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Decomposition of Hydrates in Pipeline

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GRAPHICAL ABSTRACT

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ABSTRACT

In general, a gas hydrate is a combination of gas and water. For example, a group of mineral compounds are called solid hydrates. These are ionic solids that ions are surrounded by water molecules and make crystalline solids. In any case, in the gas industry, hydrates are a combination of a small molecule of gas and water. During the nineteenth century, hydrates remained an unknown and controversial topic. Early efforts were focused on understanding what compounds make up hydrates and under what conditions they form. During this period, many constituents of hydrates were discovered. However, it was not until the twentieth century that the industrial importance of the gaseous hydrates proved. In the oil industry, the term gas hydrate refers to compounds that are usually gaseous at room temperature. These include methane, ethane, carbon dioxide, and hydrogen sulfide. This led to the term hydrogen and at the same time one of the most common misconceptions about these compounds. Obstruction does not cause much of a problem during the normal pipeline operation. However, our unforeseen problems such as pump failure or obstruction problems in the transmission cause hydration and thus blockage of pipelines. It takes several weeks to remove these contractions. The purpose of this work is to investigate the phenomenon of hydrate decomposition in pipelines. A model has been discovered that is similar to the decomposition of hydrates in pipelines. The purpose of this work is to develop an optimal strategy for dehydration in pipelines with bilateral contraction.

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Introduction

In engineering tables, the density of ice {(Ib2/ ft. 57.2) or (917 Kg/m)} is less than the same quantity for water {(62.4/Ib/ft) or (1000 kg/m)} at freezing point. The reason for this expansion is that the water molecules themselves are arranged in a regular arrangement, and the molecules in the crystal take up more space in the crystal than when they are in a liquid state [1-5].

However, this behavior is due to the shape of the water molecules. Sometimes it is also called hydrogen bonding. A gas hydrate is a crystalline solid in which water molecules surround the gas molecules. There are many gases that are well-structured to form hydrates including, the carbon dioxide, hydrogen sulfide, and low-carbon hydrocarbons. The hydrate property can also be utilized to transfer the gas [6-9].

The conditions for hydrate formation are including appropriate pressure and temperature, the presence of water molecules and the presence of gas molecules. In the always frozen polar- regions, this substance is found in large quantities in combination with ambient ice. Discovered gaseous hydrate in 1811 by "Davy Companion" while producing chlorine gas bubbles in cold water by laboratory method. In 1832, Michael Faraday proposed the first chemical formula for the gas hydrate, in which one molecule of gas was surrounded by ten molecules of water [10-15]. In 1943, when the first designed gas pipeline was put into operation, the phenomenon of clogging of the pipe by solid particles of hydrate gas was introduced by Heimrashmit in the United States [16-19].

The technique of preventing the formation of this substance in oil and gas pipes and a process for dehumidification of gas flow was formed [20-23]. In 1951, Vandrovals assessed and explained the thermodynamics of the gaseous hydrates. The oil and gas industry are involved with the gaseous hydrate deposits in pipes and equipment. Gas hydrates are present in pipes and equipment carrying natural gas, associated with the gas and mixtures of associated gas and oil that produce liquid water [24-26].

Solid gas hydrates are formed at temperatures below 20 °C and the pressure typically found in pipes and process equipment. Oil and gas industry professionals need to become more aware of the importance of the properties of gas hydrates [27-30].

As hydrates contain 170 gases per cubic meter of hydrates. Also for the storage and transportation of natural gas and associated gases can be used. The amount of gaseous hydrates depends on many factors, including their formation pressure [31]. The pressure required to make hydrates (formation pressure) depends on the temperature, in the range of 10 bar and more. In recent years, it has become possible for the gaseous hydrates to form at atmospheric pressure and temperatures below 10-20 °C below freezing. This has solved the problem of costing and transporting associated gases in the form of hydrates [32-35]. In fact, gaseous hydrates are crystalline solids made up of water and smaller gaseous molecules. They are a subset of compounds known as clathrate. Other molecules are trapped. Although water chelators called hydrates are the goal of this book, they are not the only compounds in clathrate [36-39]. Urea, for example, makes very interesting inclusion compounds. Agreements are reached between gas companies and pipeline companies on the quality approved by the buyer [40].

This restriction includes the amount of impurities, calorific value, and hydrocarbon cloud point. Among natural impurities, what limits gas sales is the amount of water. One of the reasons why water should be removed from the gas is to help prevent the formation of hydrates. Water is usually accompanied by natural gas. In the tank, there is always water [41-43].

Therefore, the natural gas produced is always saturated with water. In addition, water is sometimes produced in combination with gas. In addition, water is often present in natural gas processes. Aqueous solutions are commonly used in the natural gas desalination process (when hydrogen sulfide and carbon dioxide gases, called sour gases, are removed). The most well-known type of these solutions are aqueous solutions of aminol canine. The product of the desalination process of these processes is saturated with water [44-46].

Several processes have been proposed to separate water from natural gas. Mixing water and natural gas means that hydrates are present in all phases of the natural gas production and process [47-49].

Computational Model

The development calculation model in this work is an extension of the previous method discovered by Kelkar et al. [4], which is related to the finite cylindrical fit. The resulting equation system requires a numerical solution. In this method, the hydrate appears to be porous and permeable. Recent Lynse experiments demonstrated that the hydrate pores vary between 33% and 84%. Subsequent experiments confirmed that the hydrates in the pipelines were also permeable. As the hydrate is porous, it is able to transmit pressure while acting as a barrier to the normal flow of pipelines [50].

The temperature of the hydrate remains constant during decomposition and will be the same as the ambient temperature. If the system pressure is less than approximate, the same hydrate temperature will be less than the freezing point and freezing will be possible. When the temperature is lower than the freezing point, every drop of water obtained from the decomposition of the hydrate freezes immediately [51].

It seems that hydrate decomposes radially and its axial decomposition should be ignored. In this method, changes are made in the amount of hydrates so that the pressure is reduced or worse. The available equilibrium pressure is less than the ambient pressure, which causes the heat to melt in a radial flow or bad and hydrate [52].

Experimental Measures

Experimental tools include stainless steel activators. The actuator has a length of 0.2 m^2 and an internal diameter of 0.048 m. The activator is contained in a temperature-controlled ethylene glycol water tank. The tank temperature is controlled by a platinum type resistance thermometer. The hydrate temperature is controlled by 5 different axial positions with the J type thermocouple thermometer [53].

The temperature of the gas in the two ends of the thermometer is also measured by a type J thermocouple. System pressure is measured through the converter pressure. All of these temperatures and pressures are stored in an information program and stored on a specific computer. The method of hydrate production was Stern method. In this method, m850 ice particles are stored in stainless steel activator. When the activator is filled with ice, it is contracted by methane gas. The activator temperature then rises above the freezing point to begin hydrate formation. The amount of hydrate change is controlled by measuring the system pressure. When the pressure drops, all the ice particles are converted to hydrates. Those who use the change and evolution of gas as a breakdown of hydrate also confirm the amount of hydrate produced. Hydrate decomposition begins by pressure reduction at both ends of the rod. The initial temperature of the hydrate in tank three is 40 °C. When the pressure drops below the equilibrium pressure at the reservoir temperature, the hydrate begins to decompose.

When Hydrate Decomposes Two things must be measured: The amount of methane gas emitted from the hydrate decomposition (using the water displacement tool) and the hydrate temperature at the center of the rod in 5 different axial positions. In this decomposition method, it is possible to keep the decomposition pressure constant during the test at atmospheric or compressive pressure of about 2.4-5.2 MPa. This pressure is maintained by the valve.

Conclusion and Discussion

The results of experimental formation demonstrated that up to 90% of the possibility of changing ice to hydrate. This method of development showed that, as far as possible, reducing the pressure leads to the optimal breakdown of hydrates. If the pressure decreases or the time of final decomposition decreases, the time of ice and hydrate disappearance will be reduced. These results suggested that the ice formation helps to remove the hydrates and create more ice.

There are two reasons: 1) despite ice, heat is more important than water 2) despite ice, there is more heat dissipation. This indicates that when the hydrate clears from the pipelines, it is better to shrink the pipelines quickly and reduce the pressure. When the pressure decreases rapidly , the gas cools, which is related to the Joule-Thomson law, and then cools the hydrate and causes ice. An important result of the experimental analysis method is the change of the radial analysis hypothesis. The advantage of the radial analysis method is that the length of the pipe does not matter, and only the radius of the pipe is considered. Each hydrated tube decomposes over a period of time, after which the activator stops working to control the rest of the hydrates. These images clearly reveal the radial decomposition of hydrates. The small space at the end of the activator is due to the presence of a coating that attaches the hydrate to the activator during the test. Experiments also showed that when the pressure created at the equilibrium temperature is higher than the freezing point, the hydrates remain at a constant temperature.

There is also a compressive pressure balanced by the mean decomposition temperature during the test. However, when the decomposition pressure is lower than the freezing point, and in the ice system, the hydrate temperature is fixed at the freezing point, which only includes a temperature chart. However, other curves follow this method. Ice is formed from the decomposition of hydrate by absorbing heat and decomposing the temperature of the hydrate. As a result, the ice regulates the solid temperature between 0 °C and 1 °C. The experiment and the model both predicted the fastest experimental time at the lowest decomposition temperature. This process can be performed both by the model analysis and by measurement of experimental experiments by comparison. This model is able to predict the movement time of ice / hydrate limit. Both the model and the experiment predict the same decomposition curve. It should also be noted that the decomposition time is approximately 5% of the experimental decomposition time.

Safety Care Related to Hydrate Breakdown

When hydrate is broken down in pipelines, this happens radially. This indicates that the hydrate decomposes, first diffuses through the tube wall and then into the inner cortex. The only downside to the mechanism of the decomposition is that the pressure drop at the end of the rod causes the hydrate to move, as soon as the hydrate is released from the tube wall. There have been many reports that the rod has contracted at both ends and the rod is gradually breaking, causing millions of dollars in damage. Another possibility is that there may be some rods in the pipelines. When pipelines contract from their two ends, there may be a lot of pressure between several pipes, so it is not possible to reduce the pressure quickly. Instead, the pressure should be reduced slowly.

Conclusion

A method has been discovered that does not have fixed parameters and predicts the decomposition time of hydrates in pipelines. This method changed the experimental results. Hydrate is decomposed radially. However, due to the adjustment of the ice capacity, reaching temperatures below -1 °C is difficult. However, the results are contrary to two previous beliefs: 1) the formation of ice in pipelines during hydrate decomposition is harmful. 2) Hydrate is broken down longitudinally. The result was a valuable contribution to future hydration techniques. Despite these results, it is possible to create hydrate breakdown. Models and experiments demonstrated that the ice formation is beneficial and helps eliminate the hydrate. This proves that the pressure must decrease or decrease as rapidly as the atmospheric pressure at both ends of the bar. Care should be taken to avoid pressure drop in the bar. When the bar wall begins to decompose, a blocking operator (e.g. methanol) may be placed in the bar to increase the decomposition rate. This method can predict the hydrate radius over time. Using the prediction method, it will be possible to determine the flow time of the blocker in the hydrate. The result of this work is only in bilateral contraction. Recent research has been useful in expanding the model and experience, which is similar to one-way contraction.

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