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Increasing Oil Productivity by Using PLC &SCADA

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ABSTRACT:In this current scenario automation plays a vital role in oil and gas plant.This paper deals about the increase of the crude oil productivity by proposing EOR-Enhanced Oil Recovery method. The programmable Logic Controller is used to control the field instruments.PLC interfaced with SCADA(intouch)software,the operator can view monitor and control the whole EOR process.By establishing this technique the crude oil productivity will gets increased in the range of (45-65)%.

KEYWORDS:EOR, Enhanced Oil Recovery, PLC, SCADA, water flooding method.

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I.INTRODUCTION

One of the primary objectives of EOR method is to increase the production of crude oil.In this current scenario automation play a vital role in oil and gas plant.In conventionally drilled reservoirthe expected rate of production is 15% and the residual range is 85% of hydrocarbons in the reservoir.By initial gas injection or thermal recovery can hike that to capture 25-30% range.By inquire EOR technique you can extract another 15-20% of crude oil. There are two major ways to console the hydrocarbons to flow through the wells are increasing pressure and permeability. This process is combined by voltage replacement, injection of water,increases the pressure of reservoir to its initial level and to maintain the pressure. In primary recovery and thermal recovery the productivity of oil is increased to 40-45%.In primary recovery the separated water will be carried out for the water treatment process.Then the purified water will be used for secondary recovery process or EOR process.In the existing recovery method they use nitrogen,CO2 and foam injection while comparing to above injection method water flooding is low cost, renewable resource and the production rate in water flooding method gets increases.Then the EOR method is carriedout by low cost and it is also safety recovery method. In this recovery method 2-phase separator is used to separate oil and water.

II.HARDWARE

The hardware components used in the EOR process are OMRON PLC,MAD-11,beam pumpoil booster pump, water injection pump, shut down valve,separator oil outlet valve, 2-phase separator, oil outlet level control valve,flow indicator,pressure control valves,pressure indicator,water injection pump,crude oil level low alarm crude oil level high alarm, Water side level alarm low(shutdown),Water side level alarm high(shutdown).Beam pump were introduced to suck crude oil from the well.OMRON PLC has 24 i/o's it has 16 input and 6outputs.OMRON PLC is interfaced with the field instrument to control the field parameters. Shut down valve will be operated during emergency situation. oil outlet control valve and level transmitter shows the level of the separated oil level. Alarm are implant in the oil storage tank low level alarm and high level alarm are operated depends upon the low level indicate 45% of separated oil and high level indicate the 70% of oil in the tank. Similar to oil storage tank water tank also implanted with two alarm low level indication and high level indication.Inthe second phase of process filtering and chemical injection will be done.The water will be transferred through feed pump from water storage tank to filtering process.In this process the digital actuators were used for back wash, rinse and filter process. The actuators are placed in the pressure sand filter and carbon filter. Dosing pump will inject antiscaling and PH if it is inadequate. OMRON PLC has only digital inputs/output. For external analog input/output MAD-11 driver was used.

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III.SOFTWARE

The OMRON PLC programming software is cx-11 programmer and the programming software for SCADA is INVENSYS WONDERWARE INTOUCH. In PLC software there are 16 digital input, 6 digital output, 4 analog input and output. Wonderware intouch SCADA has only 32 tag names. In SCADA the EOR process simulation also done in both simulation and in real time. After PLC program was developed, it is transferred to the PLC hardware through RS-232 to RJ-11 cabel. After the development of the SCADA program, the pc with SCADA software will be interfaced with PLC through the LAN cabel and field instrument is interfaced with PLC through LAN Cabel.

IV.DESCRIPTION OF PROCESS

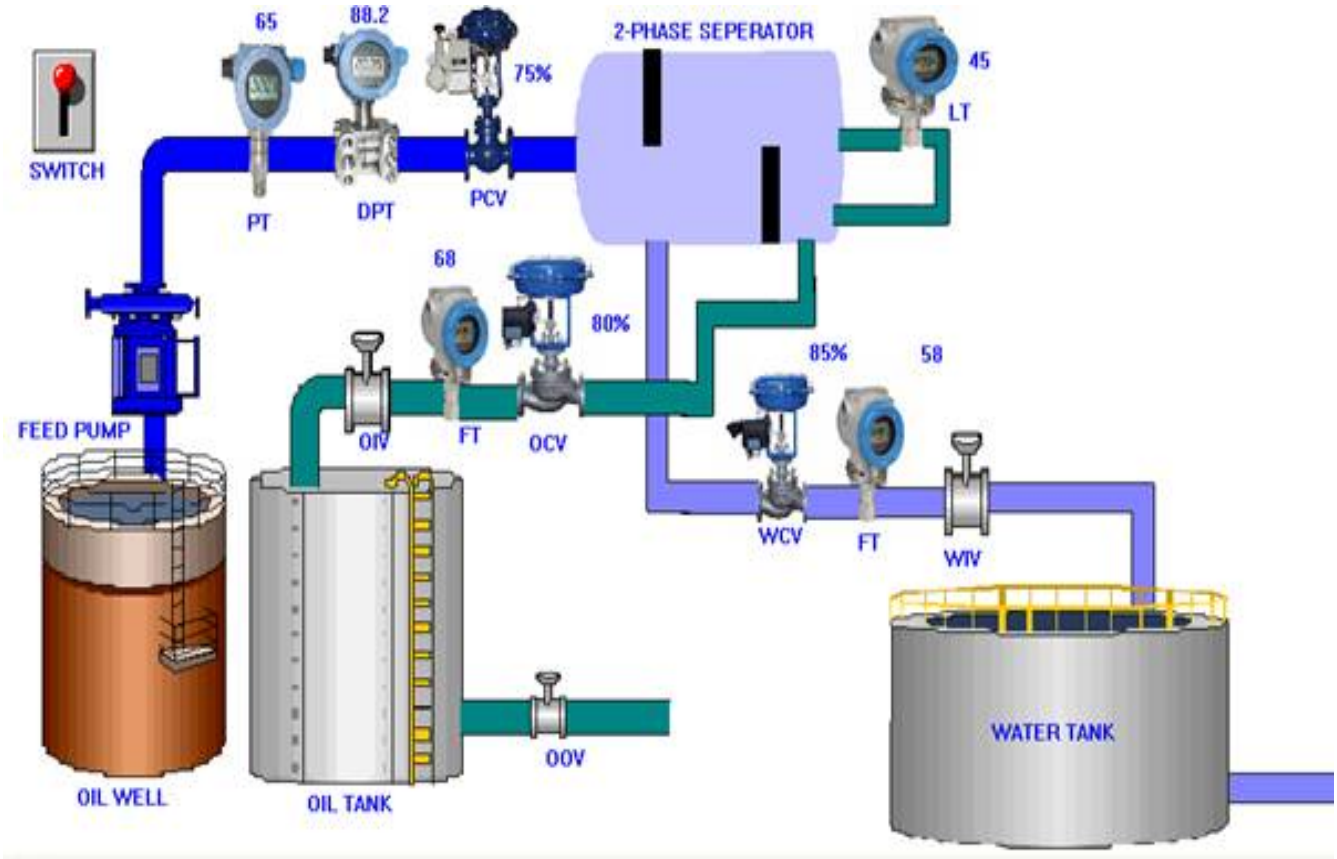

Figure 1: Oil and Water separation process

In primary drill process the oil which is recovered (40-45)%will be sucked from the oil well via the beam pump and it will be carried to the 2-phase separator through the FIT(Flow Indicating Transmitter) and DPT(Differential Pressure Transmitter.In 2-phase separator the oil and water will be separated based on the specific gravity separation. In oil side, the oil outlet level transmitter continuously transmits the oil level and once if the oil level attains high, oil inlet valve will be opened whereas oil inlet valve will be closed as it gets decreased.At the same time, if the oil level reaches high and low, similar process will take place in water inlet valve.Before oil and water reaches to the oil and water inlet valve the flow will be measured by flow indicating transmitter.Then the oil and water will be stored in their respective oil and water storage tanks.The high and low level alarm is implanted in the oil and water storage tank. If the oil level reaches 45% the low level alarm will blow,if the oil level reaches 70% high level alarm will blow, then the oil will be taken out by theoil outlet valve. The figure-1 shows oil and water separation process.

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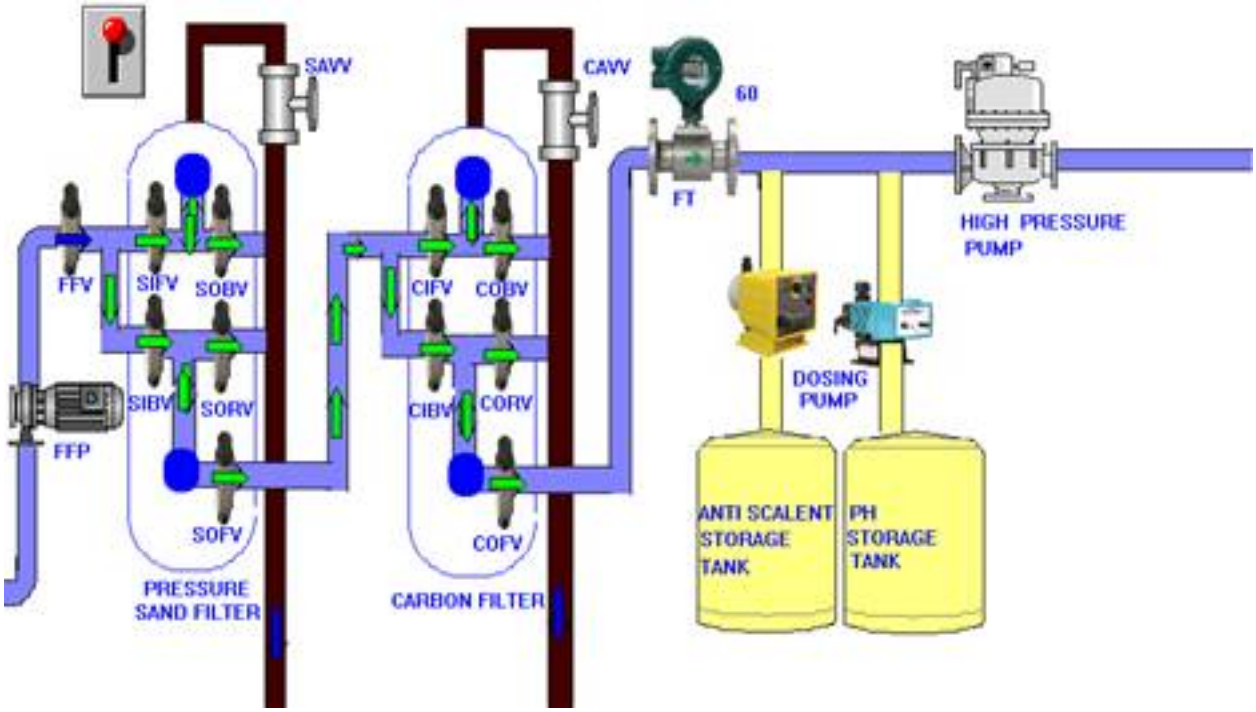

Figure-2: Filtration process

If the water reaches high level, the water will be moved to the second phase of the process. Here, filtering and chemical injection processes takes place. In second stage the treated water will be sucked from the water storage tank and it is passed to the pressure sand filter and carbon filter by the water transfer pump. The water treatment process accomplishes two major filter process namely pressure sand filter and carbon filter. Pressure sand filter is extremely approved for the removal of floating solids and undissolved impurities like dust and heavy metals. Pressure sand filter is an universal solution for the system with high sediment,slit and sand.The sand filter is specially designed forthe removal of floating materials. Carbon filters are most widely used to remove the chlorine content, volatile organic compounds.Taste and odour of water can also be modified by this filter.These are not effective in removal of minerals, salts and inorganic compounds.Three modes of filtrations occurin pressure sand filter and carbon filter namely backwash,rinse and filter modes.General process of rinse and filter modes takes place in pressure sand filter.The back wash mode will be switched on to clean up the impurities of both the pressure sand filter and carbon filter membranes.During the process of filtration digital actuators were employed and the corresponding actuators will gets open and close. In the rinse mode of process the following actuators SIFV,SORV and SAVV will be in open condition and SAVV will be in off condition. In pressure sand filter during filter mode SIFV,SOFV and SAVV will be open and SAVV will be close after 10sec. Similarly in carbon filter during rinse process following actuators will open CIFV,CORV and COVV and COVV will close after 10sec.In carbon filter,the process of following actuators will open CIFV,COFV and COVV after 10 sec COVV will close. The figure-2 shows filtration process.

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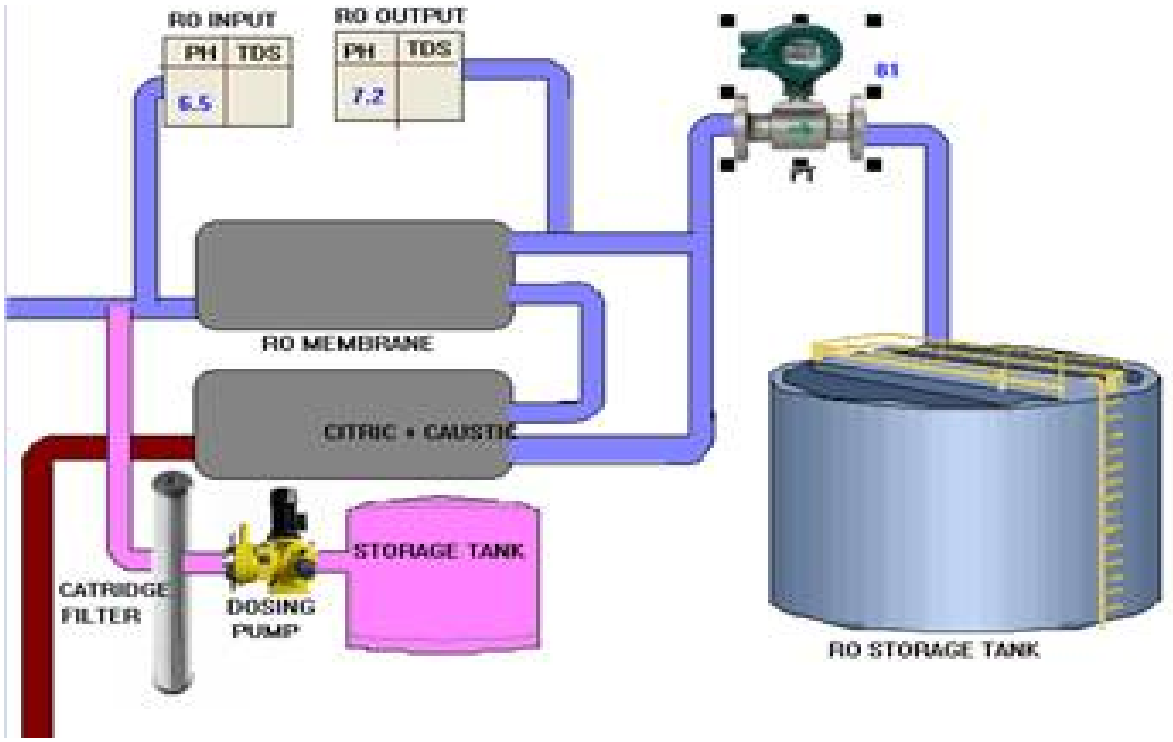

Figure-3: Chemical injection process

After treating water to the filter process the flow water flow is measured and it is moved to RO membrane. The RO membrane spots the PH level and TDS will be measured and incase of any low pH conditions, the dosing pump will inject the PH to the water.After measuring the PH and TDS the flow indicator will be placed, if the flow is low the high pressure pump will be in on state and if the flow is high the high pressure pump will be in off condition.Finally the purified water will be stored in RO water storage tank.When the secondary recovery process gets switched on, the purified water in RO storage tank will be carried out to the well before injecting water into well it will be given to the high pressure pump.The outlet water of high pressure pump will be injected into well in high pressure. Due to the high pressure and density of water it sweeps the remaining cluster of oil in the well, then the mixture of high pressure water and oil will be sucked by beam pump and it will be passed to 2-phase separator. In 2-phase separator it separatesthe oil and water in their proportion by this secondary recovery and the productivity will be increased. The figure-3 shows chemical injection process.

V.SECURITY

The whole EOR process will be viewed, monitored and controlled in the single control room by SCADA screen. If any problem occurs in field instrument it is clearly viewed in SCADA monitor. If any field instrument gets damaged, it can be monitored and troubleshooted in the SCADA monitor.All the datas from the field instrument will be calculatedevery second. If any improper process takes place, the whole process will be immediately switched off by ESD(Emergency Shut Down).The PLC will be directly interfaced with field instrument so as to provideenhanced protection to field instrument and EOR process.

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VI.CONCLUSION

By implementing this EOR-enhanced oil recovery method that the productivity rate will be increased from (45 to 65%). Then the protection of EOR plan is highly secured and ESD is introduced for emergency situations.The waste water collected from the well will be purified and used for both water flooding process and drinking purpose.If any problem occurs in field device, the operator can give the field input in SCADA monitor.EOR process will be controlled and monitored using SCADA.Hardware prototype is implemented and output is viewed through LED.

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