Journal of Physical Science and Application 7 (3) (2017) 41-43
doi: 10.17265/2159-5348/2017.03.005

# Microbial Assessment of Used Drilling Mud and Mix Cement Fluid for Production Well

Abdulmohsen Al-Humam, Mohammed Sindi and Abdullah Al-Wadei

*Research & Development Center Saudi Aramco, Applied Microbiology Unit, P. Box 62, Dhahran 31311, Saudi Arabia*

**Abstract:** Drilling fluids and mud additives are generally acknowledged as potential sources of contamination in deep drilling programs, as they may contain high concentration of nutrients for subsurface microorganisms. Microorganisms introduced into drilling process cause a number of problems that can lead to significant costs for the industry. Numerous studies have shown that biogenic sulfide production in oil and natural gas fields have led to a number of problems, including reservoir plugging, reservoir souring, reduced product quality, and corrosion of metal-containing equipment. The aim of this study is to determine the microbial contamination of water drilling mud and cement Mix fluid at two Saudi Aramco well SA-10 & SA-12 and to adequately perform microbial assessment for the well both wells. Microbiological analyses were conducted to evaluate the level of contamination by TB (total bacterial) and SRB (sulfate reducing bacteria) using and q-PCR (quantitative poly chain reaction) technique. Microbial results for SA-10 indicated that total bacteria were $2.21 \times 10^3$ /mL for mix fluid sample and $1.22 \times 10^5$ /mL for drilling water sample. In addition, microbial results for total SRB were $1.65 \times 10^2$ /mL and $1.34 \times 10^2$ mL, respectively. Moreover, microbial results for SA-12 indicated $5.89 \times 10^5$ /mL of total bacteria and 98 /mL of SRB in the sample.

**Key words:** SRB, drilling mud, mix fluid, bacteria contamination.

## 1. Background

Microorganisms that is present in oil and natural gas fields cause a number of problems that lead to significant costs for the oil and natural gas industries [1, 2]. Studies have shown that microorganisms can significantly alter or degrade a number of hydrocarbons in both oil and natural gas [3, 4]. Numerous studies have also shown that sulfide production by microorganisms in oil and natural gas fields can lead to a number of problems, including reservoir plugging, reservoir souring, reduced product quality, and corrosion of metal-containing equipment [1, 2, 5, 6]. Even though it is clear that microorganisms cause problems in oil and natural gas fields, very little is known about the origin of microorganisms in these ecosystems [7]. The majority of studies that have monitored the microbial communities in oil and natural gas reservoirs have done so using production water samples, which provide very little insight on the origin of microorganisms in these ecosystems [7, 8]. To date, very little is known about the populations of microorganisms that are introduced into petroleum and natural gas wells during drilling.

During the 4 1/2” liner job cement set prematurely and prevented the retrieval of the liner running tool from the wellbore in Saudi Aramco well -10. As consequence the drill pipe cannot be disconnected from the top of the 4 1/2” liners and the entire drill string is stuck in the wellbore. The drill string was backed at +/- 10,200 ft and after setting a whip stock the well is currently being sidetracked.

In addition, the cement set too quickly on this 9 5/8” casing cement job for the Saudi Aramcowell -12. The additives lignosulfonates and naphthalene sulfonates, responsible for delaying the set, are not working. The expected 8 hours thickening time for the first confirmation fluid was reduced to only 1 hour and 51 minutes that was not enough time to perform the job successfully. In addition, the mix fluid of the first

**Corresponding author:** Abdulmohsen Al-Humam, Ph.D., research field: petroleum microbiology.

**Table 1 Microbiological analyses results usingq-PCR (quantitative poly chain reaction) method.**

| Sample No. | Total bacteria (bacteria/mL) | Total SRB (bacteria/mL) |
|---|---|---|
| Cement mixed fluid SA-10 | $2.21 \times 10^3$ | $1.65 \times 10^2$ |
| Drilling water SA-10 | $1.22 \times 10^5$ | $1.34 \times 10^2$ |
| Cement mixed fluid SA-12 | $5.89 \times 10^5$ | 98 |

stage omit a strong odor of "rotten eggs", which may indicate the presence of $H_2S$. As a result, cement mix fluid samples were collected to investigate the presence of microbial contamination in the cement mix fluid samples.

## 2. Technical Program

Three samples from Saudi Aramco well-10 & 12 were collectedto determine if cement mixed fluid and drilling water samples contaminated by microorganisms. Therefore, the microbial analyses program was focused on isolating TB (total bacterial), and SRB (total sulfate reducing bacteria) [8, 9].

The samples were collected in sterile plastic bottles, and sent to Laboratory for analyses. Molecular method; q-PCR was used for the enumeration of TB and total SRB in the samples. This method is used to detect relative and absolute bacteria gene expression level. The three samples of mix fluid and drill water were filtered with 0.45 micron filters. The DNA from the filter papers was then extracted and microbial analyses experiments for the groups of TB, and total SRB were performed to calculate the microbial concentrations in the two samples [10, 11]. The results are reported as bacteria/mL.

## 3. Result

Table1 summarizes the results of q-PCR method for SA-10 indicated that total bacteria in cement mixed fluid sample is $2.21 \times 10^3$ /mL and $1.22 \times 10^5$ /mL in drilling water sample. Moreover, the total SRB results indicated $1.65 \times 10^2$ /liter of oil, and $1.34 \times 10^2$ /mL, respectively. However, the result for SA-12 cement mixed fluid sample indicated total bacteria of $5.89 \times 10^5$ /mL bacteria, and 98mL SRB.

## 4. Conclusion

As a conclusion, both Saudi Aramco well SA-10& SA-12 are contaminated with GAB and SRB which may be a cause of concern that bacteria gets to different depth in the well which may effect on the drilling mud characterization and viscosity [12, 13, 14]. Therefore, sort of treatment may have to be considered to control the bacterial activities in the drilling mud and cement mixed fluid [15-17].

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