The Effect of Resin Injection on the Productivity of Shallow Sandstone Layer in Mawar Field

(Effect Injeksi Resin Pada Produktivitas Lapisan Batupasir Dangkal Di Lapangan Mawar)

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Abstract
Mawar Field is located in North Kalimantan Province. The field has an unconsolidated sandstone layer which is located in Tarakan formation. Porosity of the layer is more than 20%, while permeability of that is between 100 mD and 1000 mD. The zone which is poorly cemented is a source of sand problem. This sand production has an effect on the stability of oil and gas production. Sand production results in the formation of channeling around cement bonding. Sand production problem can be reduced. To overcome the acidity of the shallow formation, it can be done in two ways, that is Gravel pack using propan and stimulation using resin where the sand will be retained behind the formation. In research that has been done using core data and produced sand samples where the results obtained information about the characteristics of sand in shallow zones so that the appropriate treatment method can be recommended that is stimulation with resin. In the use of this resin there will be a permeability reduction of 15% - 27% and a maximum flow rate reduction of 20%.

Keywords: Sand Problem, Permeability, Maximum Flow Rate

I. INTRODUCTION
As the production time increases, the production rate of an oil and gas reservoir will decrease due to the decline of reservoir pressure. Pressure drop in a shallow layer may lead to sand problem. A shallow layer (reservoir) usually has a low compressive strength and poorly cemented. Since it experiences low overburden pressure, both permeability and porosity of the layer are usually high. Sand problem may result in the damage of surface facilities. In addition, the damage of cement bonds around the wellbore due to sand production may cause the increase of water production rate significantly. Consequently, the production rate of oil is drop or even vanishes [1].

In order to handle the sand problem in shallow formation, two methods are usually applied, namely mechanical method and chemical method. The first method is performed by injecting proppant into formation (gracvel pack) to restrain the sand and installing a screen to hold the proppant in the position [2, 3]. The second method is performed by injecting resin to attach the sand grains. Therefore the sand production can be prevented or reduced.

The methods should be designed according to the properties of formation to attain an optimal performance. In Mawar Field which has a layer with thickness of 6 – 8 meters with water zone in adjacent layers and fine sand grains, resin injection (chemical method) is believed as the most appropriate method.
II. METHOD
The procedure of the research is depicted in Figure 1. The research covered laboratory experiment of resin injection through three core samples. The cores were obtained from two wells (X-1 and X-2). Permeability reduction of the cores due to resin injection was analyzed. The research was then continued by the resin injection into the two wells. The reduction of productivity of the wells was observed by comparing the production data before and after resin treatment.

III. RESULTS AND DISCUSSION
Tables 2 and 3 show the result of permeability measurement before and after resin injection into core samples of Wells X-1 and X-2 respectively. The tables indicate that permeability of the three cores after resin treatment is lower that that before resin treatment. The reduction of permeability due to resin injection ranged from 129 mD to 271 mD or from 15% to 27%. In other word, the resin injection regains permeability as much as 72.93% to 84.22% from the initial permeability of the cores.

Three core samples (one core sample is from Well X-1 and the rest is from Well X-2) were tested. 1 to 1.5 post volume (sand consolidation volume) of resin was injected. Permeability of the core samples was measured before and after resin treatment to regain permeability.

The research was continued after the resin treatment of Wells X-1 and X-2 to analysis the effect of resin injection on well productivity.

In field work, resin injection was injected into Wells X-1 and X-2. It has been carried out by determining the volume of postflush to determine the optimal permeability and keeping draw down
pressure as small as possible can result in a longer well life time and sand production can be reduced from 15% to 0.05%. Success in sand consolidation work using resin provides benefits in the Mawar Field, which is to revive suspended wells, reduce the risk of channeling and increase the life time of the well. Maintaining drawdown pressure and postflush resin volume design is very important for the success of this stimulation work.

Based on the production before and after resin injection, the change of well productivity was observed. Figures 1 and 2 shows the change of inflow performance relationship (IPR) curves due to resin injection. The maximum flow rate (\(q_{\text{max}}\)) of X-1 and X-2 before resin injection is 845 bpd and 1067 bpd, respectively. The figures indicate that the maximum flow rate X-1 and X-2 after treatment is 675 bpd and 859 bpd. This means that the initial maximum flow rate is decreased by 20.13% and 19.48%, respectively for Wells X-1 and X-2.

Well X-2 is more stable than that of Well X-1. The production time of Well X-2 is more than 14 months, while that of Well X-1 is only about 7.5 months.

**IV. CONCLUSIONS**

Based on the experiments and analyses above, several conclusions are made as follows:

1. The reduction of permeability due to resin injection ranged from 129 mD to 271 mD or from 15% to 27%.
2. The use of resin injection to prevent the production of sand grains reduced deliverability of production well, where the maximum flow rate after treatment reduced about 20%.
3. The production performance of Well X-2 is better than that of Well X-1, where Wells X-2 has higher maximum flow rate and longer production time than Well X-1.

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