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Carbonate Acidizing Optimazation in Iranian Oil Field

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SUMMARY

The main point in matrix acidizing treatment optimization is to reduce the skin factor in every single stage of injection and finally reaching the minimum value. If the skin effect owning to damage is quantified, then the treatment must reduce the total skin effect by that amount. Further, to be cost-effective, the injected volume and the pumping time should be minimized. The goal of this study is to evaluate various acidizing treatments for three wells placed in south east of Iran.

Introduction

Acid matrix treatment is the most-used technique to stimulate wells and reservoir rock for improving well inflow performance in Iranian oil fields which are carbonate common-type. Carbonate acidizing is a more difficult process to predict than sandstone acidizing because despite the chemistry of the process being much simpler than sandstone acidizing, the physic is decidedly more complex, thus it is necessary to evaluate and stimulate the candidate matrix acidizing treatment.(Economides *et al*., 1993)

The most common acid used is hydrochloric acid (HCl) to dissolve carbonate minerals. Various acidizing solution to damage problem have been proposed like 1.HCl 28% 2.HCl 15% 3.Foam Acid 4.Organic Acid. To effectively apply acidizing treatment in well stimulation, a proper investigation of different acidizing solutions in several issues such as time, expense and effectively of the treatment, is required. If the skin effect owning to damage is quantified, then the treatment must reduce the total skin effect by that amount. Further, to be cost-effective, the injected volume and the pumping time should be minimized. The goal of this study is to evaluate various acidizing treatments for three wells placed in south east of Iran.

Method and/or Theory

The main point in matrix acidizing treatment optimization is to reduce the skin factor in every single stage of injection and finally reaching the minimum value. For starting the optimization of an acidizing treatment first the reason of skin existence must be known. Because the type and severity of the skin is an important factor in the approach design. After selecting the type of injection fluid and its concentration percent, acidizing stage design must be considered. It consists of determination of the number of stages and rate and volume of the injection fluid in the wellbore in each stage.

The investigation of different acidizing treatment is executed by an acidizing simulator program named StimCADE that involves modules that make up a comprehensive matrix simulation design and it also has analysis engineering tools which can show the decline in skin during a proposed acid treatment and gives ability to compare results of treatments. For validation of the selected treatment, its results can be compared to those gained by pressure build up test before acidizing and after production stabilized. Stabilized production maybe analyzed when formation is known. Pressure build up can also be run after acid clean-up and after production stabilized. Transient pressures during the execution of the acid treatment might be analyzed for formation permeability and wellbore conditions. Most data evaluated from acid treatment records that provide a permeability and skin estimate error within 5 to 10 percent of the actual values are not going to be a problem. (McLeod, 1984)

This paper describes investigation of three different acidizing treatments on an oil field placed in southeast of Iran. These wells of interest were considered for acidizing because of reduction in oil production rate. The information about these wells and their treatments are given in table 1.

Examples

WELL A: The main reason for creation of well skin here was fine migration (proved by core analysis) and the skin radius has extended to a wide area, so it is recommended to use HCl 15% and with surfactant additive (retarded acid) in three stages. Wide range of skin zone to be acidized can increase the probability of making emulsion, slug and even unexpected precipitation. So the best way to decrease the risk of problems is to use moderate concentration acid or adding surfactant additives to the injection fluids. Also multi-stage treatment can be one of the recommended solutions to help clean up a wider damaged zone. It must also be considered that the treatment time should not exceed 500 minutes (or about 8 hours). A comparison between reached skin by stimulation and simulator results confirm the optimization procedure. (Trehan *et al*., 2012)

WELL B: The skin related to this well is caused by completion during work-over operations and after well test analysis it has been found that is located within few inches from the wellbore. So the main working fluid is the HCl 28%. Although the obtained skin factor in a single stage treatment is greater than a skin factor obtained by multi-stage but since the difference is not too high so one stage treatment is technically economical recommended. Lastly the results from simulator is verified after stimulation well test results. (Volnov *et al*., 2013)

WELL C: Wrong fluid selection for injection may cause serious problems such as slugging, unexpected precipitation and consequently increasing the skin factor and finally losing the wellbore and the reservoir. The well test results after stimulation treatment on this well does not show any changes in skin factor. Unfortunately the wrong fluid selection has been due to a lack of enough information about the skin source. After the failure it has been detected the source of skin was related to asphaltene slugging and it can be removed by a proper solvent like xylene.

Well	Type	Permeability	Skin	Porosity	Skin Radius	Type of Damage	Stimulation Treatment	Optimized Stimulation	Skin After Stimulation
A	Oil (Carbonate)	5.5 md	3.07	15%	13 in	Fine Migration	HCl 15% 3 Stages	HCl 15% 3 Stages	0.87
B	Oil (Carbonate)	6.47 md	0.82	16.5%	8 in	Completion	HCl 28% Single Stage	HCl 28% 2 Stage	-2.19
C	Oil (Carbonate)	12.8 md	3.51	15%	?	asphaltene slugging	HCl 15% 3 Stages	Xylene	3.43

Table 1 *Wells' Information.*

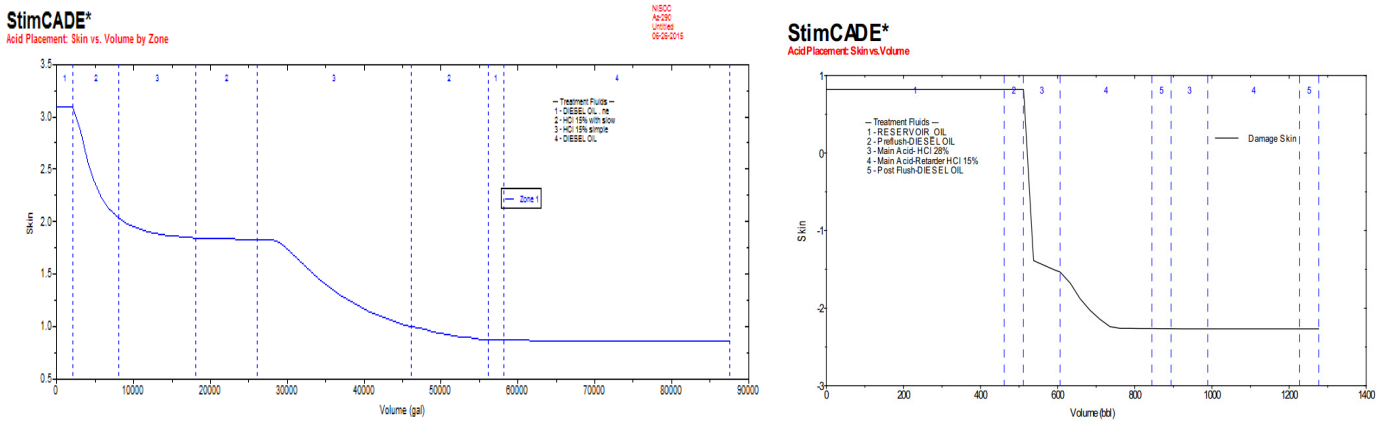

Figure 1 *Wells' treatment simulation by StimCADE.*

Conclusions

For a matrix acidizing optimization several issues such as time expense and effectively of the stimulation treatment must consider. Knowing the source of the skin and its characteristic has an important role in matrix acidizing design. Acid with high concentration percent is not advised when the well is facing with wide damaged area. Wrong estimation and treatment design can create enormous problems around wellbore.

References

Economides, M.J., and Hill, A.D., Ehlig-Economides, C. [1993] Petroleum Production Systems. *Prentice Hall PTR, New Jersey*.
McLeod, H.O. [1984] Matrix Acidizing. *SPE 13752, JPT*, **36**(12), 2055-2069.
Trehan, R., Jones, N., Haney, J. [2012] Acidizing Optimization: Monterey Shale, California. SPE Western Regional Meeting, USA.
Volnov, I.A., Suchok, S.N., Obsharov, P.A. [2013] Approach to Optimization of Acid Treatment in Oil Reservoirs. SPE Arctic and Extreme Environment Conference & Exhibition, Russia.