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To ensure stable operations of drainage well zones

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Abstract

In the paper an issue of stable operations of drainage well zones is discussed. The theoretically determined conditions on stable operation are confirmed by field experiments. In order to account for real-world uncertainty related to operations of drainage well zones, fuzzy If-Then rules based model is developed. This model allows to determine conditions of optimal operation mode under uncertainty.

Keywords: drainage zone; gas hydrodynamic processes; centrifugal pump; bottom pressure; maximum regime

1. Introduction

Different technological difficulties (related to sand, gas and water streams into the wells) in the exploitation of the wells are existing processes. Different measures (fighting against sand plug and gas, limiting measures of water flow) have been taken out to eliminate these technological difficulties and are being applied on a large scale. But until today because of gas hydrodynamic processes no clear answer was given to technological processes formed in the drainage zones of wells[1-3].

It was determined that gas hydrodynamic characteristics of drainage zone of wells-dependence between the bottom pressure of the well and output-is similar to the working characteristics of centrifugal pump, so it means centrifugal pump can be considered as the model of the drainage zone of well[12].

It is known that the maximum regime on working characteristics of centrifugal pump is (b) and this can ensure stable operation (Fig. 1).

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The mode of centrifugal pump is not considered stable in the part ab of working characteristics and in this part pulsations and cases of utilization cuts can be formed in the working of pumps. The work of pump is considered unstable in this part of the working characteristics. Stable operation of centrifugal pump is formed on the right of maximum working pressure of working characteristics (c)[3].
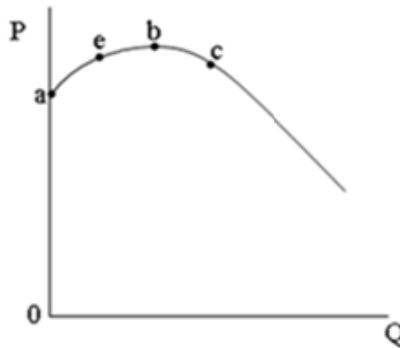
Fig. 1.Working characteristics of centrifugal pump:
a-minimum working pressure; b- maximum working pressure; c-stable mode; e-unstable mode

It should be mentioned that gas hydrodynamic characteristics of the wells-dependence between outputs of liquid Q and layer of gases V of the well- is depicted below in the Fig. 2 [1,4-8].

According to this research we must choose such a regime for the pump that it should be used between optimal and maximum regimes (O, M).
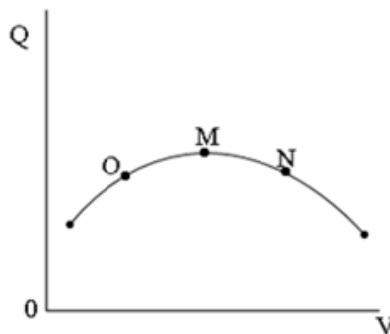
Fig. 2. Dependence between the outputs of pump well and layer of gases: O-optimal regime; M-maximum regime; N-stable regime

But according to working characteristics of centrifugal pump if we use the well from the maximum regime (M) to stable regime (N) (on the right in the Fig.2) this can ensure stable operation of drainage zone. It also should be mentioned that in this case for 1 ton of oil production layer gas consumption will be increased. Instead drainage zone of the well will be worked with pulsation, it means liquid and gas flow into the well will be prevented and sand plug will become weak.