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Calculation of Corrosion in Oil and Gas Refinery with EOR Method

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ABSTRACT

EOR method evaluation is performing for petroleum gravity, stone type, and tank humectant and tank localities conditions for liquid injection. When the water inject to the tank the interaction could be performed in different ways, if the is humectant, penetrated water canexit petroleum from tank, which is because of capillary absorption. The studies have been done on the tube lines, land and the metal workforces that are related to the oil and gas industries, shows that in most cases, weld lines and edge of a sharp regions has been influencing on location of corrosion and eroding of effective thickness of coating film. In this study we studied EOR methods for dense oil recovery from mold in the breakage tanks. Analyze and comparison of recovery with capillarity of salty water, polymeric solution and hot water on different sample of rocks showed high recovery of dense row oil in the EOR methods, and it is more detected in the diluted row oil. Oil (diluted) can recover by water injection in the sand stone condition and with chemical matter and thermal methods.

Introduction

EOR method evaluation is performing for petroleum gravity, stone type, and tank humectant and tank localities conditions for liquid injection. When the water inject to the tank the interaction could be performed in different ways, if the is humectant, penetrated water canexit petroleum from tank, which is because of capillary absorption. If the frame is humectant, petroleum exit will perform whenever the pressure is more than threshold; this is controllable by the height of tank block. Experiments and experimental data for recovery capillary absorption are according to data in 1950. Brownscoble & Dyse (1952) studied the ability of water absorption in the sandstone lands. It will discuss about technical and economic condition, in the next year, it was performed by many of universities of United States in laboratory. Caspian sea is one of the good case for water injection and row petroleum recovery by capillary absorption, that is because of carbon in the tank`s stone. Row petroleum viscosity, is one of the limitation factor in the tank recovery. High viscosity in the petroleum leads to low recovery. In this article, it was performed many experiments on different stones by dense row petroleum and for comparison between dense petroleum and diluted petroleum on sand stones and lime stones. Whenever diluted and dense petroleum are comparing, lower final recovery of dense petroleum is because of its high incipient factor temperature and low humectant of tank is for coupling of water and dense petroleum. In any case, recovery is usually dependent to the petroleum viscosity. So, first is rapid production and Second point is increasing of find recovery. In this condition, it is evaluating the interaction between water phase and hemi cylindrical frame, and as we observe, recovery velocity and final recovery of dense petroleum is limited. The high cost of corrosion, the corrosion engineer's concern and its reduction in oil, gas and petrochemical countries is essential, about 10 percent of the cost of producing a barrel of crude oil now costs related to the corrosion industry. Corrosion rates in the world costs 42 to 80 cents a barrel for crude oil is produced, Specific climatic conditions, history of the country's refineries and oil production, the main factors affecting the cost of corrosion in oil country.

Chemical Matters Lead to EOR

Polymer: Before these experiments, polymeric solution injection as aqueous phase was performed for tank petroleum recovery in the laboratorial condition, for diluted, petroleum. The only case about polymeric solution injection that leads to the high recovery was in the river basin in Vioming (2000).

In this study, for both sandstone and limestone, the polymeric matter was as an aqueous phase. The results were shown in the figure 4a, about injection on dense petroleum with sandstone. One of the limitation factors in this method is: it is necessary to use very dense polymeric, for high viscous petroleum, clay increases the surface absorption of polymer will have good results, when the polymer injection begins before increasing the relation between water to petroleum. Polymeric solution injection leads to increasing of recovery velocity. But final recovery is not affected by adding polymeric solution. Fluids characters are noted in table

Pay attention that polymer injection leads to decrease of IFT. Every one can see polymeric solution effects on dense petroleum recovery for limestone. Dense petroleum reaction is the same as limestone, without taking into that polymeric matter injected to the dense petroleum. When limestone and sandstone diluted petroleum are comparing with each other, evaluating of absorption effect become more logical.

It expected that, because of higher surface absorption of polymeric matter on limestone than sandstone, recovery results decrease. Stripe coat is a coating film of color which is applied before and after a full coating on the edge or weld lines of metal skeleton. This kind of coating is applied in order to create an appropriate structure and enough resistance against corrosion in these regions. Therefore SC has more protection for the edge of the coverage or weld line. It is applied before preparation of surface or before a full coating. Technical knowledge is relevant to community of protective coatings that has the following

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recommendations about SC {color usage, the shape of painted area and keeping of color of steels.

1. If SC has been determined for a project, it would have been before Primer or a complete coating in order to use for all corners, gaps, nails, screws, welds and sharp edges.
2. It should involve around the edges at least 2cm.
3. To prevent from peeling of Primer during the actions, it should reach to touch dry {it should be dry enough and non-sticky} and then use Primer {so this time should not be too long because it cause to regions without Primer become corrode.}
4. Maybe SC use once after Primer action, especially if much time is needed to dry.
5. SC is more effective on surfaces that are reduced of sharpness by grinding.

Most SC is used for all edges, vertebrates and the weld because liquid colors move and flow in these parts; this phenomenon is the result of tension of surface and contraction of color film during drying. If this event happens, the color film will become thinner at location or close of edges. When color destroys in the regions of vertebrates, screws and welds can lead to crisis. Because these factors cause the continuity of skeleton become destroy. Overall SC has 2important advantages: the first one cause to cover small defects and differences of surface such as: porosity of welds, the second one: If enough time gave to SC for drying, it would have prevented from flowing of last coating on the edges and causes more problem for them. Colors with high percentage of solid toward colors with low percentage of solid are less apt to be thin in the edge of the regions because overall, colors with high solid have more curing time and against Viscosity are higher and have less tension on the surface.

However SC is used for sharp regions and the edges which maybe have not suitable thickness for coating. We should remember that the first advantage of SC is reducing the thickness of coating. We can use SC for all the coating layers. Excess colors increase the residual tension of film of coating that leads to gap or become membranous. Operator of color and expert at first maybe choose the best method by quality of control. It is able to inject gases into the pit as a gas phase. Gas phase is usually as a phase that leads to high recovery of pit, whenever, we have gas oil gravity drainage, that because of different gravity between fluids in the breaking point of mold and in the mold. This process will decrease the recovery than other mechanism, especially about dense oil, and it can lead to high recovery by heat and mixed gases injection. Many studied had performed on oil recovery from pit by mixed gases. They use Nitrogen gas for breaking tank because of it is available and cheap. If the mixed condition exits, it can increase the oil recovery of the tank. Methane is another gas that is used for this purpose. Morel et al. observed that oil recovery by methane is twice of nitrogen. Lately, Lenormand et al., purposed transfer subsidiary for diffusion between tank and breakage, in these studies diluted oil is used as a typical from in the oil tank. CO_2 injection is one of the most available ways about non-hydro carbonic gases that release industry about natural gas injection for grazing, CO_2 gas can exits diluted and medium components from oil, and if the pressure is high, it can exits oil from the tank by more mixing, so the viscosity become lower and oil turgid. This method is very valuable for dense oil with varicose type of solvents. In the current study, an experiment for increasing the recovery of pit by saluted gases was performed. So, part of this study is experimental. It is important to note that, availability to mixed methane and nitrogen with dense oil is so difficult, and we can use another solvent for that, and it is not economical, but it is successful way for technical aspect. Whenever, there is low humectant and permeability, the only substitute for heating method in the carbonate tank or tanks with dense oil is, saluted gas injection (CO_2), and the oil recovery increase. CO_2 limitations are: very low viscosity for CO_2, leads to low control on movement, so quick separation become difficult and other problems and limitation.

Nitrogen or combustion gas means: high injection of nitrogen, or other gases into the tank that it can mix with each other according to the pressure and it`s components. This method is used for diluted oil recovery that is able to absorbed added gas into the tank. This condition is low methane and at least 5000 feet depth that leads to resistant of rock tank on high pressure of injection, and it wouldn`t break. When nitrogen injects into the tank, we will have mixture phase, that`s because of light component evaporation. It forms a mixture or solution phase, by its movement from injection phase to the tank. Continuous injection leads to oil mass movement into the production pits. It is able to use water injection, alternatively, for higher recovery and high buoyancy index for oil. Nitrogen advantage that is, it doesn`t have corrosive effect. Because of its price that is cheap, we will have more injection. Nitrogen injection is usually after the carbonic. Gas or mixed hydro carbons. This method`s limitations are: mixing will performed in the diluted oil and high pressure, so it`s necessary to be more depth, slope excavation is suitable for decreasing unsuitable movement, that`s because it allows gravity to control movement.

In the EOR project: remains oil determinations in the tank, necessary mechanisms for better exploitation and in-use equipment are important factors, Generally, if the purpose is to exit tank oil completely, it`s important to pay attention to the final recovery, but if the purpose is high production, it`s important to focus on the increasing recovery velocity methods, than final recovery. The best candidates for this strategy are low recovery factors (dense oil carbonates). Final recovery and its velocity are practical factors of recovery in this article. Following the experimental methods is not suitable for total expense analyze. That`s because of I statics nature of this method, but in reality, continuous injection in the abuse phase is possible. Understanding the injection velocity and it`s density is one way for determining method`s expense and chemical matter that`s necessary for injection and final recovery. It`s necessary to perform exact experiments in laboratories for determining Fluid`s amount for final recovery. This fact determines how the method is effective, and finally it leads to determine project expense. Beaver et al. performed exact analyze for determining exploitation amount of chemical matters injection in to the homogeneous samples, they performed various experiments according to the absorption and salty water effects and analyzing different ways for chemical injection, for determining the best way. Results were useful in the same forms (breaking systems), but there`s no report about chemical injection into the breakage tanks, until now. Useful numerical and experimental studies were performed for fluid flow in the breakage environments. Expenses analyze for water injection, are an important factor because of low expense for its injection, and were performed studies about numerical dramatis tic to determine optimistic velocity of vapor injection for different tanks, according to breakage and days. Both two studies showed that, injection velocity is depending on tank type and penetration and its thermal capacity. In these studies, chemical absorption (especially for carbonate rocks), critical density (for chemical matters or gas injection), or thermal degree (hot water) were taken into consideration for optimize process.

Test Conditions

Aqueous solution used in the laboratory , Actual water samples from the production fluid and gas field in Iran and Water samples from the injection well chosen that the owner refused to wear the wellhead facilities Corrosion studies of the corrosion rate of fluid can be precisely manufactured and also reduce the corrosion rate in the psychological effects are still. The PH of the solution should be study. Generally it is better not to be blown in the air, unless a solution is needed. If a solution is needed to allow air to be blown to the surface oxygen to the deal, where the reactions take place reducing the oxygen and cause corrosion on the surface, to eliminate air in solution can be use the azot without oxygen, nitrogen and argon. In this experiment, nitrogen out of air from the cylinder must be at least half an hour before the test. Volume of solution should be high enough to reduce the corrosive materials in the experiment and the high accumulation of corrosion products in place to avoid. In these experiments, the solution volume is 500 mL of TB laboratory,(± 1°C) temperature must be controlled carefully and Room temperature is 25°C is usually, The temperature should be fixed in the test chamber to create a thermal gradient changes the solubility and the ability to prevent the potential changes. The effect of fluid velocity on the corrosion of a metal sample was used to pump And the appointment of the place was very small laboratory cell output and soluble cell surface can be kept constant laboratory For this purpose, a bypass path from the output of the pump inlet to the pump tank and a path of pump output to the input cell is built The heat pump is used to prevent burning at a low capacity pump, and maybe taken. With both the control flow path taken Equipment required for the fluid flow can be seen in the movie, too.

Factors in the Corrosion of Gas Wells

Temperature: Effect of fluid temperature corrosion in oil and gas industry in similar chemical environments, Corrosion rate is increased at higher reaction temperature corrosion so often that every 20 degrees Fahrenheit (C_{11}) increasing temperature, the corrosion rate is doubled. Corrosion of steel in corrosive CO_2 gas in the vicinity there are three temperature diets:

A) Low temperature and non-protective iron carbonate C_{60} and the corrosion rate is a function of CO_2 partial pressure.

B) Between temperature and C_{150}-C_{60} almost protective iron carbonate layer is formed and the corrosion rate reaches an acceptable value.

C) C_{150} Mgntayt top layer is formed which completely cover and it is also resistant to high velocities and extreme turbulence and is only sensitive to chloride ions. The combination of these three types of diet excluding salt water, the fluid velocity and the ratio of partial pressure of CO_2 to H_2S gas on the corrosion rate, these factors should also be entered in the protective layer.

Pressure: High pressure gas wells in the gas solubility in liquid corrosive effects. Gas pressure can reach psi 12000. Partial pressure of corrosive gases is an important point. The amounts of corrosion of a well produced by CO_2 are as follows:

- Partial pressure of CO_2 is less than 7 psi: non-corrosive environment.
- Partial pressure of CO_2 between 7-30 psi: corrosive environments.
- Partial pressure of CO_2 is 30 psi: highly corrosive environments.

The role of Fluid in the Corrosion: Experience shows that the wells have corrosion problems when Water cut in the total amount of fluid in them is more than 85 percent. Of course it has plenty of exceptions. Fluid emulsion of water in the fluid conductivity and efficiency as a conductor affects. Mode of the large amount of water wells (without emulsion) produce more corrosive than water wells with Less water cut and more emulsions . Many studies have been conducted to determine the corrosive fluid within the well. Brad Bern 20 different wells of the contract and amounts of water and acidic gas CO_2 produced as the variables considered. He found that the amount of water is more productive; the amount of CO_2 is more soluble in the vicinity of the wall and creates more corrosion.

Fluid Velocity: Fluid velocity in the fluid regime and the regime's fundamental role in determining the type of fluid are corrosive and performance inhibitors. Experiments have shown that a diet supplemented fluid and field tests are equal, Mechanism and the corrosion rate was similar in both conditions. Regardless of diet, fluids, in order to evaluate the effect of corrosion rate in the temperature range considered three, The corrosion of CO_2 at low temperature (less than C_{20}) has a range of corrosion depends on the hydrolysis rate of CO_2 And is independent of the speed . Range 20 to 60°C. The rate of corrosion is very little because the phase of the reaction is CO_2. But in high temperature conditions (above C_{150}) that Mgntayt layer is formed. The wear rate of the m / s 15 is also more corrosion product layer without being damaged. Unless there are factors such as chloride ions, so if the temperature is well over C_{150} and chloride ions there is no corrosion of any kind, unless the flow rate of is 15 m/s, but if the temperature is lower than C_{150} is just a well with corrosion. But if there is a well producing at high water, all wells will be affected by corrosion.

Fluid Composition: As mentioned before, the combination of salt water and dissolved solids in terms of the protective layer is effective. Chlorine in water is not corrosive and destructive only in the carbonate layer and the corrosion rate is increased. The presence of condensate in turn will prevent corrosion, even some of the condensate containing natural inhibitors to prevent corrosion, but not local.

Corrosive Gases: CO_2 and H_2S gases, corrosive agents in the oil and gas wells are considered, however, each of these gases alone can protect the right circumstances can produce. For example, hydrogen sulfide gas at high temperature C_{100} product of pyrite (FeS_2) is completely stable, which protects the metal surface. When these two gases are combined effects of corrosion leave the complex, Mr. Dunlop has an opinion on this situation, if the ratio is less than 500 CO_2 to H_2S, sulfide layer is formed. Haslrv Astgman believes in higher temperature conditions, this number (500) is larger, when the partial pressure of CO_2 partial pressure of H_2S is more than 2000. Hydrogen sulfide can't damage to iron carbonate layer.

Corrosion Control Methods: Check for corrosion protection of pipes and walls of gas wells can be used the following methods:

A) Creating a durable plastic coating inside the tube
B) The use of corrosion resistant alloys
C) The use of non-metallic materials
D) The stabilizer PH
E) Corrosion inhibitor injection

Polyolefin Coatings

Poly olefin coatings include polyethylene or poly propylene that has mechanical strength; fairly low pride and high resistance to carrion. The big problems of these coatings are less adhesion of them to steel pipes. For solve the problem has recommended to use three layer coating system including epoxy lining, middle layer, improved copolymer polyolefin and surface coating is polyolefin. In this systems cohesion and resistance to cathodic disbanding by epoxy lining and penetration to water and oxygen, mechanical properties and chemical resistance has supply by polyolefin larger. Epoxy lining by spindle and middle

coatings and polyolefin surface coatings has apply on pipes by extrusion methods. Low resistance against penetration sharp edge of stones and rooks especially in high temperature, mad crackup due to soil stress and low thermal resistance, has made some restrictions to using from polyethylene coating.

While high stroke resistance in extensive range of temperature and resistance against penetration of sharp edge of stones and rocks even in temperature more than 100C, has spread largely using from there layer systems on base of polypropylene. Polyurethane is a thermoses polymer with various applications. Using form this polymer has spread for military applications by Otto Bayer in 1930. In one general look polyurethane is product of iso Syanate and polyol with each other, So that: Iso + polyol = polyurethane.

Term of "100% Solid" Used for Coatings that in them has been any Solvent for dissolve, carrying or reduce amount of coating resins. In addition to, Resins that usually are liquid, after implementation (use) completely change to Solid. Contrary to common coatings Such as epoxies that just limit number of them has been usable for coating, polyurethane coatings have large output from types and shapes; (forms).Tem (Statement) of polyurethane coating is general. Tem, because already contains all things, from wood Seal to building floor and underground tanks coatings. Nowadays, various type of polyurethane has used in money applications. Flexible polyurethane foams has used for make bed, pillow and car Seat. Hard foams has used for insulation of freezers, refrigerators and roofs. Many Sport Shoes manufactures, has used impact resistance and elastic polyurethane in make shoes surface. In automobile industry, parts such as dashboard and bumper cuttings has mad by polyurethane. In addition to, polyurethane coatings also has used as bridges, seals, surface or tanks lining. Tem "100% Solid" make a little short Range of all kind of polyurethane Bust yet there are hundred different types of iso syanate and polyol that by them has produced much polyurethane in this range. Another factor that could limit polyurethane by it is type of used iso syanate in them. The most common isomers that used in polyurethane production are aromatic. Polyurethane that make by aromatics, have economic profit, and doing their work well, But when put against sun light, become as chalky and dark. Corrosion feature and other physic features of aromatics a system has not affected by sunlight. But if required, are used these coatings in applications that their appearance are important, and cover surface of them should be coatings. Automobile colors named as dominate sample of this type of polyurethane.

Polyurethane Coatings Properties

There are many reasons for tendency to using 100% solid polyurethane coating for pipeline coating.

First of that, using this material has excellent results and this material are famous. Due to harmless, this material are more adjustment than anti corrosion traditional coatings with environment secondly, due to quick rate of cooking this material, could be put coating pipes under holiday pores test and buried. Third, this material has ability to cook in low temperature, this subject is impossible in other coatings at last, due to this coatings for application are not need to exothrimicity, and they are applied in any thickness or length and diameter of pipe. Response nature of Iso syanate and polyol for polyurethane production is exothermic. Due to this reason, the reaction itself provides needed heat. At last this coatings could be applied in any environment temperature, until apply this coatings unlit 40C' temperature under zero without using extra heat, is not impossible. In spite of properties that mention, 100% solid polyurethane has other good properties, such as:

1- Without pothole
2- High hardness and impact resistance
3- Good flexibility
4- Strong adhesion to metal surface
5- Be resist against steam penetration
6- Separable resistance due to climate factors
7- Chemical resistance

The polyurethane coatings can be classification according to type and their additive quantity. But this additives, usually is added to reduce extra price. Also, should be attention additives that reduce price, will be reduce quality. Adding 10 to 20 percent filling material (especially tar) has effective impact on price reduction, but the impact on coating qualities is small. Increase 40 percent or more will reduce price intensively, but will reduce coating properties so much. The common usable filling in 100% solid polyurethane, are tar materials. In this state, usually is use raw oil, asphalt or tar pitch, although should be attention tar pitch is carcinogen.

The existence of much amount of sulfate in swedge cause to produce H_2S, as result, in state that speed of Swedes movement in pipes are low (level region) , produced sulfuric acid, and due to it , internal coatings pipes destroyed severely. Experience presented that iron case pipes without internal coatings, in this condition has corrode less than 3 years. In analysis has done in Virginia water and swedge research center, samples of cast – iron pipes with 100% solid polyurethane internal coatings has put in Acid souphric 20% and evaluate internal surface resistance. This analysis has present high resistance of this coating. From 1988 until now, about 610 kilometer from internal coatings of pipes with 12 to 48 inch diameter has used in virginal swage network, and covered by 100% solid polyurethane and this usage has increase process. Covered swedge pipes, has not found any problem during work and operation (application) method of this coatings are very ideal.100% solid polyurethane coating, is non- toxin and has effect on smell or taste of drinking water and is not pollute it.

For this reason, it used widely as internal coatings of water drinking pipes and has cover intemal coating of water drinking tanks. With adding antibacterial factors to 100% solid polyurethane could be achieve coating that prevent from bacterial growth in the water. Also with adding special compound to 100% solid polyurethane, achieved coating that has high chemical resistance and used for internal coatings of chemical transaction pipes.

Conclusion

In this study we studied EOR methods for dense oil recovery from mold in the breakage tanks. Analyze and comparison of recovery with capillarity of salty water, polymeric solution and hot water on different sample of rocks showed high recovery of dense row oil in the EOR methods, and it is more detected in the diluted row oil. Oil (diluted) can recover by water injection in the sand stone condition and with chemical matter and thermal methods. Hot water recovery is more rapid and higher than chemical recovery. For higher recovery of sand stone, hot water has higher and more rapid recovery than gas injection, polymeric matter can increase recovery velocity, but finally its recovery is as the same as salty water. Because of thermal breakage, hot water has the most rapid recovery of dense row oil for oil-wet carbonate. So, it`s possible to use hot water injection instead of mixed gas injection. To final exploiting, hot water degree and process optimize is technical and economical. Berea sand stone and

Indiana lime stone were used as rock samples. They were cut in 2.5cm diameter and 7.5cm length from blocks and they have medium value in porosity and penetration is 17% and 8.5cm for lime stone. Each sample was examined once to avoid error. Experiments were performed in the statistical condition with oil injection, in the 100% saturated condition, and recovery than time, until when there is no oil from sample.

In addition to suitable (proper) properties, not be toxin and harmless, more adjustment with environment in comparison with traditional cold coatings , high speed of cooking and in result quick use ability and cooking low temperature of these coatings and lack of need to exothrimicity has cause.

100% Solid polyurethane coatings has account as ideal choice for covering (coating).Has mentioned in thermal cases such as, transitational water tanks, external surface of urban pipes, internal surface of swedge pipes, internal surface of carrying limy and abrasive solution, mobile concrete coating and upper ground pipes coating.

According to very suitable (proper) properties and qualities of 100% Solid polyurethane coatings could have used these coatings widely in covering to equipments inside the country, for example used in pipeline. High electrical, strength and cohesion resistance and also resistance to crack developing such as important specification of suitable coating for external pipes of gas and oil transition pipes and tar, fusion bounded epoxy and polyamine coatings are as the most common coatings that used. In spite of dominate specifications of polypropylenes coatings in comparison with other coatings choose type of coating, number layers and their thickness, are severity under effect of installment environment condition of and oil transition pipes.

Polarization Resistance: Corrosion rate of various experiments by the use of inhibitors was tested and In each experiment, the corrosion rate was different Indicating that this is The effect of change static to turbulent, concentration polarization is reduced and corrosion is increased and the speed of the electrolyte can be beneficial, because the inhibitor to reach the metal surface and the inhibitor can act more effectively.

1) With increasing concentrations of inhibitors by testing the electrochemical corrosion rate can be achieved and see the reducing. However, in practice the optimum injection rate and corrosion inhibitor with respect to the issue of reasonable economic gain.

2) The effect of velocity on corrosion rate at low speeds is a dual On the other hand reduces the corrosion inhibitor material to the metal surface is due to reach more and on the other hand The concentration polarization is reduced, because the solution will be homogeneous and the corrosion rate increases and most of the reduction material reaching to the surface. When the solution is turbulence, because of the washing solution can be increased and the corrosion abrasion is increased too.

3) Using various electrochemical tests reached the conclusion that the Potantio dynamic test in comparison with other tests gets more useful information about Corrosion.

4) With Comparison about Galvano acetate and Potantio acetate can be said: Routine does not find in the case of metals such as current density is determined for each potential, it is indicative Corrosion rate, Potantio acetate method offers current in each potential is more useful than Galvano acetate method.

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