

Evaluation of the effectiveness of filtrex installation in overcoming sand in the "RSK" well with the result of sieve analysis test

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ABSTRACT

Sand production is one of the major operational challenges encountered in unconsolidated reservoirs because it can reduce production performance and damage downhole as well as surface production equipment. The RSK Well, located in the Mutiara Field of the Kutai Basin, experienced severe sand production caused by unconsolidated sandstone formation, mature well conditions, and increased fluid velocity associated with the Permanent Coiled Tubing Gas Lift (PCTGL) system. Conventional sand screen technology was unable to effectively retain fine sand particles, resulting in unstable production and operational limitations. This study evaluated the effectiveness of Filtrex as an alternative sand control technology based on formation particle size distribution obtained from sieve analysis. A descriptive quantitative approach was employed using well production data, wireline logging, and laboratory sieve analysis. The findings demonstrated that Filtrex effectively minimized sand production while improving production stability and increasing oil production to approximately 300 BOPD and gas production to approximately 150 MMSCFD.



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INTRODUCTION

Sand production is one of the most significant technical and operational challenges encountered in hydrocarbon production from unconsolidated and weakly consolidated sandstone reservoirs. Poor grain cementation reduces the mechanical strength of the formation, while reservoir-pressure depletion, excessive drawdown, increasing fluid velocity, and high near-wellbore pressure gradients may generate sufficient drag force to detach and transport formation particles into the wellbore. This process commonly involves three interconnected stages: failure of the formation around the wellbore, erosion and detachment of sand grains by flowing fluids, and transportation of the released particles toward the surface. Uncontrolled sand production can consequently cause wellbore instability, accumulation of solids, erosion of downhole and surface equipment, flowline blockage, increased maintenance costs, reduced well availability, and declining hydrocarbon production (Asfha et al., 2024).

Mechanical sand-control devices, particularly standalone screens, are commonly installed to restrict the movement of formation particles while maintaining hydrocarbon flow. Their performance, however, depends strongly on compatibility between the screen aperture and the particle-size distribution of the formation sand. An excessively large aperture may allow fine particles to pass through the screen, whereas an excessively small aperture may promote plugging, increase pressure loss, and restrict well productivity. These risks become particularly important in mature wells because reservoir depletion, water breakthrough, changing flow conditions, and artificial-lift operations may alter the stresses and fluid velocities around the wellbore. Accordingly, the limited performance of a conventional screen should not be attributed solely to the Permanent Coiled Tubing Gas Lift (PCTGL) system; it should be evaluated by considering screen condition, aperture size, formation particle-size distribution, production rate, drawdown pressure, gas-lift injection rate, and other operating parameters. Accurate particle-size characterization and appropriate sand-retention testing are therefore essential for selecting a screen that can retain formation sand without imposing excessive flow restriction (Khan et al., 2024).

In response to the limitations associated with conventional screen selection, Filtrex equipped with a multilayer Open Cell Matrix Polymer (OCMP) structure offers a potential remedial sand-control

alternative. The OCMP filter acts as a mechanical barrier and creates a tortuous flow path that traps sand particles while allowing reservoir fluids to pass through. Its compressible configuration enables the system to be conveyed through restricted tubing and subsequently expand to conform to the larger internal diameter of the target interval. A field application in three Mahakam wells showed that OCMP filters could accommodate different formation particle sizes and support oil and gas production, although their long-term performance in gas wells remained affected by water breakthrough and renewed sand detection. These findings emphasize that Filtrex selection must be based on reservoir-specific particle-size data and followed by continuous monitoring of sand rate, production rate, pressure, and operating conditions (Iqlima et al., 2022). Therefore, the present study aims to characterize the formation grain-size distribution of the RSK Well through sieve analysis and to evaluate Filtrex performance by comparing sand production, oil and gas rates, operating stability, choke opening, and other relevant parameters before and after installation.

RESEARCH METHODS

A descriptive quantitative approach was employed using field production data, wireline logging, well completion information, and laboratory sieve analysis. Grain-size distribution was determined through sieve analysis to calculate the Uniformity Coefficient (Uc) and Sorting Coefficient (Sc). Production performance before and after Filtrex installation was compared to evaluate the effectiveness of the technology in mitigating sand production and improving well productivity.

Table 1 Sieve Analysis Parameters of RSK Well Formation

Parameter	Value
D10	0,28836 mm
D40	0,24701 mm
D90	0,17808 mm
D95	0,13335 mm
Uniformity Coefficient	1,38
Sorting Coefficient	2,16

As shown in Table 1, the sieve analysis of RSK Well formation samples produced D10, D40, D90, and D95 diameters together with a Uniformity Coefficient (Uc) of 1.38 and a Sorting Coefficient (Sc) of 2.16. These values indicate a relatively well-sorted formation containing a substantial fraction of fine particles, which provided the technical basis for selecting Filtrex as the sand control method, as further discussed in the Results and Discussion section.

RESULTS AND DISCUSSION

The RSK Well is a mature production well completed with a Permanent Coiled Tubing Gas Lift (PCTGL) system in an unconsolidated sandstone reservoir. Such formations are particularly susceptible to sand production because weak intergranular cementation may be unable to withstand changes in effective stress, reservoir-pressure depletion, and hydrodynamic forces generated during fluid production (Nemati et al., 2024). An increase in production rate or pressure drawdown can intensify the near-wellbore pressure gradient and drag forces acting on loosely bonded grains, thereby promoting formation failure, particle detachment, and sand transport into the wellbore. Sand production can subsequently erode downhole and surface equipment, restrict fluid flow, increase well-shutdown frequency, and reduce production continuity. These conditions tend to become more complex in mature wells because declining reservoir pressure, water breakthrough, and changing artificial-lift parameters may alter near-wellbore flow conditions over time (Ahad et al., 2020; Asfha et al., 2024).

The conventional sand screen previously installed in the RSK Well was unable to prevent the passage of fine formation particles, resulting in unstable production and operational limitations. However, this condition should not be interpreted as evidence that all conventional screens are ineffective. Screen performance depends on the compatibility between the screen-aperture size and the particle-size distribution of the formation, as well as fluid velocity, pressure differential, screen material, installation quality, and changes in reservoir conditions. An aperture that is too large may allow fine particles to pass through, whereas an aperture that is too small may cause plugging, increase

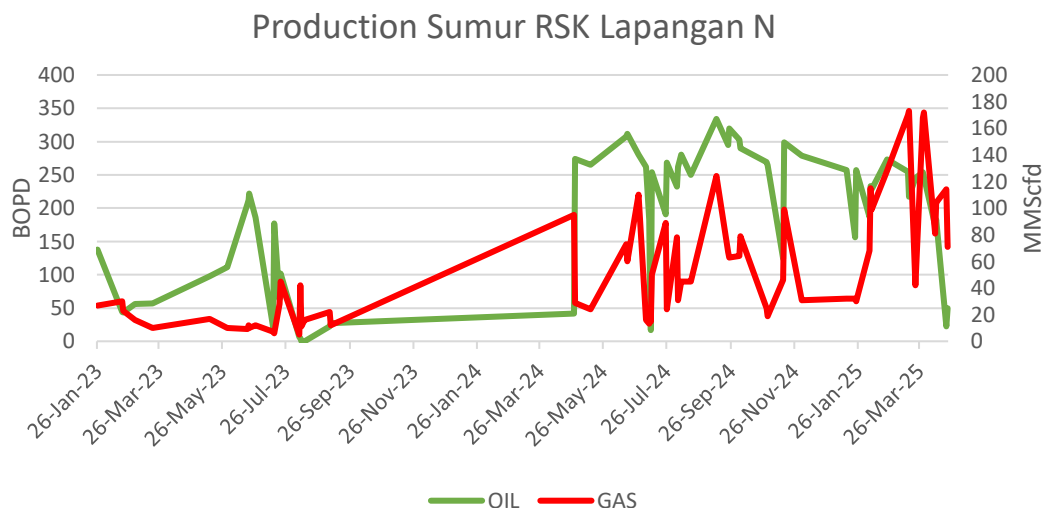
pressure loss, and reduce well productivity. Furthermore, erosion caused by high-velocity particle-laden flow can enlarge screen openings and gradually reduce their sand-retention capability. Consequently, selecting an appropriate sand-control device requires an integrated assessment of formation particle-size distribution, sand-retention performance, expected flow rate, and operating conditions (Abduljabbar et al., 2024; Khan et al., 2024).

The sieve analysis of the RSK Well formation sample yielded a Uniformity Coefficient (U_c) of 1.38 and a Sorting Coefficient (Sc) of 2.16. These parameters were used to characterize the particle-size distribution and evaluate the compatibility of the formation sand with the proposed filtration system. Accurate determination of particle-size distribution is essential because fine and poorly sorted particles are generally more difficult to retain and may either pass through an oversized aperture or plug an undersized screen. Nevertheless, the interpretation that the formation is relatively well sorted should be supported by the equations and classification criteria used to calculate (U_c) and (Sc). The reported (D)-values and cumulative-distribution convention must also be verified because the particle diameters currently decrease from D_{10} to D_{95} . Under the conventional cumulative-percentage-passing method, particle diameter normally increases as the cumulative percentage increases. Therefore, the calculation procedure must be confirmed before the degree of sorting is used as the primary basis for Filtrex selection (Ahad et al., 2020; Khan et al., 2024).

Based on the formation characteristics and remedial requirements of the RSK Well, Filtrex equipped with a multilayer Open Cell Matrix Polymer (OCMP) filter was selected as an alternative sand-control system. The OCMP structure functions as a mechanical barrier and provides a tortuous flow path that captures formation particles through bridging and trapping mechanisms while maintaining pathways for reservoir-fluid flow (Subbiah et al., 2021).. Because the polymer filter can be conveyed in a compressed condition through existing tubing restrictions and subsequently expanded at the target interval, it is particularly relevant for remedial installation in mature wells where a major workover may be technically difficult or economically unattractive. A field study in the Mahakam Field reported that OCMP filters with multiple pore-size layers were successfully deployed in three wells and supported oil production of up to 600 BOPD and gas production of approximately 2.6 MMscfd. Nevertheless, the same study also reported renewed sand production in some gas wells following water breakthrough, indicating that OCMP performance remains dependent on reservoir-fluid behavior and post-installation operating conditions (Iqlima et al., 2022).

Following Filtrex installation in the RSK Well, oil production reportedly increased to approximately 300 BOPD, while gas production reached approximately 150 MMSCFD. Field observations also showed no measurable sand production during the post-installation monitoring period and indicated improved production stability. These changes suggest that the installed OCMP filter improved sand-retention performance and reduced the operational restrictions previously associated with fine-particle production. However, the gas-production value and unit should be verified because 150 MMSCFD appears disproportionately high relative to an oil rate of approximately 300 BOPD and may have been intended as 150 MSCFD. The method used to detect or quantify sand, its detection limit, and the duration of the post-installation observation period must also be reported before claiming that sand production was eliminated (Shahsavari et al., 2021; Tananykhin et al., 2021).

Overall, the post-installation response indicates that Filtrex has the potential to provide effective remedial sand control under the evaluated conditions of the RSK Well. This interpretation is consistent with previous research emphasizing that successful sand control requires compatibility among particle-size distribution, filter-pore structure, pressure-drop behavior, and well-operating conditions (Ahad et al., 2020; Abduljabbar et al., 2024; Khan et al., 2024). The result also supports the field observations of Iqlima et al. (2022), who demonstrated that an OCMP filter could retain sand while sustaining hydrocarbon flow in mature Mahakam wells. Nevertheless, a definitive conclusion that Filtrex is more effective than the previous conventional screen requires a quantitative comparison of sand rate, oil and gas production, choke opening, operating hours, pressure, and PCTGL injection rate over equivalent periods before and after installation. Thus, the present findings should be interpreted as evidence of improved sand-control and production performance during the evaluated period rather than as proof that Filtrex is universally superior to conventional sand screens.



Picture 1. Production Rate Well RSK

Figure 1 shows the oil and gas production performance of the RSK Well from January 2023 to approximately April 2025. Before May 2024, oil production was relatively low and unstable, generally declining to approximately 25–45 BOPD despite a temporary increase to about 220 BOPD in mid-2023. From May 2024 onward, oil production increased sharply to approximately 270 BOPD and subsequently fluctuated between 200 and 335 BOPD. Gas production also increased but remained highly variable, with several sharp rises and declines throughout the post-intervention period. If Filtrex was installed immediately before May 2024, this production response indicates an improvement in well deliverability and operational performance after installation.

The increase in oil production suggests that the OCMP filter reduced sand-related flow restrictions while maintaining pathways for reservoir-fluid flow, consistent with the field application reported by Iqlima et al. (2022). Nevertheless, the graph alone cannot demonstrate that the entire production increase was caused by Filtrex because choke opening, reservoir pressure, water production, gas-lift injection, and PCTGL operating conditions may also have affected well performance. The gas-production unit should also be verified because a reported rate of approximately 150–175 MMscfd appears disproportionately high relative to an oil rate of about 300 BOPD. Therefore, Filtrex effectiveness should be confirmed using quantified sand-production data, the exact installation date, equivalent pre- and post-installation periods, and supporting operational parameters

CONCLUSION

The reservoir characteristics identified through sieve analysis confirmed the suitability of Filtrex as a sand control technology. The calculated Uniformity Coefficient (1,38) and Sorting Coefficient (2,16) indicated that the formation contained fine particles requiring advanced filtration. After Filtrex installation, production performance improved significantly while sand production was effectively eliminated. This study concludes that integrating sieve analysis with Filtrex selection provides an effective engineering approach for sand control in mature unconsolidated reservoirs.

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