Proceedings, Twenty-Eighth Workshop on Geothermal Reservoir Engineering
Stanford University, Stanford, California, January 27-29, 2003
SGP-TR-173

DEPOSITION ANALYSIS AND TESTING OF CHEMICAL INHIBITORS

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ABSTRACT

There were recorded scaling problems during geothermal waters utilization both in Romania and Iceland. The solid depositions from production wells from these countries were analysed and their composition seems to be very close.

In Iceland it was chosen a high temperature geothermal well for inhibition testing. There were projected and made the equipment for testing with chemical inhibitors. The results indicated the good efficiency of the used inhibitor

INTRODUCTION

Geothermal fluids often display hostile thermochemical characteristics resulting in formation damage of the exploitation equipment. Damage could occur in the form of metal corrosion and deposition of scale species.

Source mechanisms are governed by pH, temperature, salinity, flow rate. By modifying the thermodynamic conditions induced by the production, precipitation processes will accelerate.

SCALE FORMATIONS IN ROMANIAN AND ICELANDIC GEOTHERMAL WELLS

In this paper there were reviewed scaling problems occurred in geothermal wells from Romania and Iceland.

There were taken for studies four low temperature geothermal wells from Romania, which have been utilised for greenhouse heating. These are: wells 529 and 4155 from Bors, well 4668 from Ciumeghiu and well 4058 from Sacuieni.

During the exploitation of these geothermal fields scales have been encountered inside the wells and in the surface construction. The solid depositions were chemical analysed by using analytical methods. They were also analysed by X-ray diffraction and thermic.

The results indicated calcium carbonate as aragonite crystals in the solid sample from Bors, well 529 and calcite, magnesian crystals in the solid samples from the other three wells. A very low content, less than 5% at Ciumeghiu and less than 1% at well 4155 from Bors and well 4058 from Sacuieni, consists of MgO and traces of Fe_2O_3. These showed that calcite formed the main constituent of the solid samples from wells: 4155 Bors, 4668 Ciumeghiu and 4058 Sacuieni.

It was taken for study the well Klausturholar 7 located at about 60 km south-eastern to Reykjavik, Iceland. This well was drilled at 180 m depth and the wellhead temperature has been 143^0C. The flow rate is 2 l/s. It is used for heating the houses in the area and at a fish farm.

There were noticed scale formations on the pipe inside the well through the surface. As a result of fluid flashing a severe scaling problem has been recorded. A solid sample was analysed by XRD. The obtained diagram (Figure 1) indicated that the sample consists of calcium carbonate as aragonite and calcite crystals.

TESTING OF CHEMICAL INHIBITORS

The damage encountered during utilisation of well Klausturholar 7 consists of a thick layer of calcium carbonate inside the pipe, that restricts the well performance. Without a mechanical cleaning once a week, the well could not be used. In order to avoid the scale formation there were used chemical inhibitors.

The present paper will illustrate the technology used for testing of chemical inhibitors. The surface equipment is presented in Figure 2. The principle sketch of the installation for inhibitors injection is shown in Figure 3.

It was used for testing a polyacrylate as inhibitor. The concentration of the inhibitor was modified. Before using the inhibitor and after each change of its concentration, there were taken water samples. These samples were analysed by atomic absorption spectroscopy at λ=422,6 nm to find out the calcium content of the geothermal water. The measurements made during the testing and the laboratory results are presented in Table 1.

Based on these data, they can notice the lowest calcium concentration in the raw geothermal water. By using the polyacrylate inhibitor, the calcium concentration in water increases as the inhibitor concentration increases. This mean that this inhibitor keep the calcium in soluble form, preventing particle aggregation.

Even a low concentration of inhibitor (2.77 ppm) is followed by a double calcium concentration. There are not large differences in calcium concentration when they use higher concentration of inhibitor (Figure 4).

CONCLUSIONS

The structure of the depositions from the wells from Romania is close to that from the tested well from Iceland.

They look for a method to combat scaling, that does not require high costs and does not need to stop the production of the well during the water treatment. It is the case of chemical inhibition, that was successfully experienced in Iceland, at well Klausturholar 7.

The good efficiency of the polyacrylate inhibitor was proven. It could be used a low concentration of this inhibitor to prevent calcium carbonate scale.

It is recommended that this kind of inhibitor to be used to prevent scales in the production wells from Romania, as well.

ACKNOWLEDGEMENTS

I wish I thanked to Kristjan Kristjansson, who award the NATO grant fellowship. Thanks to Orkustofnun staff, who allowed the analysis in the laboratory and thanks to all the chemists who contributed in these experiments.

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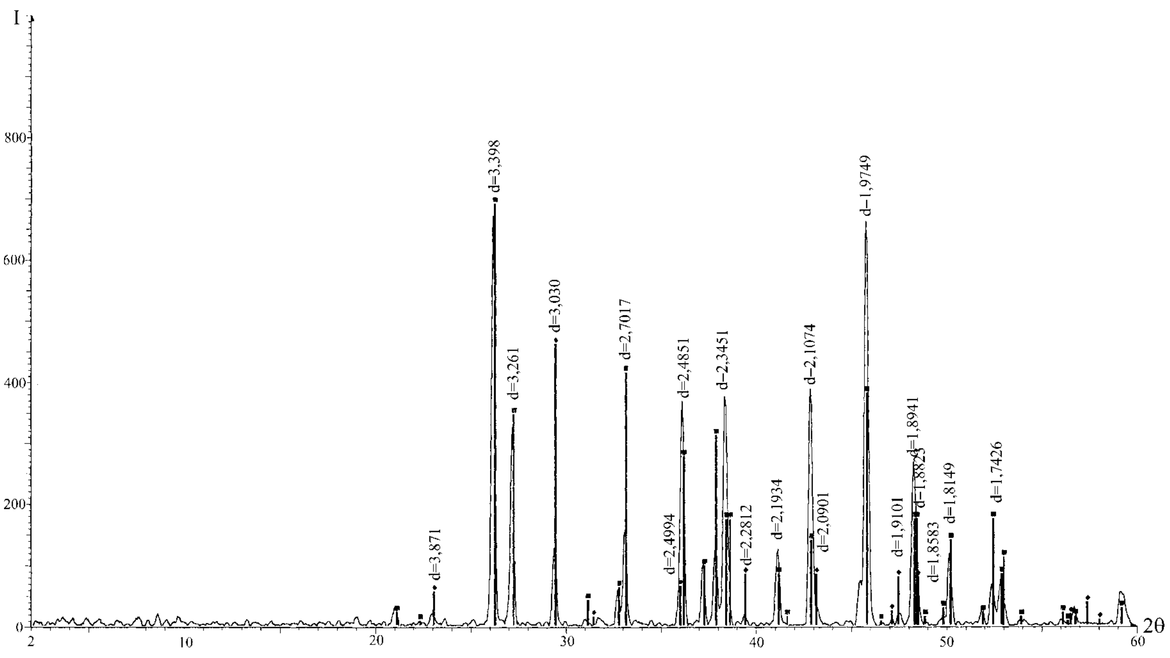

Figure 1. The XRD diagram of the depositions sample from Klausturholar 7

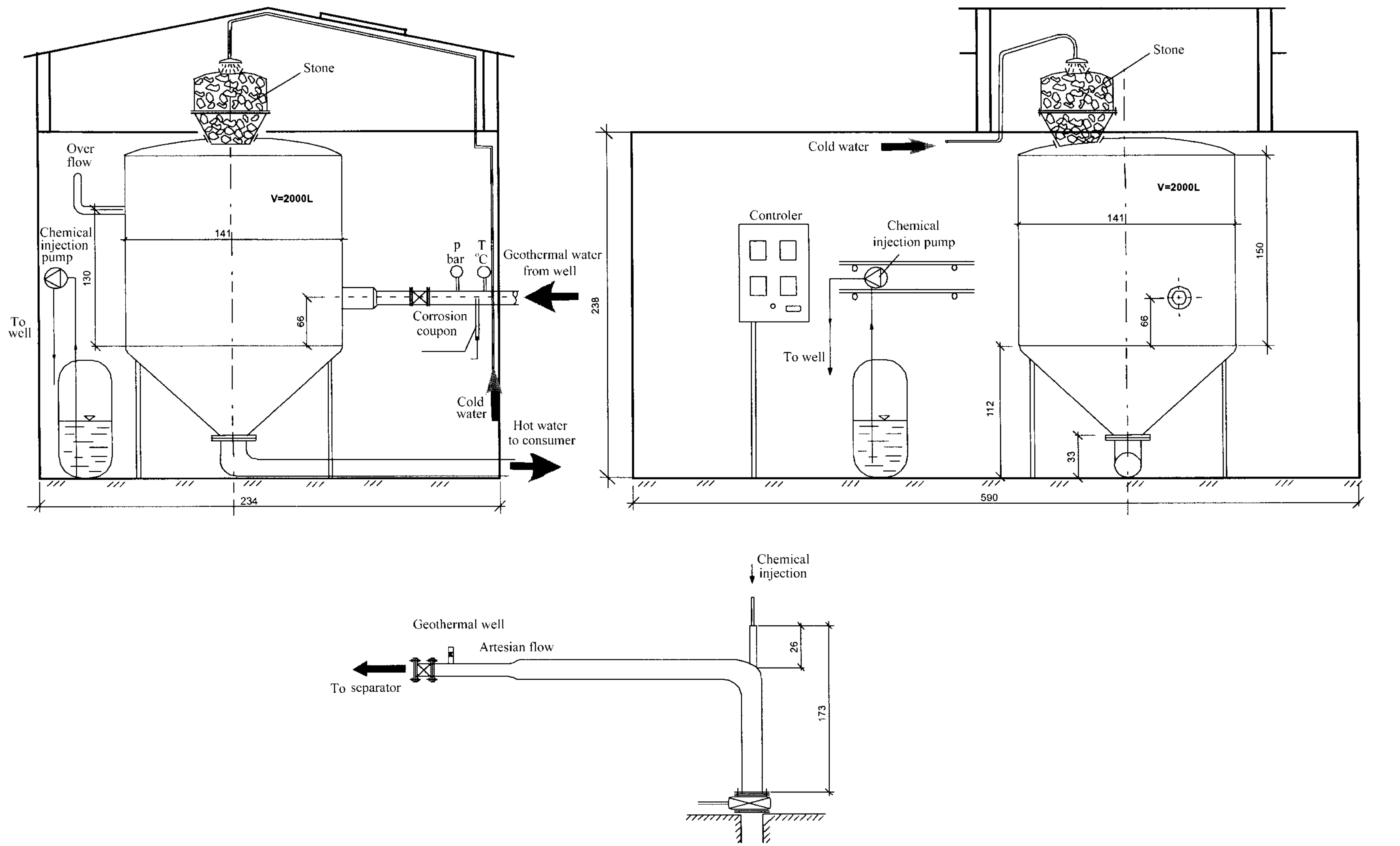

Figure 2. Surface equipments

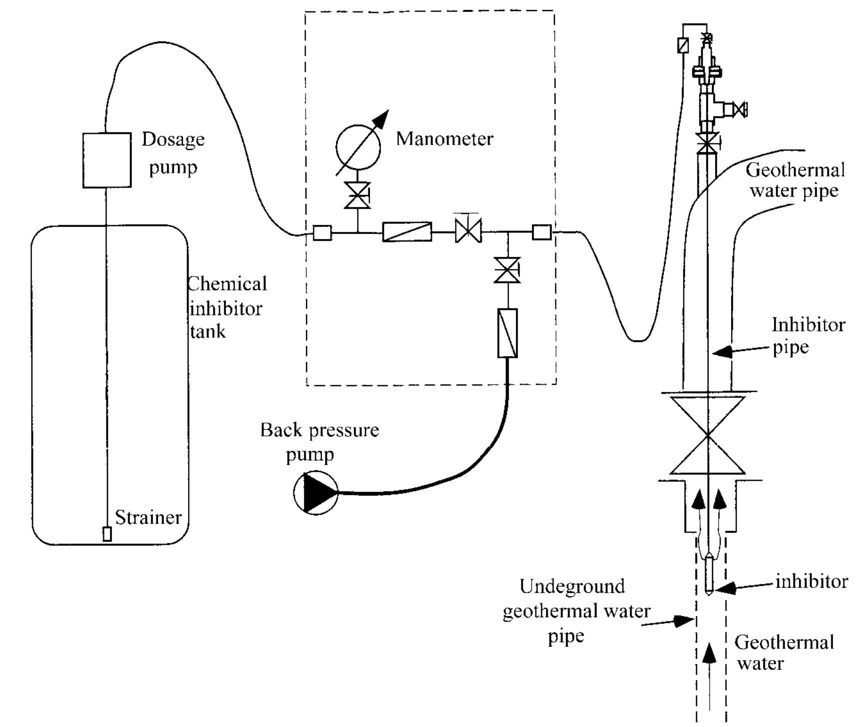

Figure 3. Installation for inhibitor injection

Table 1. Experimental data

Sample No.	Dosage pump		Rate injection of inhibitor [l/h]	Flowrate of well [l/s]	Calculated concentration of inhibitor [ppm]	Conc. Ca^{2+} [ppm]
	SPM	%Stroke				
1	Without inhibitor					4,57
2	50	40	0,4	2	2,77	9,6
3	55	55	0,7	2	4,86	10,21
4	55	80	1,2	2	8,3	10,44
5	80	80	2	2	13,8	10,51

Figure 4. Calcium concentration against inhibitor concentration