

Research Article

Barium Sulfate Scale Removal at Low-Temperature

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Precipitation of the scale in the oil and gas reservoirs, surface and subsurface equipment, and processing and production facilities is a big problem as it affects petroleum production. The scale precipitations decrease the oil and gas production and cause economical loss. Solving this issue requires an engineering investigation to provide a safe, efficient, and economic solution. Consequently, this study proposed a developed dissolver for barium sulfate scales, where two field-scale samples were collected from different locations. The compositional analysis for scale samples showed that sample 1 is 100% barium sulfate where sample 2 has 97.75% barium sulfate and 2.25% of quartz. The composition of the developed dissolver has diethylenetriamine pentaacetic acid (DTPA) as a chelating agent, oxalic acid, and tannic acids as an activator, nonionic surfactant, and water as the base fluid. The new dissolver was investigated with extensive lab tests to determine the dissolution efficiency, precipitation tendency for the dissolved scale solids, corrosion rate, and fluid-rock interaction. The obtained successful results indicated that the developed dissolver had a dissolution efficiency for two real barium scale samples as the results showed 76.9 and 71.2% at 35°C and 91.3 and 78.4% at 90°C for samples 1 and 2, respectively. The new solution has a great performance compared with common scale dissolvers in the oil field as hydrochloric acid, ethylenediaminetetraacetic acid, and diethylenetriamine pentaacetic acid. The developed dissolver showed a very low precipitation tendency for the scale dissolved solids (1.9 and 3.2% for samples 1 and 2, respectively) under 35°C for 24 hours. Without any additives of corrosion inhibitors, the corrosion rate was 0.001835 g/cm² at 6.9 MPa and 100°C for 6 hours. Injecting the developed dissolver for damaged sandstone core sample with barite mud by flooding test showed a return permeability of 115%.

1. Introduction

The oil and gas industry suffers from the scale precipitation in the well equipment. The scale depositions will affect the internal capacity for the well equipment either downhole or at the surface as the production tubing, subsurface valves, wellhead, surface pipelines, and production and processing facilities, in addition to, the reservoir formation [1–4]. The scale precipitation causes formation damage, decreases the reservoir injectivity and productivity performance, and also changes the rock wettability [5, 6].

There are many reasons for the scale deposits and exposing many fluid streams during the production cycle was found to be the most critical factor as these streams have different ions and concentrations. These streams might include the oil, formation water, and injected water and will format

different types of scales [4]. Barium and calcium minerals are commonly found with higher concentrations in the formation water than the seawater; moreover, a higher concentration of sulfate ions is commonly existing with the seawater than the formation water [7]. Many different types of scales are prevalent with the oil and gas field from the sulfate type as barium sulfate which is commonly called barite (BaSO₄), calcium sulfate (CaSO₄), and strontium sulfate (SrSO₄) [8, 9].

Many operational parameters and conditions have a great impact on the scale precipitations in the field as pressure, temperature, interaction time, degree of acidity or alkalinity pH, and chemical equilibrium [10]. The location of the scale and its type will occur based on the streams' ions concentrations and the operating conditions. One of the hardest scale types is the sulfate scales that are commonly formatted due to the incompatibility between the two water streams of

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Production Chemicals for the Oil and Gas Industry, Second Edition Malcolm A. Kelland, 2014-03-13 Production chemistry issues result from changes in well stream fluids both liquid and gaseous during processing Since crude oil production is characterized by variable production rates and unpredictable changes to the nature of the produced fluids it is essential for production chemists to have a range of chemical additives available for rectifying issues that would not otherwise be fully resolved Modern production methods the need to upgrade crude oils of variable quality and environmental constraints demand chemical solutions Thus oilfield production chemicals are necessary to overcome or minimize the effects of the production chemistry problems *Production Chemicals for the Oil and Gas Industry Second Edition* discusses a wide variety of production chemicals used by the oil and gas industry for down hole and topside applications both onshore and offshore Incorporating the large amount of research and applications since the first edition this new edition reviews all past and present classes of production chemicals providing numerous difficult to obtain references especially SPE papers and patents Unlike other texts that focus on how products perform in the field this book focuses on the specific structures of chemicals that are known to deliver the required or desired performance information that is very useful for research and development Each updated chapter begins by introducing a problem such as scale or corrosion for which there is a production chemical The author then briefly discusses all chemical and nonchemical methods to treat the problem and provides in depth descriptions of the structural classes of relevant production chemicals He also mentions when available the environmental properties of chemicals and whether the chemical or technique has been successfully used in the field This edition includes two new chapters and nearly 50 percent more references *The Journal of Industrial and Engineering Chemistry*, 1913

Essentials of Flow Assurance Solids in Oil and Gas Operations Abdullah Hussein, 2022-10-19 Flow assurance solids deposition is one of the main challenges in oil and gas production operations with millions of dollars spent annually on their mitigation *Essentials of Flow Assurance Solids in Oil and Gas Operations* works as an all inclusive reference for engineers and researchers covering all the different types of solids that are commonly encountered in oil and gas fields Structured to flow through real world operations the reference branches through each solid deposit problem where the root causes are as well as modeling monitoring characterization and management strategies all comprehensively reviewed in the light of contemporary research breakthroughs Backed by several field case studies *Essentials of Flow Assurance Solids in Oil and Gas Operations* gives petroleum and reservoir engineers a resource to correlate between the theoretical fundamentals and field practical applications allowing for sustainable and optimal operations Provides the main operations of oil and gas fields the characteristics of produced fluids and the main flow assurance challenges Furnishes the basic principles of deposits formation and mitigation starting with a full investigation of the problems then mechanisms causes predictions modelling and sample analysis followed by management Distinctively discusses the operational and environmental implications of flow

assurance solids and their management using chemical and nonchemical methods Teaches engineers through impactful visuals and data sets included in every chapter Production Chemicals for the Oil and Gas Industry Malcolm A. Kelland, 2016-04-19 Modern production methods and environmental constraints demand chemical solutions And as oilfields age the need for chemicals to ensure steady production increases Production Chemicals for the Oil and Gas Industry describes classes of production chemicals for use topside and downhole in the upstream oil and gas industry It includes coverage of **Advances in Analytical and Coordination Chemistry - Applications and Innovations** Mozaniel Santana de Oliveira, Berta Barta Holló, Muhammad Zafar, Eloisa Helena De Aguiar Andrade, Mirjana M. Radanović, 2025-02-26 This comprehensive work explores recent analytical and coordination chemistry advancements highlighting how cutting edge research drives innovation across diverse industries The book covers topics such as the versatile chemistry of Schiff bases and chelating agents advanced chromatographic techniques microfluidics and crystallization processes among others The text emphasizes the potential of Schiff bases and their metal complexes in practical applications including materials science sustainable energy e g solar cells and industrial processes such as petroleum field operations It also explores innovative analytical technologies such as chromatographic methods for isolating bioactive molecules and microfluidic systems for medical diagnostics underscoring the interdisciplinary role of analytical chemistry in healthcare and environmental science Additionally the book examines crystallization processes and their impact on material properties featuring detailed studies on sulfur curing systems and their influence on elastomer performance These insights offer valuable guidance for industrial applications Authored by renowned experts this volume is an essential resource for researchers academics and industry professionals seeking to stay at the forefront of analytical and coordination chemistry Water-formed Scale Deposits Jack C. Cowan, Donald J. Weintritt, 1976 *Petroleum Abstracts* , 1997 *Journal of Industrial and Engineering Chemistry* , 1913 *Carbon Dioxide Treatment for Scale Removal and Control in Potable Water Systems* Temkar Prakash, 1987 **Oilfield Review** , 2007 **SPE Production & Facilities** , 2005 Proceedings - Production Operations Symposium , 1991 *Production Operations* Thomas O. Allen, 1993 *Managing Matured Fields and Wells* István Lakatos, 2005 According to a widely accepted forecast the world reserve of crude oil known and to be explored is about 360 Gt The global oil demand in the 21st century however will be roughly 250 260 Gt thus the recovery factor must be doubled from 30 35% at present to 65 70% on average to meet the predicted global demand Unfortunately more than 70% of the worldwide oil and gas production comes from depleted reservoirs Consequently revitalization of matured oil and gas fields have priority as part of the availability of hydrocarbons Implementation of novel IOR EOR technologies and stimulation and optimization of well performance while minimizing the environmental impacts will form the main stream of developments in the coming years and decades Necessarily the R D activity will and must be strengthened in the future putting the oil and gas industry on a new pedestal This book demonstrates the recent contributions of research projects to oilfield chemistry and advanced production

te *Technical Association of the Pulp and Paper Industry* ,1970 Drilling and Production Practice American Petroleum Institute,1958 *Paper* ,1991 **State-of-the-art of Liquid Waste Disposal for Geothermal Energy Systems, 1979**
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In a world inundated with monitors and the cacophony of instant transmission, the profound energy and emotional resonance of verbal beauty frequently disappear in to obscurity, eclipsed by the continuous onslaught of noise and distractions. Yet, located within the musical pages of **Barium Sulfate Scale Removal**, a interesting work of fictional splendor that pulses with natural feelings, lies an unique trip waiting to be embarked upon. Published with a virtuoso wordsmith, that mesmerizing opus guides visitors on a psychological odyssey, lightly exposing the latent possible and profound affect stuck within the complicated web of language. Within the heart-wrenching expanse of this evocative evaluation, we will embark upon an introspective exploration of the book is main themes, dissect its captivating writing model, and immerse ourselves in the indelible impression it leaves upon the depths of readers souls.

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