

Adopted Factorial and New In-Situ Micro-Designs for Stimulation of Matrix Acidizing of Carbonate Reservoir Rocks



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<https://doi.org/10.3390/app13031752>

Abstract

Matrix acidizing has been developed in the petroleum industry for improving petroleum well productivity and minimizing near-wellbore damage. Mud acid (HF: HCl) has gained attractiveness in improving the porosity and permeability of reservoir formation. However, there are several challenges facing the use of mud acid, comprising its corrosive nature, high pH value, formation of precipitates, high reaction rate and quick consumption. Therefore, different acids have been developed to solve these problems, including organic-HF or HCl acids. Some of these acid combinations proved their effectiveness in being alternatives to mud acid in reservoir rock acidizing. The current research deals with a new acid combination based on Hydrochloric–Oxalic acids for acidizing carbonate core samples recovered from Qamchuqa Formation in Kirkuk oilfield, northern Iraq. A new in-situ micro-model adopted laboratory technique is utilized to study the microscale alteration and evolution of pore spaces, dissolved grains and identification of matrix acidizing characteristics. The in-situ micro-model is based on the injection of an identical dose of different concentrations of the new acid combination into thin section samples under an optical light microscope. The adopted procedure aims to provide unique and rapid information regarding the potential for texture and porosity modification that can be caused by the acidizing stimulation procedure. In connection, solubility tests for the untreated and treated reservoir core samples and the density of the combined acids after treatment are conducted based on designed experiments using response surface methodology (RSM). The effect of acid concentration [12% HCl: Oxalic acid (3.8–8.8%)] and acidizing temperature (from ambient to 78.8 °C) on the solubility percentage of the samples and percentage increase in the combined acid density after acidizing were optimized and modeled. The obtained results confirm that the optimum dissolution of the core samples took place using 12% HCl:3.2% Oxalic acid with an optimum solubility (%) of the carbonate core rock of 53.78% at 21.7 °C, while the optimum increase in density (%) of the combined acids was 1.54% at 78.3 °C. The promising results could be employed for matrix acidizing of carbonate reservoir rocks for other oilfields. Keywords: matrix acidizing; simulation; optimization; optical microscopy; in-situ micro-model; petrographic analysis; pore area; solubility; RSM

پوخته

ترشکردنی ماتریکس له پیشه‌سازی نه‌تدا پهره‌ی پندراوه‌ی بۆ باشت‌کردنی نه‌وت به‌رهمه‌هێنانی بیرمه‌کان و که‌مکردنه‌وه‌ی زیانه‌کانی نزیک له‌ بیرمه‌کان. ترشی قور (HF: HCl) سه‌رنج‌راکێشی به‌ده‌سته‌هێناوه‌ له‌ باشت‌کردنی کونیه‌یی و رژیانی دروستبوونی خه‌زنه‌کان. به‌لام چه‌ندین... نه‌و ته‌حه‌ددایانه‌ی که‌ پرو به‌رووی به‌کاره‌ینانی ترشی قور ده‌بنه‌وه، که‌ پیکه‌اتوه‌ له‌

اختبارات لعينات الخزان غير المعالجة والمعالجة وكثافة الأحماض المجمعة بعد إجراء المعالجة بناءً على تجارب مصممة باستخدام منهجية سطح الاستجابة (RSM). تأثير تركيز الحمض [12٪ حمض الهيدروكلوريك: حمض الأكساليك (3.8-8.8٪)] ودرجة الحموضة (من المحيط إلى 78.8 درجة مئوية) على نسبة الذوبان في العينات وزيادة النسبة المئوية في تم تحسين ونمذجة الكثافة الحمضية المجمعة بعد التحميص. النتائج التي تم الحصول عليها تؤكد أن الانحلال الأمثل للعينات الأساسية حدث باستخدام 12٪ حمض الهيدروكلوريك: 3.2٪ حمض الأكساليك مع الذوبان الأمثل (٪) للصخور الأساسية الكربونية بنسبة 53.78٪ عند 21.7 درجة مئوية ، بينما الزيادة المثلى في كثافة (٪) الأحماض المجمعة 1.54٪ عند 78.3 درجة مئوية. يمكن توظيف النتائج الواعدة لتحض مصفوفة صخور مكامن الكربونات لحقول النفط الأخرى.

About Soran University

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