixed with one part water. The 126 Liters of East Baghdad crude oil had been mixed with 54 liters of water to make a 30% water oil mixture. The mixture was placed in a top reservoir (open storage tank) to fill production units and this mixture filled the 4, and 6 in pipes continuously. Then the whole system connected to a source of electric power.

Using LPG was injected gases inside oil water mixture at injection pressures 0.5, 1.0, 1.5, and 2.0 bar, and at injection depth from 280 to 220 cm. by regulating gas injection pressure and open the valve at the position and then recording Bottom-hole pressure, gas injection pressure in the control panel, Top-hole pressure by pressure gauge, liquid flow rate, and gas flow rate.

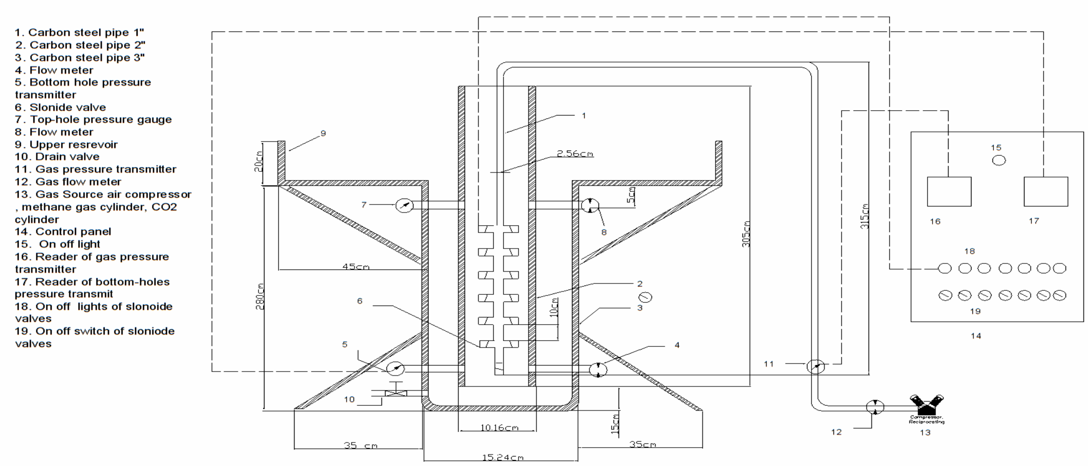


Fig. 1 Experimental setup for oil production

Resulits and Discussion

In this study 28 experimental runs were carried out for the LPG gas injection through oil water mixture. The effects of depths of injection, and gas injection pressure on the Bottom-hole pressure, Top-hole pressure, and liquid flow rate were studied.

Effects of injection depths

Effects of injection depths on the Bottom-hole pressure

Figure 2 represents the relationship between Bottom-hole pressure and injection depths, at different injection pressures. It is clearly that Bottom-hole pressure decreases with decreasing injection depths.

When LPG injected inside liquid mixture which is soluble with oil and similar to the composition of oil (hydrocarbon) and also miscible with water also, LPG reducing the density of liquid mixture (reducing hydrostatic pressure) as the depth decreasing the amount of the liquid uprising from the liquid column increasing and this reduce the Bottom-hole pressure.

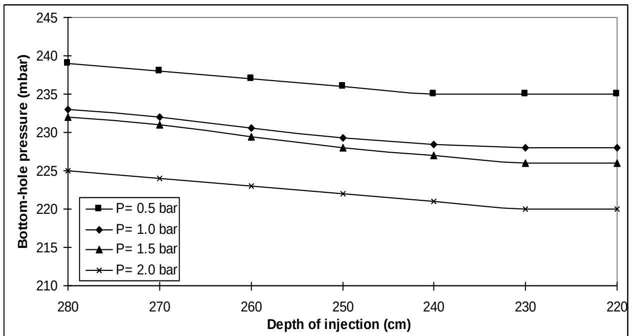


Fig (2) Bottom-hole pressure verses depth of injection at different pressures of injected LPG

The effects of injection depth on the Top-hole pressure

Figure 3 represents the relationship between Top-hole pressure and injection depths, at different injection pressures. It is clearly that Top-hole pressure increases with decreasing injection depths.

When LPG injected inside liquid mixture as the depth decreases, liquid flow rate increases which mean more liquid effects on the top of the pipe.

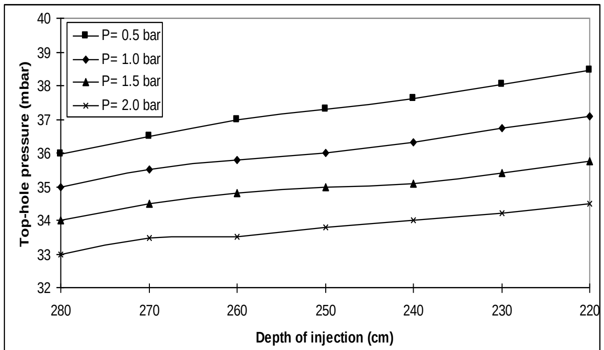
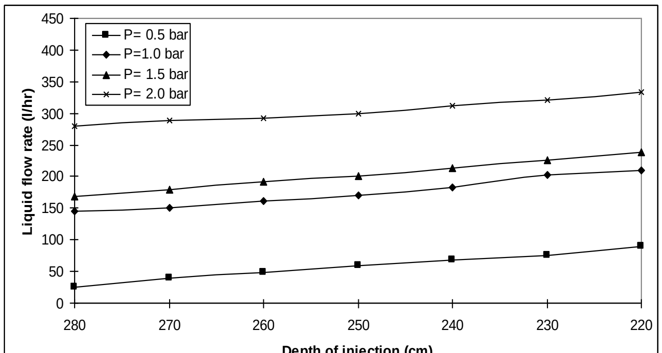


Fig (3) Top-hole pressure verses depth of injection at different pressures of injected LPG

The effect of the injection depth on the liquid flow rate

Figure 4 represents the relationship between liquid flow rate and injection depths, at different injection pressures. It is clearly that liquid flow rate increases with decreasing injection depths.

Decreasing in the injection depth that mean decreasing in the pressure head of the column which mean that the resistance due to gas injected at 220 cm depth is less than 280 cm depth. Drag forces that liquid exposed will to decrease water-oil production.



Fig(4) Liquid flow rate verses depth of injection at different pressures of injected LPG

Effects of injection pressure

Effects of injection pressures on the Bottom-hole pressure

Figure 5 represents the relationship between Bottom-hole pressure and injection pressures, at different injection depths. It is clearly that bottom-hole pressure decreases with increasing gas injection pressure.

As the gas injection pressure increases, the amount of injected gas is more and density of the mixture will be reduced more than at low pressures.

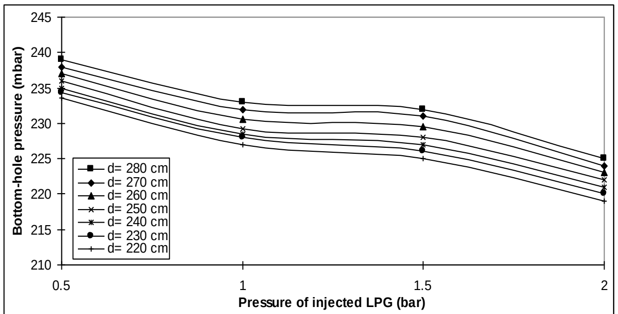


Fig (5) Bottom-hole pressure verses pressure of injected LPG at different depths of injection

Effects of injection pressures on the Top-hole pressure

Figure 6 represents the relationship between Top-hole pressure and injection pressures, at different injection depths. It is clearly that Top-hole pressure decreases with increasing gas injection pressure.

At high pressures of injected gas fast penetration of injected gas through liquid mixture which become less in its effect on the wall because of the density become less than before and that means amount of gas is too high and this lead to low pressure.

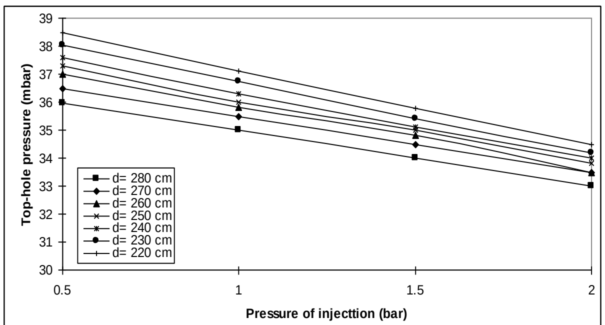
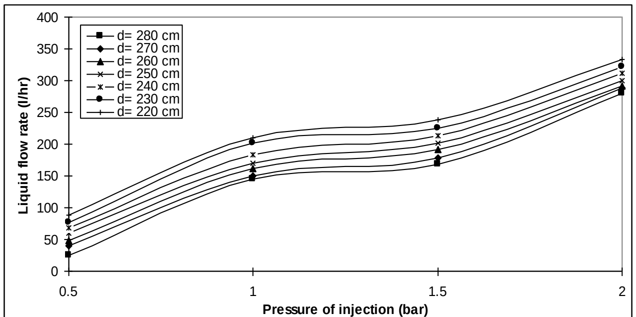


Fig (6) Top-hole pressure verses pressure of injected LPG at different depths of injection

The effects of injection pressure on the liquid flow rate

Figure 7 represents the relationship between liquid flow rate and injection pressures, at different injection depths. It is clearly that liquid flow rate increases with increasing injection pressures.

Pressure of injected gas increases which means increasing the amount injected gas. This will give high flow rate of liquid due partly because reduction in the liquid mixture density and partly because increase lifting pressure at the bottom of the liquid mixture and also because the solubility of the gases in the liquid phase.



Fig(7) Liquid flow rate verses pressure of injected LPG at different depths of injection

Type of two phase flow

The type of two phase flow regime can be specified by evaluating the gas void fraction (α') which specify the flow regime which was annular vertical two phase flow through the all runs

Conclusions

The injection gas inside oil water mixture to reduce hydrostatic pressure of liquid column by reducing the density of the mixture mixed with liquid mixture when the gas injected inside liquid mixture gas mixed with liquid mixture and soluble inside it. This solubility increased by increasing the pressure of injection. The hydrostatic pressure reduced from 246 to 220 mbar and giving of 334 l/hr fluid (oil-water) flow rate at 2.0 bar gas injection pressure and at 220 cm depth of injection.

References

1. J Jayskera, and S. G Good Years., "The Development of Heavy Oil Field in United Kingdom Continental Shelf Past present and Future". This paper prepared by Petroleum Engineering society (1999).
2. Edward G. Stokes, Marshall H. Mitchael and Dennis T. Perry., "A method of controlling oil production from gas Lift Production Well system" Patent No. US 703762, (2000).
3. Frick Thomas C., "Petroleum production Hand Book" vol II New York McGraw Hill Book co (1958).
4. J. Wardlly Smith., "The control of oil pollution on the sea and inland waters" Graham and Trotman lted (1979).
5. Kishore K Mohanty., "Development of Shallow Viscous Oil Reverse in north slope". Quartly Progress Report by department of Chemical Engineering University of Huston (2003).
6. Kermit E. Brown., "The technology of Artificial Lift Method" PPC Books Tulsa (1977).
7. Mayron Khulman., "Boosting Oil Recovery" Al Manhal Petroleum Development Magazine (2005).
8. Salmon Levy, "Two phase flow in complex systems" John Willey & Sons, Inc (1999).
9. T. E. W. Nind., "Principles of oil well production", Mcgraw Hill Books co (1964).
10. Tom Reid, and Bartlesiville O. K., "Study of Hydrocarbon Miscible Solvent Slug injection Process for Improved Recovery of Heavy oil from Sharder bluff Pool Miln point Unit, Alaska" Prepared by petroleum development laboratory University of Alaska (1994).