Production Increase of 1,010 m³/d with MaxCO₃ Acid System and SXE Acid

Acid treatment results exceed operator expectations by more than twofold

CHALLENGE
Provide diversion technique to achieve effective stimulation throughout a naturally fractured horizontal openhole carbonate well.

SOLUTION
Applied MaxCO₃ Acid® degradable diversion acid system and SXE® emulsified acid to divert and create multiple fractures in the openhole lateral and control fluid loss.

RESULTS
Achieved production increase of 1,010 m³/d—nearly twice the operator’s anticipated gain.

An overall production gain of 1,010 m³/d, which was achieved from three wells, is similar to that obtained from six wells in the operator’s previous stimulation campaign in the same field.

Diversion and fluid loss control during acid fracturing
An operator in the Caspian region needed to optimize stimulation for horizontal openhole wells. The company had been using chemical diverting systems with no significant improvement to the production profile after the treatment. Looking for a solution that would offer diversion and fluid loss control during the acid fracturing procedure, the operator contacted Schlumberger.

Staged acid fracturing treatment enables efficient plugging
Schlumberger engineers proposed an acid treatment with two main fluid systems—MaxCO₃ Acid system and SXE emulsified acid. The SXE acid is a viscous, highly retarded, concentrated acid system formed with a 70:30 hydrochloric acid (HCl)—to—oil ratio, stabilized with an emulsifier. Because it can penetrate farther into the formation than any live acid, SXE acid was used for deep penetration. The MaxCO₃ Acid system achieves superior diversion through degradable diversion technology. The combination of these two fluid technologies creates a system that improves leakoff control for naturally fractured reservoirs as compared to conventional acid-alternate gel systems used in acid fracturing.

A staged sequence followed. After a prewash of 15% HCl to break down the formation and push hydrogen sulfide (H₂S) out of the wellbore, the first MaxCO₃ Acid system stage was pumped. Bracketed by 15% HCl, the main 28% SXE acid followed. This procedure was repeated twice to increase the etched half-length of the fracture and to increase the coverage of SXE acid through the entire open hole. The best results were achieved when the MaxCO₃ Acid system stage was pumped at below fracture pressures to get the best plugging efficiency. The MaxCO₃ Acid system and SXE acid disintegrated following the treatment, leading to excellent cleanup and zero formation damage.

Production doubles after diversion system implementation
An overall production gain of 1,010 m³/d was almost twice the return of the 517 m³/d that the operator expected. This production gain was achieved from three wells—similar to that obtained from six wells in the operator’s previous stimulation campaign in the same field.

CHALLENGE
Provide diversion technique to achieve effective stimulation throughout a naturally fractured horizontal openhole carbonate well.

SOLUTION
Applied MaxCO₃ Acid® degradable diversion acid system and SXE® emulsified acid to divert and create multiple fractures in the openhole lateral and control fluid loss.

RESULTS
Achieved production increase of 1,010 m³/d—nearly twice the operator’s anticipated gain.
The treatment using MaxCO₃ Acid system and SXE acid effectively stimulated the well and improved production.

### Naturally Fractured Reservoir

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottomhole temperature</td>
<td>250 degF [121 degC]</td>
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<tr>
<td>Well type</td>
<td>Horizontal 5 7/8-in open hole</td>
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<tr>
<td>Treatment</td>
<td>Acid fracturing</td>
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<tr>
<td>Reservoir fluids</td>
<td>Oil</td>
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<tr>
<td>OH interval</td>
<td>1,080 ft [329 m]</td>
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<tr>
<td>Permeability thickness (kh)</td>
<td>50 m MD</td>
</tr>
</tbody>
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