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Short Review Article

Optimization of Well Production by Designing a Core pipe in one of the Southwest oil Wells of Iran

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Abstract:
One of the most important parts in choosing a well completion is to study the geological and reservoir structure of the well where the well is located. For instance, if the reservoir material is of a carbonate type, it can be consolidated into an open cavity. If the material of the reservoir where the well is located is sandstone, the first step to take is to determine the rock mechanics properties of the reservoir. In this study, while introducing and presenting a variety of complementary methods, the effects of various variables such as GOR, PI, reservoir pressure and wellhead flowing pressure, water cut, WCT percentages, and choke size reducing on the natural flow rate of the well were investigated.

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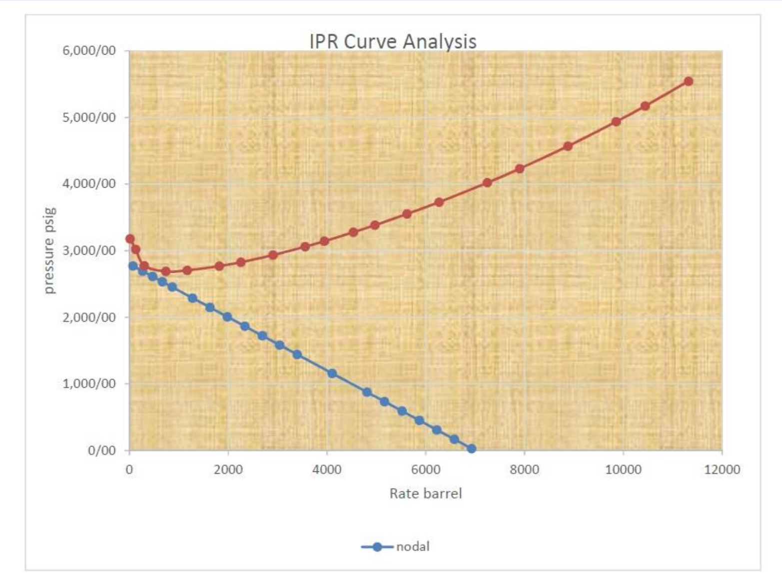
Keywords: Well completion; Reservoir structure; GOR; WCT; Well head pressure

Graphical Abstract:



Biography:

Alireza Bozorgian was born in Kashan, (Iran). He completed his BSc, MSc and Ph.D. Degree in Chemical Engineering. He currently works in Chemical Engineering at the Islamic Azad University of Mahshahr. His studies focused on Heat Transfer, Transport Phenomena, Nanotechnology and Gas Hydrate. He has published more than 20 papers.

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1. Introduction

Finishing can be done in an open cavity if the reservoir stone is sufficiently solid. Also, if the reservoir has layers of shale shards, it should be completed in the case of a hole and also if the well produces sand, the sand control completion system should be used to complete the well. In this study the studied well is connected with two reservoirs. Tank A is at the top and B is at the bottom. Reservoir A consists of eleven substrates (A_1 to A_{11}). Reservoir B also contains 3 substrates (B_1 to B_4). Based on the description of microscopic thin sections prepared from drilling kernels and crumbs and geological data of formation A wells in the oil field consist of lime, dolomitic lime, calcareous dolomite, marl lime, shale and anhydrite thin layers [1]. In reservoir formation A, Substrates A_1 and A_2 consist mainly of calcareous dolomitic with minor and dispersed amounts of shale and anhydrous calcareous dolomites with higher dolomite content in these parts although in layer A_2 the dolomite content decreases, layers B_1 to B_5 consist mainly of calcareous dolomitic lime dolomite with dispersed shale and anhydrite percentages, with the presence of dispersed shale's and anhydrite veins in layer B_1. The C_1 and C_2 layers are mainly composed of lime, dolomitic lime, sometimes calcareous dolomite with minor amounts and shale remnants. Layers D_1 and D_2, which are substrate B of the reservoir, consist of dolomitic lime and sometimes marl lime, which increases with increasing depth of marl tracks, as well as layer A to D formations mainly of pure lime and sometimes with lime [2]. Density of the reservoir rocks studied is shown in Table 1. A small percentage of dispersed shale is formed. For formation of A, the density of lime and dolomite grains were 2.71 and 2.845 g/cm^3, respectively, and for formation B.

Table 1. The density of the reservoir rocks studied [3].

Type of mineralization	Density of grains (tank A) gr/cm^3	Density of grains (tank B) gr/cm^3
Lime	2.71	2.71
Dolomite	2.845	2.845
Anhydrite	2.98	2.98
Clay	2.65	2.65

2. Fluid Properties of Investigated Wells

Another parameter that is very effective in examining the results of modeling and choosing how to complete it is the fluid properties of the oil well. In this well, after obtaining the RFT (Repeat Formation Test) diagram, which is a graph that measures the pressure changes, it is possible to calculate the oil-gas contact surface as well as the water-oil contact surface. The gas-oil contact area in the well at the reservoir 200 m below sea level and the oil pressure at a depth of 1500 m below sea level is 2400 psig and also the slope of oil pressure changes relative to depth is 0.32 psig which is calculated by surface pressure the gas-oil contact initial saturation pressure was calculated as 2184 psig [4]. According to the fluid properties tests carried out at temperatures close to 160 degrees Fahrenheit, the reservoir oil volume coefficient was calculated to be 1.33 bbl/STB at baseline, which was matched with 1.35 as the reservoir oil volume coefficient at initial conditions calculated from the calculations. According to the tests of the fluid properties of the reservoir, the ratio of the gas to othe il dissolved in the initial conditions of the tank is 650 SCF/STB at 141 °F. Since fluid saturation pressure may vary with the temperature changes, the saturation pressure of the tank increases with enhancing the temperature. Investigation of saturation pressure to depth changes will be happened due to two factors of temperature change and changes in fluid composition [5]. Figure 1 reveals the bubble point pressure variations against depth [6]. To study more precisely, these changes by simultaneously saturating pressures to 160 °F the effect of temperature on saturation pressure changes to depth was eliminated for this purpose, samples whose saturation pressure was measured at different temperatures were used. After isothermal pressing, the depth chart was saturated according to saturation pressure and according to the sampling time. It can be concluded that saturation pressure changes to depth mainly due to temperature changes decrease with time and the output from the saturation pressure tank decreases. This is called the Bubble Point Pressure Depression Saturation Pressure phenomenon that occurs in fissile reservoirs. In oil cracks in vertical cracks due to reservoir temperature gradient moves with convection phenomenon. For this reason, the diffusional molecular diffusion phenomenon plays a very important role in the fractured reservoirs and the large amount of gas in the solid part of the rock is transferred from the oil to the reservoir. This causes the fluid saturation pressure to decrease over time [7].

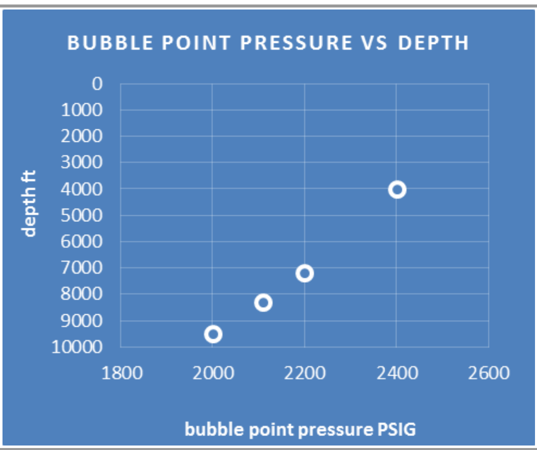

Figure 1. Bubble point pressure variations against depth [6].

Examination of changes in oil volume coefficient with respect to temperature shows oil volume coefficient increases with increasing temperature but no significant change at different times for volumetric coefficient is observed. Investigation of oil density changes with temperature also shows that oil density decreases with increasing temperature but no significant change with time. It should be noted that if the gas injection method is used in the well, the injection of gas will direct the oil to the production well and the rate of recovery of the reservoir oil will increase with the change of the thermodynamic properties of the reservoir fluid. The variation of reservoir-type texture in the hydrocarbon reservoirs has an important influence on the control of oil production and this effect in a way that controls the fluid displacement pressure during production. Areas of reservoir rock that form a connection between the pores of a weak network have low effective efficiency, accelerate the flow of oil and gas, or slow them down are factors contributing to the simplest expression of three factors in finding fluid in a reservoir. As follows:

a. Gradian pressure

b. Gravity driving

c. Capillary action

There is an urgent need for domestic and state of the art tank and gas tankers. These properties are typically isolated from the specimens of the test samples [8]. Figure 2 is shown the internal schema of the wells studied.

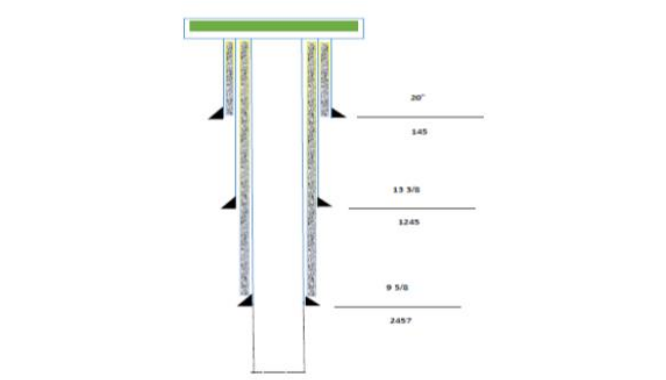

Figure 2. Internal schema of the wells studied.

3. Build a basic model of current well conditions

First, using the above data, we build the initial model and investigate the well conditions in terms of two-phase fluid flow [9]. Obviously, in order for the oil to be transported to the oilfield, it must have a minimum head pressure, so the minimum pressure required to flow the oil to the oilfield is at least 150 psig. To do this, we first plot and analyze the IPR (Inflow Performance Relationship) and TPR (Tubing Performance Relationship) analysis curves [10]. Figure 3 is shown the IPR analysis curve.

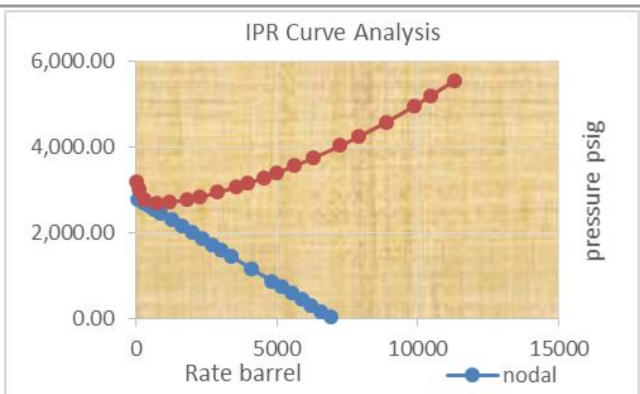

Figure 3. IPR analysis curve [11].

As seen in Figure 3, the red curve is the TPR curve, and the blue curve is the IPR curve, due to the required pressure of the 300 PSIG that the well will flow naturally in natural flow.

The next step is to choose the right flow relationship. Flow relationships are actually relationships that predict the pressure drop inside the well. We can choose an appropriate flow relationship by finding the relation that has the least deviation from the actual data.

Of all the flow correlation flow relationships, the one that is most consistent with the actual data is the GRAYO relation, and as a result it is used as a suitable relation to predict the pressure drop within the system [12]. The actual data measured in the oil well using the pressure recorder show very good agreement with the GRAYO equation. Only in the upper part of the well are some deviations in the data predicted by the GRAYO equation from the real data observed due to the separation of the gas from the oil due to lower pressure. As the well does not flow, the next strategy is to examine the revision of the current well completion method in order to find complementary ways that the well will flow naturally. So the next step is to try other complementary methods and examine their effects on the natural flow of the well [13].

4. Investigation the effect of GOR oil increase on natural well flow possibility

The drift of a reservoir depends directly on whether the reservoir energy can maintain bottom pressure at a high level. In the thrust state the pressure-soluble tank may be discharged very quickly due to continuity and continuity of production [14]. As a result, wasting gas can very quickly push the tank to the point of non-production. In a tank with a gas cap, the well at the gas-oil boundary, along with the expansion of the gas cap as a result of the production, soon rises GOR and the production range is attacked by a gas cap and it should be noted that the tendency of the gas to Production is much higher than oil, although well head pressure is increasing, but it is itself the best indicator of well closure and action to repair the well. The limited production of oil from reservoirs that have a large hydro thrust or gas cap generally results in greater oil production [15]. In weakly drifted tanks or gas warheads, if the system is weak due to low tank permeability, the tank pressure can be kept relatively high by reducing the amount of production and precise control of gas and water production. If the above controls are not possible, then reinforcement of natural drifts is the best choice for optimal completion, which results in more hydrocarbon recovery. Gas injection wells and water injection wells help to recycle more hydrocarbons [16]. It can be clearly seen that increasing the amount of gas associated with the oil enables the flow of wells naturally. Due to the function when the gas associated with the oil reaches the 1000 SCF/STB the well does not flow naturally but then the well flows naturally. So one of the options that helps us choose how to complete is to inject gas into the oil column to make it lighter [17].

5. Investigation of tank pressure changes on the natural flow of wells

Reservoir pressure is one of the most important factors in the natural flow of a well. This factor can be reduced by the impact of the damage, referred to as the skin factor. Types of reservoir damages eventually reduce the flowing bottom whole pressure well. Generally, damages to the reservoir are classified into two categories: natural and induction based on the type of creation. Natural damages are those caused by reservoir production. Induction damages are caused by operations performed on the well. Such as drilling, repairing and completing the well, stimulation, or injection. Mostly in the oil and gas wells due to damage to the formation near the well, the permeability is reduced. Among the causes of these injuries are drilling mud that causes damage when penetrating the floor [18]. Organic and mineral deposits are also included. To address the issue and increase well production, classes need to be treated and motivated. Acidification is one of the most commonly used methods in the well motivation process. In this operation, the acid is injected into the floors at various pressures to increase the rate of production by dissolving and removing the receptors as well as by opening the ducts [19]. According to our results, when the reservoir pressure is about 2000 pam it is not possible to flow the well; however, when the reservoir pressure reaches 2400 pam the well will flow naturally. So one of the options that can help us naturally find the well is to eliminate the damage to the tank by operations such as drilling or repairing it, so that the well pressure approaches the tank pressure [21].

6. Investigating the change in output capacity on natural well flow possibility

The productivity index (PI) is the ratio of the flow to pressure drop over the life of the tank. This indicator indicates the intrinsic ability of the reservoir for production, the greater of which indicates the high capacity of the reservoir rock to pass through the reservoir fluid. The productivity index is, in fact, a flow-rate diagram in wells in flow that is linear for oil tanks at pressures above the bubble point pressure and follows the Vogel equation for tanks whose pressure is below the bubble point pressure. Based on this index, we can obtain the pressure equation based on the discharge for the well being tested [22-23].

7. Reduction of Head Wells on Possibility of Natural Flow of Wells

The Choke flow reducer works by adjusting the flow rate and lowering the wellhead pressure to a pressure lower than the current pipeline. It is also used to independent current flow pressures from downstream choke pressures. Choke is a type of spout. Figure 4 demonstrates an example of a downstream flow well.

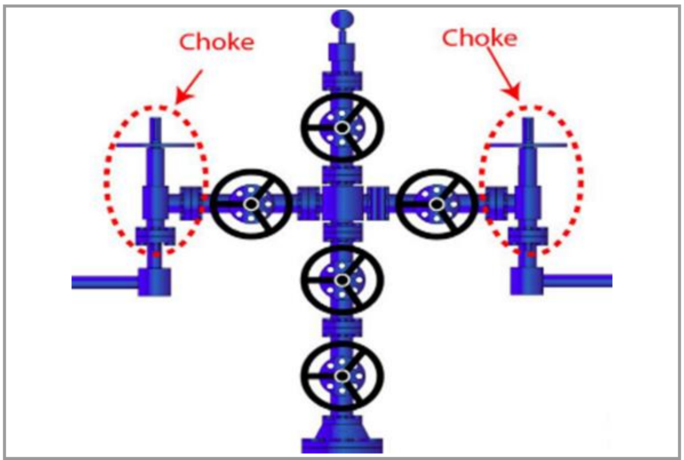

Figure 4. An example of a downstream flow well.

We investigated the effect of resizing on its flow rate and pressure by varying the size and size of the reducer. As can be seen in Figure 4, when we set the drop size to 0.375 inches, the flow rate would be about 536 barrels per day, increasing to a drop of 0.75 inches to 2446 barrels per day. It is quite clear that changing the size of the lowering does not have much effect on the increase in pressure and decreases with increasing lowering, but this decrease is negligible. Therefore, reducing wells cannot be used in wells that have a pressure reduction problem, and only in wells that do not have a pressure problem and only have a flow problem can be used to reduce the size [22].

8. Investigation of water cut changes in natural well flow possibility

In some fields due to widespread fractures throughout the reservoir, especially in the carbonate tanks, water enters the production wells through these gaps and no oil is produced from the reservoir segments. We need land, and because their construction is limited, gel injections can increase production capacity and make new water separation facilities unnecessary [20]. Figure 5. Is shown the Wellhead crown sample. The well will produce naturally if the water content is about 10%, but if the water content reaches 20% or higher, natural flow will not be possible and should be achieved using methods such as cementing and blocking the water layer controlled the water from the reservoir to the well [23].

9. Investigation the effect of wellhead pressure changes on natural well flow possibility

The well is actually a part of an oil or gas well, which provides facilities for installing wall-mounted receivers in the hard phase of the well. Also, during the production phase of the well, they also produce the parietal tube, well head valves and outlet fluid control valves. All wall tubes of different sizes should be kept in the well head and blocked, this is called a wellhead connection. The system controls the pressure and provides access to the main parietal cavity, lining or anal space. This access to pressure control allows drilling operations or well completion to allow safe operation with minimal environmental risk. Well equipment can operate in highly polluted and corrosive environments with H_2S values up to 25% and operating pressure from 2000 to 25000 Psi and operating temperatures from 6 to 112 ° C. Wellhead components are mainly made of plain carbon steel, low alloy and stainless steel depending on operating pressure, operating temperature, product components such as H_2S and their pressure and position and piece type. These components are mainly prepared by forging and casting methods and are bonded to each other after appropriate heat treatment by connections such as thread, welding, cracking or other joints. Wellhead components must be manufactured to meet the technical requirements and material properties of API 6A. According to this standard, the product specification level is introduced for wellhead equipment, these four specification levels (PSL) actually represent the level of different technical requirements.

Figure 5. A Wellhead crown sample.

The minimum required wellhead pressure is the pressure that must be present at the wellhead and crest so that the flow can move naturally to the unit of operation without the need for artificial upgrading. This minimum pressure depends on parameters such as the ups and downs of the area, the distance from the well to the operation unit, and the pressure drop along the route. In Figure 5, it examines the amount of borehole pressure over the natural flow of the well. As can be seen in the Figure 5, the head pressure of 550 pam flows naturally, but above this pressure there is no possibility of natural flow of the well [24].

10. Analysis of results

10.1. Driving a suitable filament to increase the well flow pressure

Production of oil and gas is done through production casing or core pipe or both. Generally, if the oil lacks H_2S and other corrosive materials, it is produced through the production pipe. In gas wells or oilfields containing corrosive materials to prevent corrosion and decay of the parietal tube, production is done through the cerebral tube (supplementary filament) because the filament is replaceable if it is corroded and corroded, but if the parietal tube suffers Corrosion and decay due to the cement behind it cannot be replaced and will result in costly repair work (over work). There are different types of supplementary courses. The most important and most complete field is related to gas wells. Urban finishing uses a short finish (Urban completion), the main purpose of which is to install a SSSV subsurface safety valve for emergency situations [25].

The types of supplementary disciplines described briefly are as follows;

Single strand with cerebral tube (one-layer completion)

Kick off completion

Urban completion

Protective gas and oil filing

Multilayer supplementary thread

Duplicate supplementary thread

One of the reasons for pushing the auxiliary filament is to supply the pressure needed to process the oil to form the length of the filaments depending on the point of formation of the oil bubble. By pushing the complementary strand, it prevents the bubble from forming due to pressure drop [26-31].

An oil or gas well has been in trouble for a variety of reasons after it has become productive and needs to be repaired. These repairs may be performed by a rig, a mobile tubing machine, and a well service. Today, Coiled Tubing, as a highly efficient unit, can repair over a hundred wells in one year. This is while a medium-sized semi-heavy mast can repair four to five wells in a year. Maintenance by the mast is very expensive so companies try to do the repair as much as possible without the presence of the mast. In any case, adopting the appropriate system for finishing, how to remove the tank, the quality of the finishing components, the quality of the cement behind the wall and the strength and stability of the wall pipes, the fluid properties in the tank, the rate of removal from the tank, the properties of the tank stone, the thickness of the production layer. Current and weather conditions, etc. are all factors that determine the stability of a well. But the best definition that can be given is all the programs a rig does to create a path for reservoir fluid production. Repairs may be performed by a rig, a mobile brainstem, an overhead service. Since our production in this well is from a production layer, so considering single completion we first model the completion of a single layer with a brain tube and then consider other complementary options if they fail.

For this purpose, we examine a brain tube of size 2 7/8 to a depth of 2,300 meters inside the well cavity and its effect on the production and well head pressure. Next, we examine the effect of different size and length brain tubes [27].

A well flow from the reservoir to the well is not possible, but by changing the completion of the well and selecting the complement from the well, as the well is completed without draining the brain tube and the flow is carried out solely through the parietal tube. The unique type flows through the brain tube.

10.2. Selecting the optimal length of the complementary string

To select the optimal length of the complementary strand, it calculates the well head pressure for the different lengths of the complementary strand, and each one which gives more wellhead strain is chosen as the length of the complementary strand. As the wellhead pressure is increased to about 2100 m and since then the increase in pressure has not been observed and the pressure remains constant. Therefore, the optimum length of the brain tube is 2100 m.

10.3. Brain tube size selection

To select the right size of the brain tube, draw a pressure-flow diagram for the three brain tube sizes 2 7/8, 3 1/2 and 4 1/2 inches. The 4 1/2-inch brain tube in the same flow gives us more wellhead pressure. Therefore, from the three sizes of the brain tube, the brain tube of size 4 1/2 is selected as the appropriate brain tube.

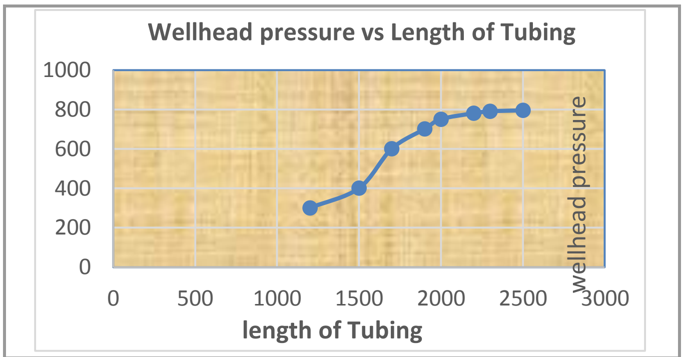

Figure 6. Determine the optimum size of the brain tube.

11. Conclusion

One of the reasons for pushing the complementary strand is to provide the pressure required to calculate the length of these strands according to the formation point of the oil bubble. Because our oil contains gas and this gas is one of the causes of fluid uptake, so by preventing the bubbles from forming a pressure drop by pushing a complementary strand. An oil or gas well has been in trouble for a variety of reasons and needs to be repaired after work. These repairs may be performed by a rig, a mobile brain tube, a well service. Today, coiled tubing, as a highly efficient unit, can repair over a hundred wells within a year. This is while a medium-sized mid-sized rig can repair four to five wells in a year. The repairs made by the mast are very expensive so companies try to do the repair as much as possible without the presence of the mast. The repair conditions should always be in such a way that it is completely safe and safe. . In any case, adopting the appropriate system for finishing, how to remove the tank, the quality of the finishing components, the quality of the cement behind the wall and the strength and stability of the wall pipes, the fluid properties in the tank, the rate of removal from the tank, the properties of the tank stone, the thickness of the production layer. Current and weather conditions are all factors that determine the stability of a well. What are nowadays referred to as well completion are all operations performed after the drill reaches the final depth of the well. But the best definition that can be given is all the programs a rig does to create a path for reservoir fluid production. Repairs may be performed by a rig, a mobile brainstem, an overhead service. Given that our production in this well is from a production layer. To select the optimal length of the complementary strand, we calculate the well head pressure for the different lengths of the complementary strand, and each one that gives more wellhead pressure is chosen as the length of the complementary strand. The well head pressure was increased to about 2100 m and the pressure remained constant. The optimum length of the brain tube was found to be 2100 m.

Disclosure statement

No potential conflict of interest was reported by the authors.

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