Abstracts Proceedings

Projects 2022-2023

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Petroleum Engineering Branch

Oil & Gas Engineering Department

University of Technology- Iraq

Republic of Iraq
Ministry of Higher Education
& Scientific Research
University of Technology
Oil & Gas Engineering Department
Petroleum Engineering Branch

FINAL YEAR PROJECT

Abstracts Proceedings

2022-2023

Prepared by:

The Scientific Deputy Office

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المحتويات

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Project 1

Development of tight oil and gas reservoirs: Evaluation of key challenges and modern production technologies

منتظر محمد فاهم و جعفر جبر جاسم

م.د. عماد عبد الحسين و م. د. وسام عيسى

Abstract: The development of tight oil and gas reservoirs has gained significant attention in recent years due to the growing demand for hydrocarbon resources. These reservoirs present unique challenges, including low permeability and complex geological formations, necessitating the application of modern production technologies. This study provides an overview of the key challenges associated with the development of tight oil and gas reservoirs and explores the modern production technologies used to overcome them. These technologies include hydraulic fracturing, horizontal drilling, fishbone wells, CO_2 injection, and the utilization of CMG software for reservoir modeling and production forecasting. The study also presents a workflow for optimizing well spacing in tight oil and gas reservoirs through advanced multi-stage fracture modelling. The objective is to determine the optimal distance between wells that maximizes individual well efficiency, total field production, and minimizes operational costs. The workflow integrates advanced fracture modelling and considers the interwell interference factor for well spacing optimization. The findings indicate that an optimal well spacing of 900ft can enhance individual well efficiency, total production, and cost-effectiveness. Close spacing of wells, such as 360ft, increases total production rates but negatively impacts reservoir pressure and associated gas production. On the other hand, larger well spacing, such as 1000ft, reduces total production rates but improves individual well efficiency. The study also investigates the effect of well configuration on production efficiency. The results show that fishbone wells are the most efficient in tight reservoirs. Fishbone wells are characterized by multiple horizontal branches that extend from a vertical wellbore. This design allows for the drainage of a larger area of the reservoir, resulting in increased production rates. Fishbone wells also have a reduced environmental footprint compared to traditional well configurations. The findings of this study provide valuable insights for the petroleum industry. The integration of advanced fracture modelling and the consideration of associated gas production and operational costs can aid in minimizing operation costs and improving the economic viability of resource development in an efficient and environmentally safe manner.

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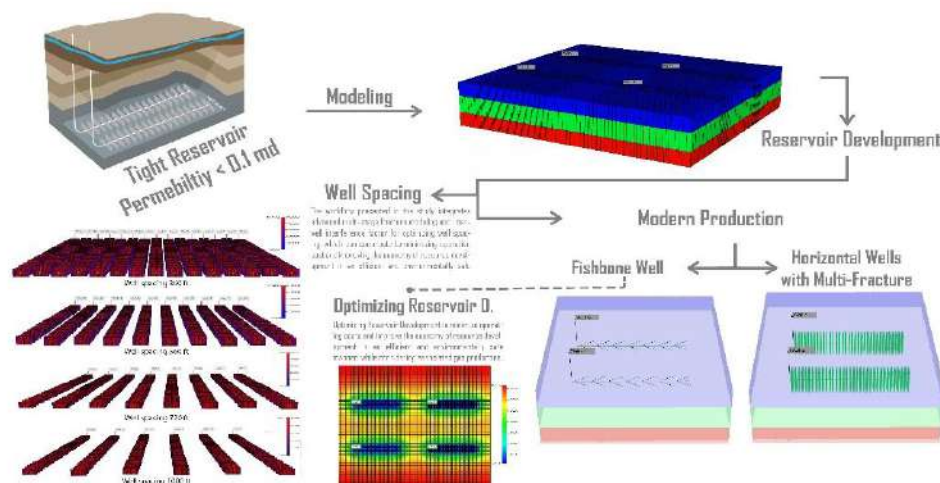
Project 2

Constructing 2d maps for petrophysical properties of Yamamma Reservoir in Nasiriya Oilfield

غاده مهدي سالم و محمد حازم شاكر

م.د. حسين العيبي زامل

Abstract: Nasiriyah oilfield considers one of the biggest and important oil fields in Iraq. This study focuses on showing the distribution of porosity, permeability, thickness, and oil saturation in the Yammama reservoirs. The wells that are included in this study are (NS-1, NS-2, NS-3, NS-4, NS-5) of Nasiriyah oilfield which penetrate Yammama reservoirs, by using surfer program to draw maps and study the variation of these properties the result show the thickness, porosity, permeability, and oil saturation for Yammama reservoirs it is increased in the middle and south of the reservoir in the wells NS-1, NS-2, NS-4.

Graphical Abstract
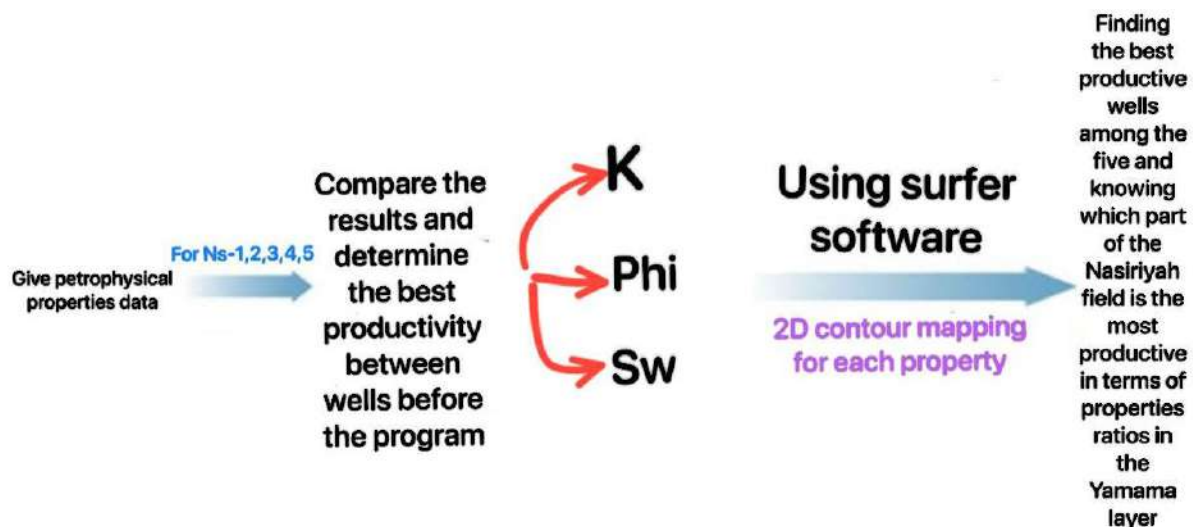
<u>**Project 3:**</u>
Wining Project
Production Logging Tools interpretation for an oil well

عمار عبد الهادي موله و جمانة مهدي ملا
م. د.عماد عبد الحسين فخار ، د. علي خيون

Abstract: Conventional well log determines the geological and geophysical data of the wellbore and formation fluids properties like porosity, permeability, saturation, resistivity, and shale volume. All these are measured during the exploration and development stages of the well's life. During a well's production or injection stages, several problems occur and need to be known. Cased hole logs are run with the objective of evaluating the integrity of different well barriers, such as tubing, casing, cement, and packers. Production logging tools (PLTs) are one type of cased hole logging, run during the production or injection stages of a well's life, PLTs in oil and gas industries are used for both production and injection wells, for obtaining fluid types and measuring fluid rates in the borehole, and to better understand the well productivity or the well injectivity of the interest zones, also, to detect some well problems, such as early water or gas breakthrough, channeling behind casing or tubing, and water or gas coning. In this study, We interpreted production logging tools by Emeraude software from Kappa company to knowing which zone represents the most contributing to the production and to detect if there is a cross-flow or not, for well (X): Vertical oil-producing well that belongs to (Y) oilfield (one of southern Iraqi oilfield), perforated with six perforation intervals, and the results were:- the first two perforation intervals (2958-2959.5) m and (2966-2969) m represent the less production interval, which accounts for 2.89 % and 3.57% of the total downhole rate, and the water cut is about 27% and 32% on the surface respectively. While perforation intervals 3 (2990-2994) m and 4 (3001-3007.5) m don't contribute to production. While perforation interval 5 (3024-3027.9) m represents the main production interval, which accounts for 65.68 % of the total downhole rate, and this interval is the main water production interval with water cut about 36 % on the surface, and the perforation interval 6 (3049.9-3053.8) m represents the secondary production interval, which accounts for 27.86 % of the total downhole rate, and the water cut is about 5% on the surface. In addition, there is no cross-flow, However, PLTs must be lowered in shut-in conditions to confirm this.

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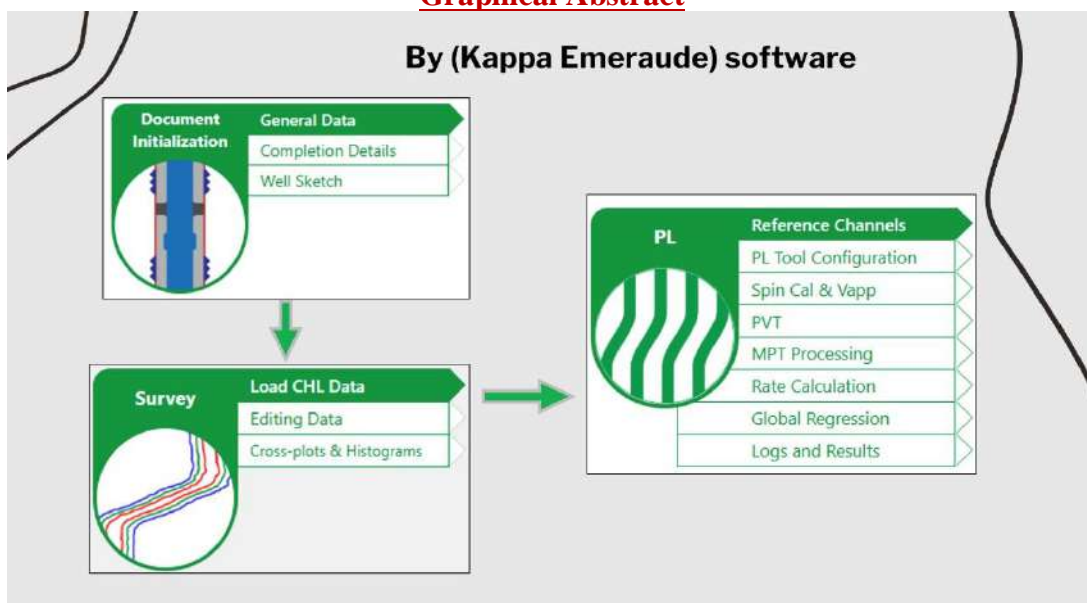
Project 4

A Comparative Study of Khasib Formation in Two Different oil Fields in Iraq

سامر قاسم سرداح و عباس حاتم كريم
م.د. هبه طارق جليل

Abstract: The Khasib Formation of Late Cretaceous (Upper Turonian – Lower Coniacian) is considered important reservoir in the Amara oil field. Knowledge of reservoirs rocks composition including fluid saturation and mineralogical components is essential for formation evaluations. The current study represents an evaluation study of the Khasib Formation using logs data to evaluate the Khasib Formation in terms of its mineralogical, lithological composition and its petrophysical properties such as porosity and fluid saturation. Logs data of two drilled wells in the Amara and Ahdab oil Fields from the Khasib Formation were conventionally processed and integrated. Also, the mineralogical components of the Khasib Formation were revealed using computer processed interpretation (CPI), where, combination of logs including (gamma ray, sonic, density, neutron and resistivity was integrated).

Graphical Abstract
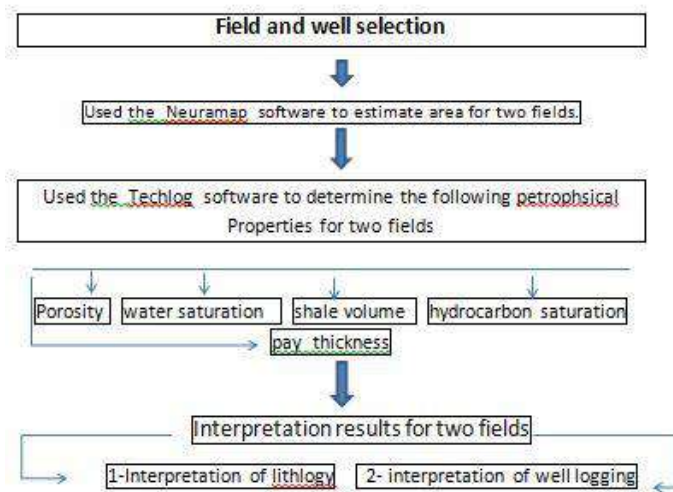
Al-Khasib formation		
Parameter	Am-6	Ad-1
Depth	2970m-2864 m	2576.1m-2686..89 m
Depth interval	106 m	110.79 m
Lithology	limestone	Limestone, sandy limestone, and dolomitic limestone
Mineralogy	Calcite	Calcite with less content of quartz and dolomite
Vsh	0.17	0.145
Average Total porosity	0.123	0.21
Average effective porosity	0.1	0.16
Average water saturation	0.584	0.72

Project 5

Machine learning approach for the decline curve analysis of unconventional reservoirs

حسين حافظ جمعة و عمار رضا فرحان

أ.م.د. سلام الربيعي

Abstract: Decline curve analysis (DCA) is a common technique used in the oil and gas industry to estimate the future production rates of wells. In the case of unconventional reservoirs, such as shale and tight formations, DCA has become an important tool to evaluate the performance of these complex reservoirs. The DCA for unconventional reservoirs involves analysing the production data of a well over time and fitting a mathematical model to the production decline curve. The model takes into account the various physical and geological factors affecting the reservoir and predicts the future production rates of the well. One of the challenges in applying DCA to unconventional reservoirs is the complexity of the reservoirs themselves, which can result in non-linear decline curves. Additionally, unconventional reservoirs typically require hydraulic fracturing, which can also affect the decline curve behaviour. Despite these challenges, DCA remains a useful technique for evaluating the production potential of unconventional reservoirs.

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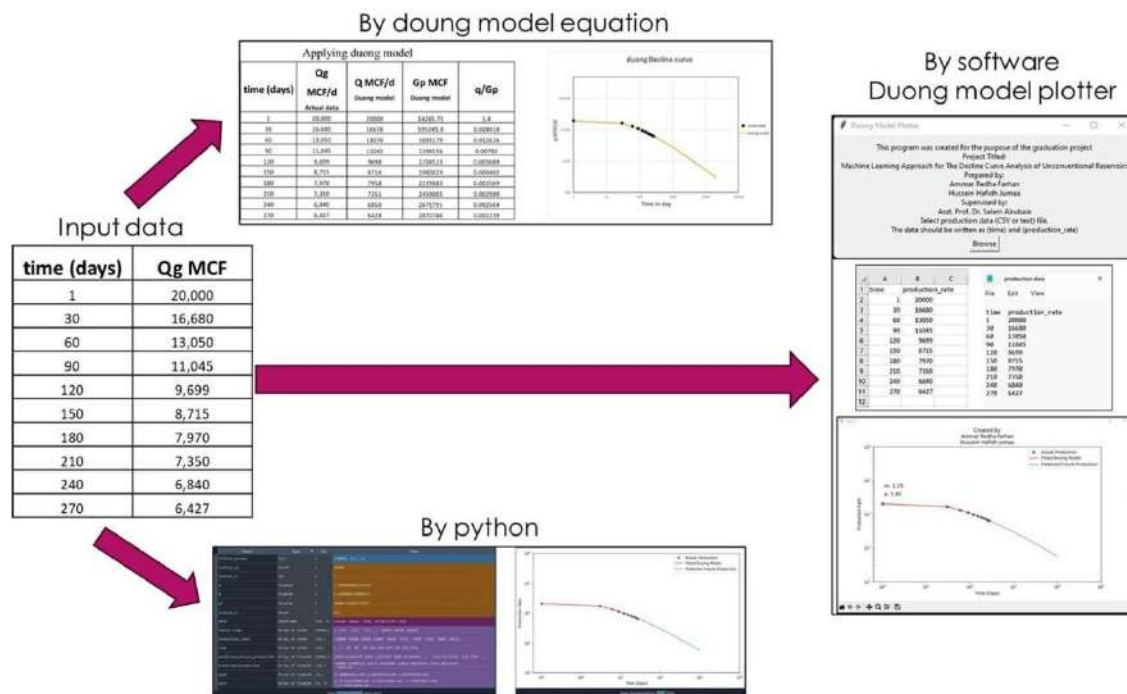
Project 6

Developing a Simulation Protocol by Python TO Analyze Pressure Records in Bounded Reservoirs

حسين علي جبوري و ايمن سلمان ابرهيم و علي معتز محمد و الحسين جاسم كاظم
أ.م.د. سلام الربيعي

Abstract: The areas of big data analytics and machine learning have become very promising research fields for a wide range of applications due to the development of high computational systems. These methods can process huge amounts of data, extract useful information from raw data, and can easily identify the hidden patterns in the given data. These advanced techniques can easily filter out noise, reduce dimensionality, model nonlinear relationships, and sometimes helpful in handling reservoir uncertainties. In this study, we will develop a simulation protocol to analyse pressure records in bounded reservoirs based on machine learning. Recurrent Neural Network is a type of artificial neural network designed to analyse reservoir limit testing for five wells and predicting permeability and shape factor. Result shows an excellent performance in training process with $R2 = 0.999$ and $MSE = 0.00001$ and a good results in testing performance with $R2 = 0.92$ and $MSE = 7.419$.

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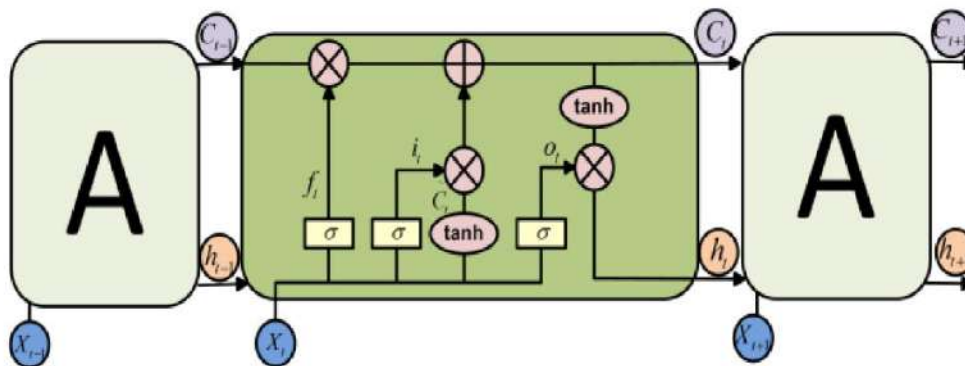
Project 7

Comparative Study of Filtration Loss Properties of Mud Prepared with Calcium and Sodium Bentonite

زينب عقيل حسن و مهدي عبدالحسن عبدالامير

م. دعاء صالح مهدي   م.م. علي خليل فرج

Abstract: One of the major problems during oil and gas drilling operations is filtration loss, particularly when drilling through permeable formations in which the hydrostatic pressure exceeds the formation pressure. Moreover, filtration loss is considered as main reasons for crack formation, and borehole instability and causes an increase in the well construction cost. Bentonites continue to be the most widely used material for thickening fresh water base drilling fluid. Bentonite is classified as sodium bentonite or calcium bentonite, depending on the dominant exchangeable cation. Sodium montmorillonite bentonite is the most commonly available commercial bentonite for drilling fluid applications. This research evaluates the filtration loss performance of calcium and sodium bentonite by determining the filtrate volume and mud cake thickness. The obtained results of the Ca-bentonite filtration loss have been compared with these of Na-bentonite. The results indicate that the Na-bentonite has lower filtration losses than Ca-bentonite. Then, and in order to improve the performance of Ca-bentonite, Carboxymethyl Cellulose (CMC) and starch additives with a composition of 2, 4, 6, and 8 grams have been mixed with 15, 22, and 30 grams of Ca-bentonite. The results show that adding CMC and starch to the Ca-bentonite reduce the filtration loss and that CMC is more effective than starch in improving the performance of Ca-bentonite filtration loss.

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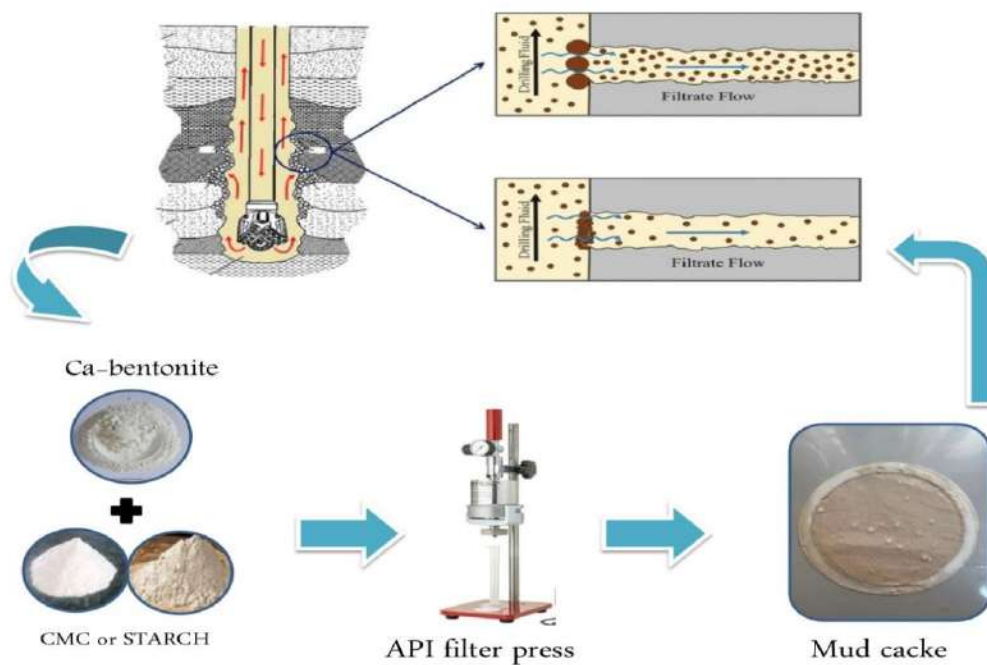
Project 8

Removing of oil content and salt from produced water by clay

علي نصير غازي   و   عبد الكريم فتحي احمد

ا. م. د. ميساء علي البدري

Abstract: Produced water is the largest waste stream generated in oil and gas industries. It is a mixture of different organic and inorganic compounds. Due to the increasing volume of waste in Iraq in the current decade, the outcome and effect of discharging produced water on the environment has lately become a significant issue of environmental concern. Produced water is conventionally treated through different physical, chemical, and biological methods. In the present study simple method will be used include: preparation of Iraqi kaolin in powder form and pressing into 2 cm-diameter capsules for use in a filter device. Design a simple device including filtration produced water in two stages. A vibrating motor has been included within the first filter to assist in continuously moving the water. A vibrating motor that is connected to the program screen can be controlled in terms of vibration intensity, work length, and work mode, such as constantly or intermittently. Six parallel valves, three of which are for pushing and three of which are for pulling, allow water to be moved in any direction.

Graphical Abstract
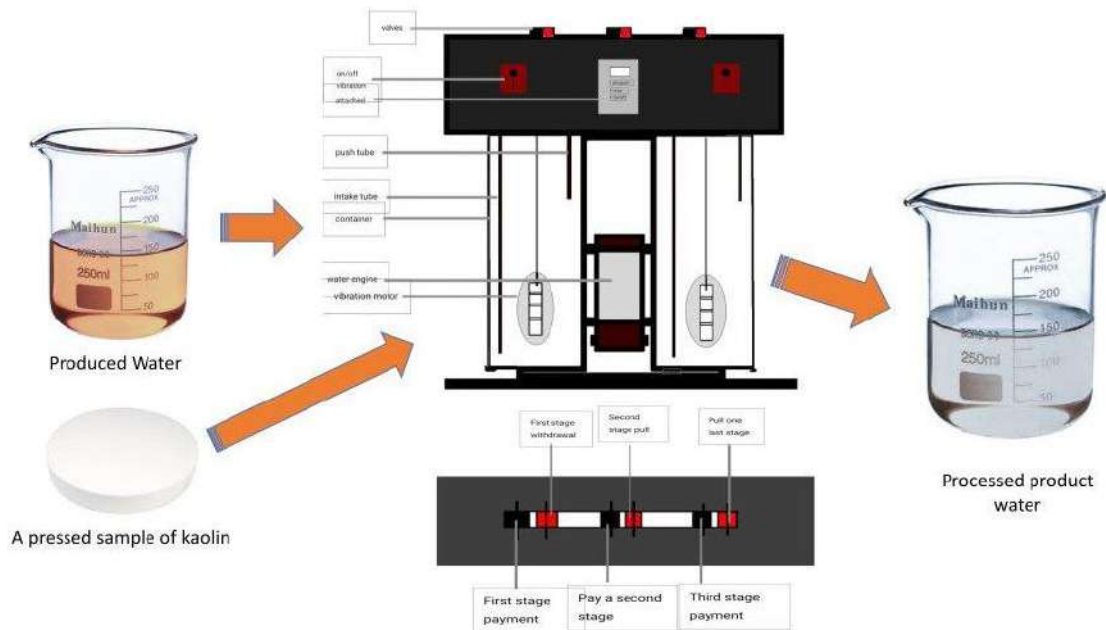
Project 9

Treatment of Saline Water Using Electrocoagulation Technique

علي عبدالكريم عبدالحسين و فاضل عباس فاضل

أ.م.د. احمد عبدالله رمضان

Abstract: Increasing discharge of saline wastewater from different industries and environmental risks associated with it has compelled researchers to search for efficient treatment methods and safe disposal techniques. Unfortunately, several industries such oil & gas require brine solution units to obtain a finished product that further elevates the salinity of discharged wastewater to a magnitude of 1–3% by weight of NaCl. Among the conventional treatment procedures, electrochemical technologies proved to be more efficient, robust and cost effective. Electrocoagulation (EC), an electrochemical based technology that produces in situ coagulant which ultimately assist in pollutant removal. It is even more suitable for the treatment of saline water as salinity increases conductivity which further enhances the EC process efficiency. In this paper, the treatment of brine produced water using electrocoagulation technique will be investigated in a practical manner for water similar to that produced from an oil field in order to obtain cleaner water for further treatment and help in achieving the quality of reuse. For this, a treatment cell using different parameters commonly used in the scientific literature will be designed to fit this scenario.

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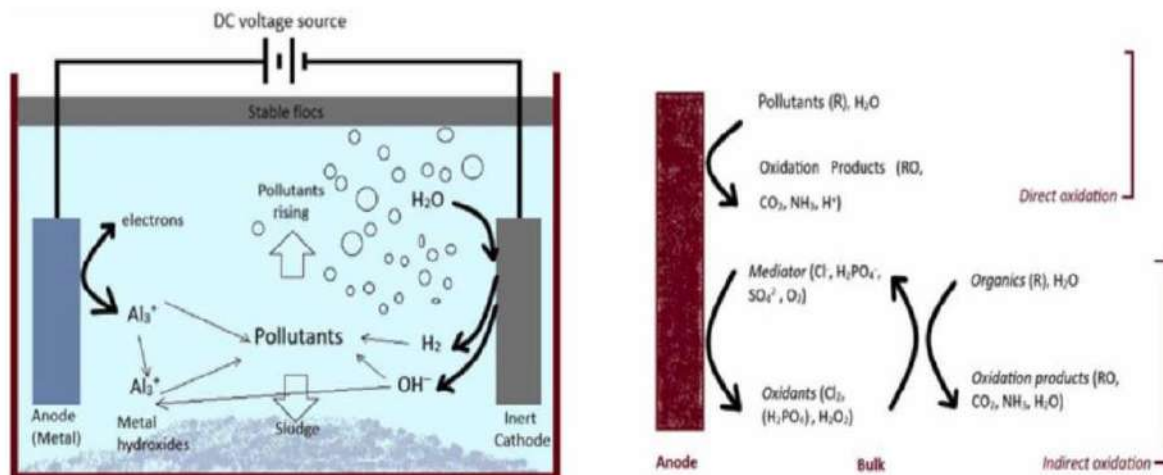
Project 10

Study the effect of Iraqi crude oil sulfur content and temperature on flow rate through Pipeline in Petroleum Industry

امير جلال حاتم و عبدالله عبد جاسم ديمي

م.د. انور ناظم محمد

Abstract: This project has been studied the effect of Iraqi crude oil sulfur content and temperature on the flow rate through horizontal oil field pipeline because there are several problems related in transporting crude oil where one of the most important aspects of oils is their viscosity, since the high viscosity of oils directly impacts the recovery and productivity of the reservoir in addition to transporting through pipelines. Several experiments have been depended to investigate these effects, these experiments based on increasing temperature (28.9, 38, 50, 75, 100, and 125 °C) and percent of sulfur content in crude oil. Four Iraqi crude oil have been taken to calculate the effect of temperature and sulfur content on flow rate, and these oils (East – Baghdad, Thi Qar, Al–Rumaila, and Mixed oil of refinery Diwaniya), and the properties of these oil such as API respectively (20, 30, 24, and 27 API), and viscosity at (28.9° C) respectively (4.18, 0.43, 0.14, and 0.13 cp). The results shows when the temperature increased, the flow increased due to decreased viscosity where the relationship was inverse, and the effect of sulfur content on crude oil viscosity is low comparing with temperature effect.

Graphical Abstract
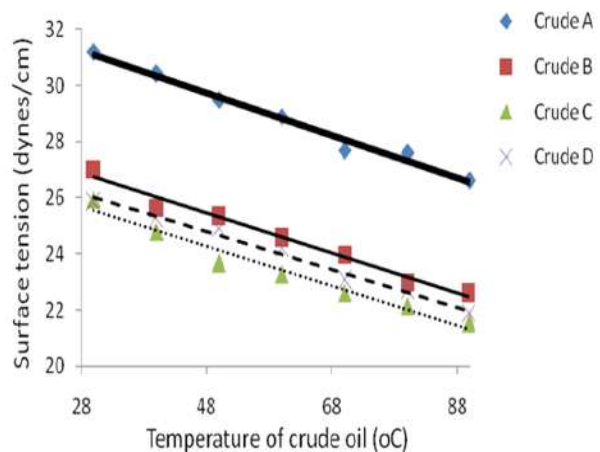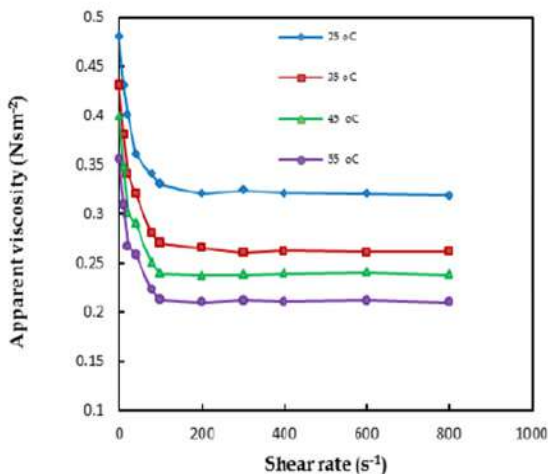
Project 11

Heavy Oil Viscosity Reduction by Using Ionic Liquids

همام حيدر عباس   زهراء علي نعمة
م.د. مؤيد حسن

Abstract: Heavy oils and extra-heavy oils (bitumen's) are difficult to produce and transport due to problems associated with the aggregation of asphaltene molecule the effects of ionic liquids on viscosity, Density of the heavy oil are investigated. The results indicate that ionic liquids have good viscosity reduction property for the heavy oil. After reaction with ionic liquids, the contents of saturates, aromatics and resins in the heavy oil increase, while the content of asphaltenes decreases. This leads to the decrease of the average molecular weight and the reduction of viscosity of the heavy oil. The results also indicate that metal ion modified ionic liquids have the catalytic effect on upgrading the heavy oil.In this work, the result of adding ionic liquid to reduce the viscosity of heavy oils and bitumen was studied. We imported an ionic liquid sample and chose Tetrabutylammonium Hydrogen Sulfate because of its cost, availability, and properties. Tetrabutylammonium Hydrogen Sulfate can react with asphaltene molecules in crude oils, and lower the viscosity of the oil. Asphaltene, the most polar fraction of crude oil, appears to be a major contributing factor to the high viscosity of heavy oils and bitumens. Interactions between tetrabutyl ammonium hydrogen sulfate and asphaltene molecules can alter the properties of the crude oil at the molecular level, which can then reduce the viscosity of the crude. With this view, we study the scope of using ionic liquids such as tributylammonium hydrogen sulfate to reduce the viscosity of heavy oils and bitumen. We will dilute the ionic liquid sample in the formation brine to maintain electrostatic stability, then react the diluted sample with heavy oil, then we measure the viscosity with the (Brookfield viscometer device, then Then the density is measured by pycnometer.

Graphical Abstract

The crude oil used (East Baghdad oil field) with 21.8 API and 72.66 cP

Crude oil mixed with different concentrations of ionic liquid

The experimental measurement was by using Brookfield viscometer to measure the viscosity
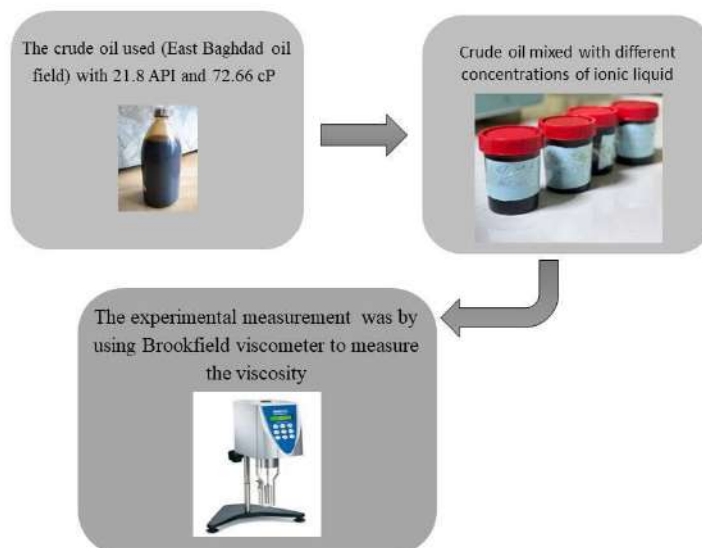
Project 12

Enhanced oil recovery by nanotechnology

حيدر ستار عبد

أ.م.د. علي عبد الوهاب

Abstract: Nanotechnology has attracted a great attention in enhancing oil recovery (EOR) due to the cost-effective and environmental friendly manner. This research shown that nanoparticles can enhance oil recovery by shifting reservoir wettability towards more water-wet and reducing interfacial tension, yet this area is still open for discussion. It is worth noting that the potential of nanoparticles to reduce the oil viscosity, increase the mobility ratio, and to alter the reservoir permeability has not been investigated to date. Laboratory tests using nanoparticles as the EOR agent, developing a new synthesis method to prepares NF nanoparticles. The structural, morphological and magnetic properties of the powders were investigated and analyzed by utilizing nano-scale tools such as x-ray diffraction (XRD), fourier transform infrared spectrometer (FT-IR), vibrating sample magnetometer (VSM), the determination of the dielectric properties and the magnetic behaviour mostly for nanoparticles on the surfaces for viscosity decreasing studies are the main parts of this investigation. In this research, nano-fluid added to crude oil and decreasing the viscosity by 37.66% compared with original crude oil. From this point of view, nano-scale size of nanoparticles makes them efficient for using in enhancing oil and gas recovery efficiency improvement. The findings of this study can lead to better understanding of fundamental basis about efficiency of nanoparticles in EOR process, activated EOR mechanisms during application of nanoparticles, selection of appropriate nanoparticles, the methods of stabilizing and economic evaluation for EOR process.

Graphical Abstract

NiFe$_2$O$_4$ Nanoparticle preparation   mixing NiFe$_2$O$_4$ nanoparticles with crude oil

Measures decreasing in viscosity by viscometer

Project 13

Treatment of wastewater by using ion exchange in oil industry

محمد علي حسن و سليم صلاح حامد علي
م. محمد غازي البرزنجي

Abstract: One of the major problems of the petrochemical industry is the great amount of wastewater produced and the high investment needed for the treatment of this effluent before it is released to the environment The wastewater from a petroleum industry consists a wide variety of pollutants like petroleum hydrocarbons, mercaptans, oil and grease, phenol, ammonia, sulfide, and other organic compounds. All these compounds are present as very complex form in discharged water of petroleum industry, which are harmful for environment directly or indirectly. Some of the techniques used to treat oily waste/wastewater are membrane technology, photocatalytic degradation, advanced oxidation process, electrochemical catalysis. In this review paper, we select using Ion exchange technologies for treatment wastewater. The aims and objectives of the present study are: Treatment wastewater where one or more undesirable ionic contaminants are removed from water by exchange with another non-objectionable, or less objectionable ionic substance.

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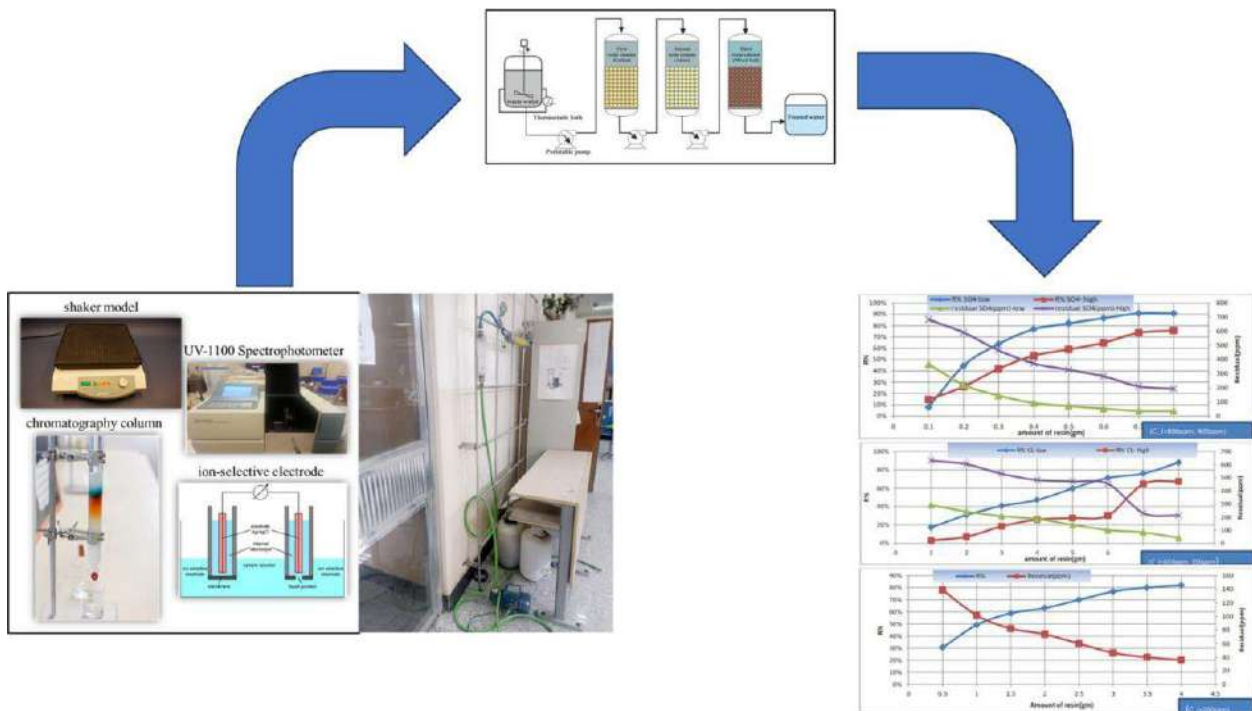
Project 14

Enhancing viscosity of crude oil

نوار جبار سويس و رنا ابراهيم حسن
أ.م. رنا عباس عزيز

Abstract: The increased demand for crude oil and the depletion of light crude oil reserves led to an increase in the production of heavy crude oil. Heavy crude oils usually have a high weight percentage of asphalt which is the most complex and heavy organic compound, which can lead to many problems during production for refining processes. Producing these reserves is technically and economically challenging due to their properties, so the key to extracting heavy oil from these resources is to reduce the viscosity of the oil. Compared to light oil, heavy oil is more expensive to produce, process, and transport crude oil. Several techniques have been applied to reduce the viscosity of heavy oil. The proposed study focused on many significant points in order to come up with a good understanding of the heavy crude oil flow properties and how to enhance it. The main theme of this investigation is to examine the rheological properties of the heavy crude oil by reduction the viscosity of heavy crude oil has been experimentally investigated, the oil used in the experiments has been taken from south of Iraq (Amara oil field) with 16 API and 135.6 cP . The solvent organic were used –Toluene, Heptane and Heptol with different fraction for dilution. This study shows that the blending of the heavy crude oil with a limited amount of diluents provided better performance .The magnetic stirrer was used to mix the HCO with the dilution that was added to it. Results show that the higher viscosity reduction was 80.58% from(135.6 cp to 26.33 cp) can be obtained through (75%T+25%H) blending with HCO at 295.15 K and 42 s-1 shear rate.

Graphical Abstract
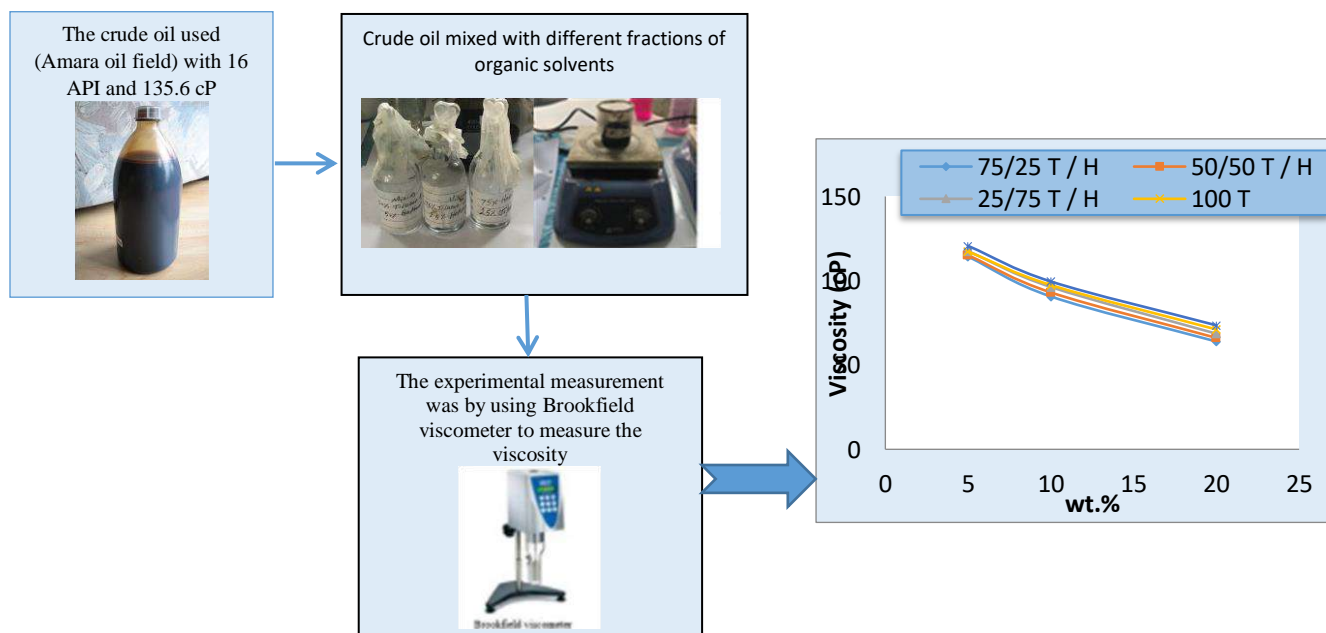
Project 15

Desulfurization of Crude Oil Using Sodium Hydroxide

علي سمير عطوان و حسين ياس خضير

م.م. انفال حيدر صادق

Abstract: Based on the presented experimental study and the obtained results from using one stage for desulfurization of heavy crude oil from East Baghdad oilfield, the followings conclusions can be drawn:- Caustic method desulfurization ... The efficiency of desulfurization increases when the reaction time and mixing speed are increased too, and with the application of moderate conditions for reaction temperature and concentration of alkaline compounds. In addition, it was found that the sulfur content, resulting from the process of, was dependent on time, temperature, weight of NaOH and mixing speed as in the following sequence: mixing speed > weight of NaOH > time > temperature.

Graphical Abstract
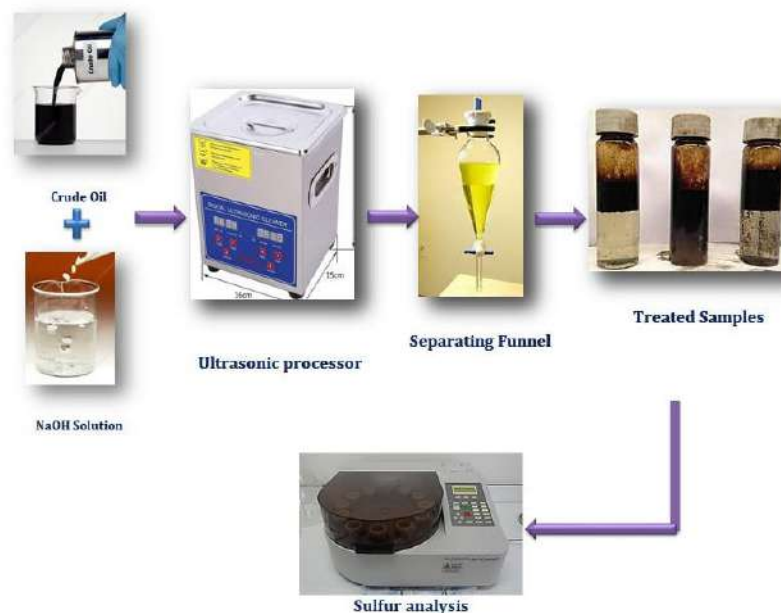
Project 16

Well Test Analysis of Horizontal Wells

طارق زيد نجم و رغد حازم محمد

م.م .علي انور علي

Abstract: The well test analysis aims at verifying permeability and skin effect, identifying fluid behavior, estimating the average reservoir pressure, confirming heterogeneities and boundaries, and assessing hydraulic connectivity. This information provides valuable insights into reservoir properties, well performance, and potential wellbore damage. The results can guide decision-making processes regarding reservoir management, production optimization, and future drilling plans. The project focused on the analysis of horizontal well tests with the aim of calculating permeability values and skin factors for different flow regimes. In this study, an Excel program has been used depending on function of IF-AND that allows the calculation of the pressure derivative, the determination of the flow regime type after plotting diagnostic plot, and the analysis and interpretation of the data obtained from the well testing. This function or Excel sheet can be used for any well test data to enables petroleum engineers to input well test data into Excel and obtain calculated permeability values and skin factors for each flow regime.

Graphical Abstract
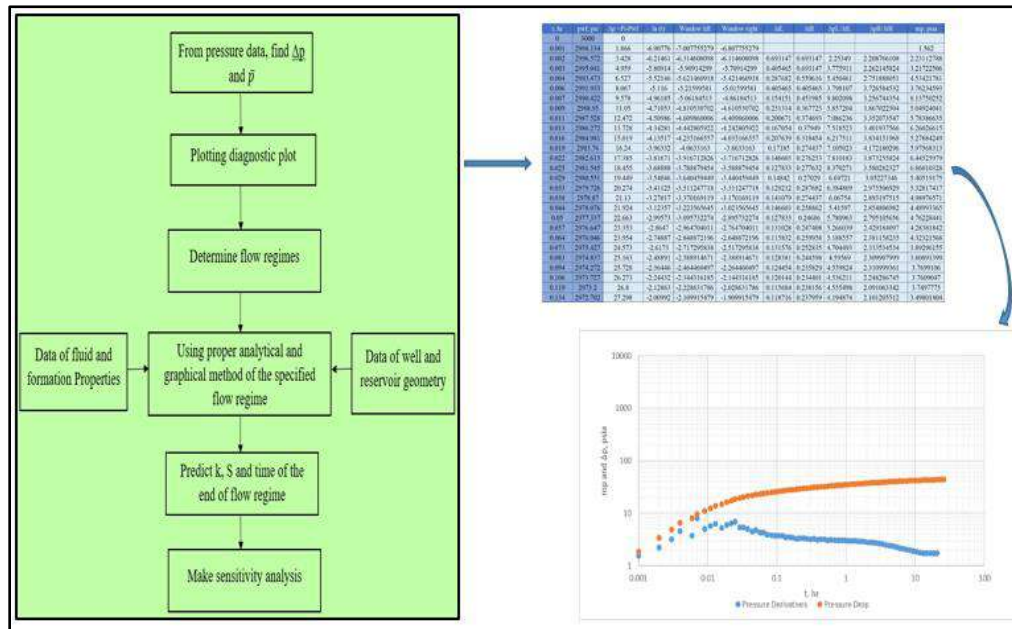
Project 17

Asphaltene Precipitation Investigation Using a Screening Techniques for Crude Oil Sample in Iraqi Oil Fields

ايه خضر علي و فريال سعد عبدالجبار

م.م .علي انور علي & م.م. محمد عبدالله احمد

Abstract: This study attempts to evaluate the performance of the most well-known screening procedures used to predict the precipitation probability of asphaltene in crude oil using an extensive database of literature. These methods were chosen based on the amount of proprietary data needed for each application. Most of the methods reported in the literature use SARA analysis to monitor the stability of the oil with respect to asphaltene precipitation. To determine the precipitation potential of asphaltene, other methods require temperature, pressure, and oil density data. The asphaltene deposition model, which is based on PVT and AOP, and the compositional analysis of the downhole sample, should be used to validate the results. After using the screening methods (De-Boer,CII,CSI,stability index), as well as the PR78A model in the Multiflash program, it gave the results of the occurrence of asphaltene precipitation in the future after the pressure drop.

Graphical Abstract
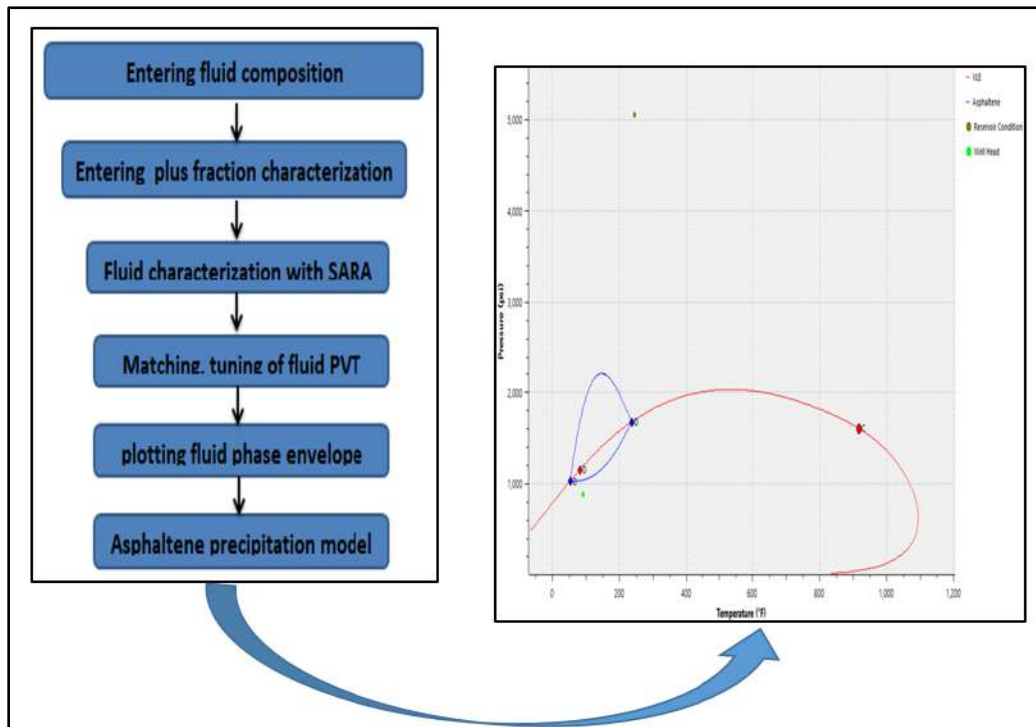
Project 18

The effect of heat on viscosity and filtration of conventional drilling mud

محمد امين فهد و مالك رشيد صبيح

م.م. وسيم علي حسن

Abstract: Study The effect of temperature in the wells tend effect the mud density and mud viscosity, there by affects the ability of the mud to perform its useful purpose in the drilling operation. First Study temperature of drilling mud. Second how much increase in the temperature with depth of the well. Third Increase temperature and effect on the mud weight. Also study term cooling is an important challenge in various industries, including the drilling industry. Drilling fluids have this primary important function in subsurface wellbore drilling operations and help prevent the costly bit failures that occur while crushing rigid rocks, at high temperature, and at the great depth. Drilling mud, or drilling fluid, represents any fluid which used during an oil well drilling operation .Generally, drilling fluid pumps from the surface tanks to the well bottom via the drill string and bit and circulates back to the surface tanks through the annulus (i.e., the annular space between the drill string and the open hole or casing). Drilling mud viscosity is one of the rheological properties of drilling mud. Viscosity represents a measure of matter's resistance to a deforming force. Thus, drilling mud viscosity needs to be adequately measured and controlled. Generally, the amount of drilling mud viscosity must be sufficient to suspend the mud solids.

Graphical Abstract

Viscometer model 900



Bentonite   API filter press

Project 19

FORMATION EVALUATION FOR SELECTED WELL LOGGING RESULTS FOR ZUBAIR FORMATION IN LUHAIS OIL FIELD

حسين داود غضبان و احمد جاسم

م. د.حسين لعيبي زامل

Abstract: The best source of petrophysical properties data is the well logging technique, which is the primary source of petrophysical evaluation of reservoirs in the oil and gas wells Well logging defines as the technique of making petrophysical properties measurements in the subsurface earth formations through the drilled borehole, in order to determine both physical and chemical properties of rocks and the fluid they contain. The petrophysical interpretation was based on geophysical well logs data to delineate the reservoir characteristics of Zubair Formation. The available geophysical well logs such a s (sonic, density, neutron, gamma ray, SP, and resistivity logs). This study focus on the interpretation of well logs data for several wells of Zubair formation at Luhais oilfield, the wells that have been selected were Lu-8, Lu-11 and Lu-13. The data entered to software program for interpretation, the software used was Interactive petrophysics (IP). The interpretation shows the units of Zubair formation, oil accumulation regions, water oil contact, shale regions and lithology of Zubair formation .in this research lies in analyzing the image data of the Zubair layer in the Luhais oil field into digital data in order to determine the petrophysical properties (permeability, porosity, water saturation) to evaluate the productivity and profitability of the Zubair layer, as well as knowing if drilling additional wells leads to economic benefit or not Luhais oilfield is located at about (50Km) southwest of North Rumaila oilfield in the Basrah city, southern Iraq. The field lies approximately between (47°, 47 1 4 °, 19) Latitude and (30°, 30 13 °, 24) Longitude [Many wells were drilled in Luhais5]. oilfield since 1973 to determine the Structural configuration and facies distribution of the reservoir rocks.

Graphical Abstract
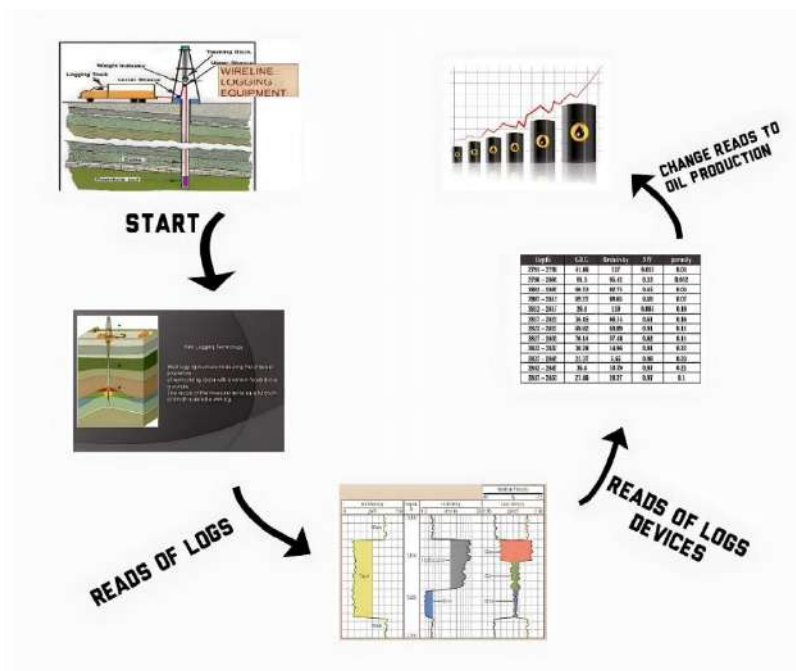
Project 20

Review of Renewable Hydrogen Production Methods

سجاد نعيم عبدالرضا و محمد علي سامي
أ.د. نجم عبد الكاظم الربيعي

Abstract: An increase in human activities and population growth have significantly increased the world's energy demands. The major source of energy for the world today is from fossil fuels, which are polluting and degrading the environment due to the emission of greenhouse gases. Hydrogen is an identified efficient energy carrier and can be obtained through renewable and non-renewable sources. A review of renewable sources of hydrogen production which focuses on water splitting (electrolysis, thermolysis, and photolysis) and biomass (biological and thermochemical) mechanisms will be presented in this study. The limitations associated with these mechanisms will be discussed. The study also looks at some critical factors that hinders the scaling up of the hydrogen economy globally. Key among these factors are issues relating to the absence of a value chain for clean hydrogen, storage and transportation of hydrogen, high cost of production, lack of international standards, and risks in investment. The study will end with some future research recommendations for researchers to help enhance the technical efficiencies of some production mechanisms, and policy direction to governments to reduce investment risks in the sector to scale the hydrogen economy up.

Graphical Abstract
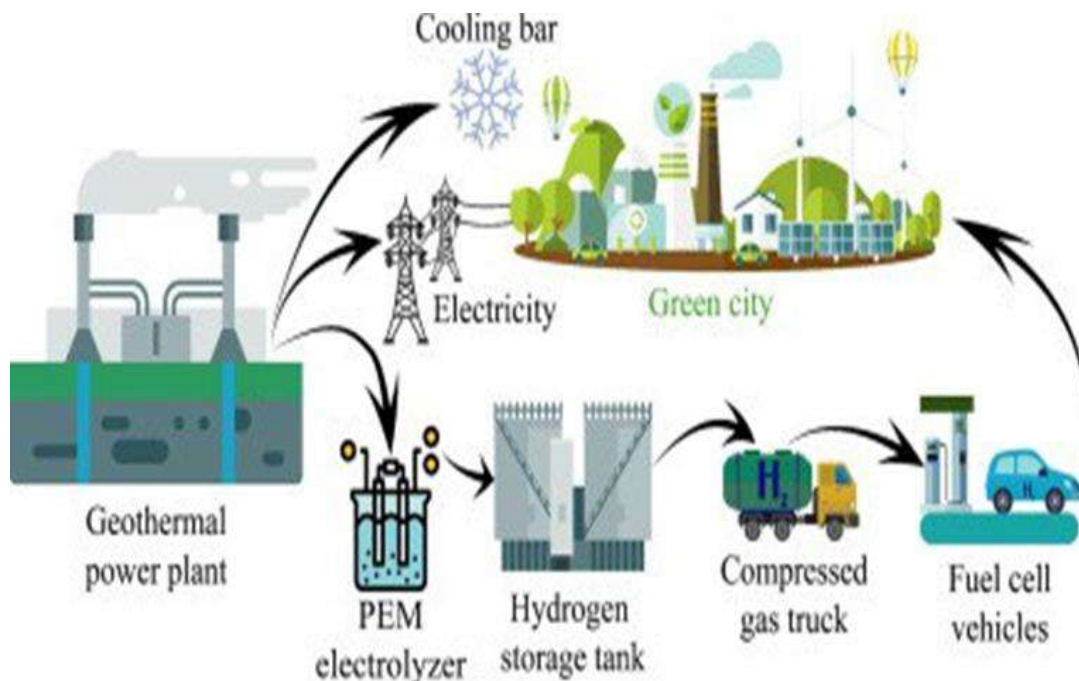
Project 21

Reservoir Performance Analysis and prediction using integrated Material Balance Model

عبدالكريم عماد عواد و بتول محمد جمعه

م.د. وسام عيسى طاهر و م.م. امين كريم صالح

Abstract: Reservoir performance prediction is crucial in the oil and gas industry, enabling effective field development planning and reserves estimation. This study focuses on the reservoir Asmari in the Abu Ghirab oilfield, utilizing the material balance software MBAL as an allocation tool. Through dominant energy analysis, non-linear regression, and performance predictions, the study provides valuable insights. The results demonstrate a recovery forecast of 40.07% by 2040, with errors of 1.13% in OOIP estimation and 3.67% in RF prediction for the same year. Additionally, the proposed scenario exhibits a significant 17.0651% increase in RF. These findings hold immense importance for reservoir engineers and decision-makers involved in reservoir management. Exploring the complex Abu Ghirab field, the integrated MBAL model proves its worth by uncovering valuable insights despite challenges such as fractures, production interruptions, and water-related complexities.

Graphical Abstract
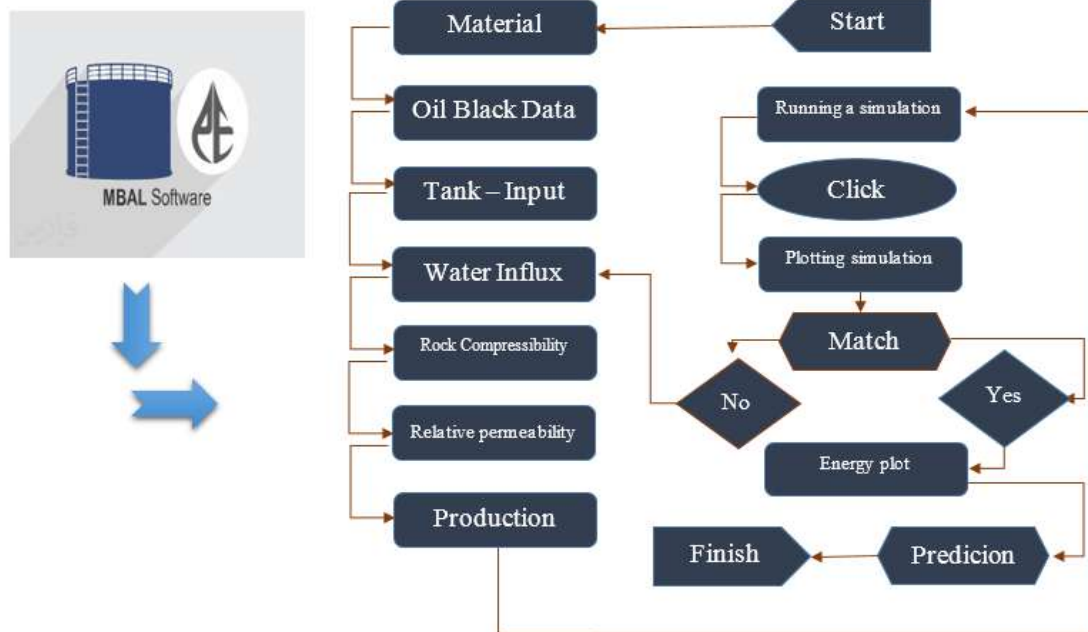
Project 22

Reservoir Simulation of Gas Condensate Field

احمد معد حمدان و ماجد عبد الله محمد

أ.م.د. غزوان نوري

Abstract: Gas condensate reservoirs are becoming more significant due to their growing role in global gas production. In these reservoirs, when the pressure at the bottom of the well drops below a certain point (the dew point pressure), liquid separates out and condensate gathers near the well opening. This build-up of condensate can decrease the flow of gas (gas relative permeability), reducing the productivity of the gas well and causing the loss of important heavy components in the reservoir. The main goals of this study are to understand how this condensate blockage occurs and how it impacts the productivity of the well. A literature review was conducted to gather the lessons learned from the work on gas condensate reservoirs to understand the main factors that affect the condensate banking process. Furthermore, this study investigates how the composition of the reservoir and well fluids changes with pressure. The study focuses on improving the Siba field to get the most liquid hydrocarbon out of it. This goal is achieved through compositional reservoir simulation, which first necessitate refining an equation of state (EOS) model to match the laboratory measured reservoir fluid PVT data. This refined EOS model is then utilized to examine various reservoir exploitation scenarios. The results of this study show that the composition changes a lot depending on the pressure at the bottom of the well (BHP) and the average pressure in the reservoir. Also, the study shows that the problems caused by condensate build-up can be lessened, and the recovery of gas and condensate can be improved by controlling the pressure (BHP).
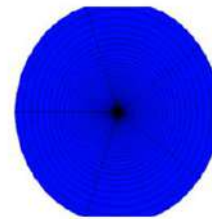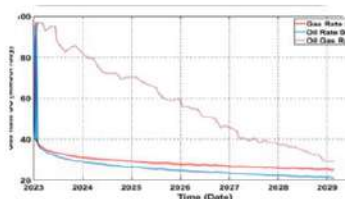
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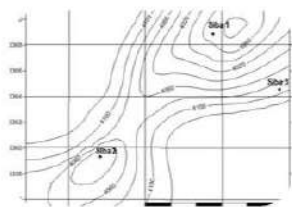
Prepare the required data (Contour map,Pvt data, Well completion data)

Input Data file for the CMG - GEM simulation software


make single well model for Siba gas field

calculating IGIP and predicting of GC reservoir behavior.

Project 23

Assessment of Gas field by using of MBAL software

ظافر عبدالحكيم ستار و عقيل منصور محسن
أ.م.د. غزوان نوري سعد و م.م. جاسم محمد جليل

Abstract   :Predicting the performance of reservoirs helps engineers to estimate reserve, development planning which requires detailed understanding of the reservoir characteristics and production operations optimization and importantly, to develop a mathematical model that will adequately depict the physical processes more occurring in the reservoir such that the outcome of any action can be predicted within reasonable tolerance of Errors. In this work, software called MBAL was used to compute the oil originally in place by performing a nonlinear regression of average pressure against cumulative oil production and to perform different scenarios of reservoir performance predictions. The data that used in this study is from Akas oil field. This software depending on material balance. We use PVT data and production to complete data for this project, estimate IGIP and the future performance for pressure to identify pressure profile. We use Emerge plot to describes the prevalent energy system present in the reservoir; water influx, pore volume compressibility, fluid expansion, ingestions etc. It describes the fractional contributions of these energy systems present in the reservoir and the most prominent at various date.


Graphical Abstract
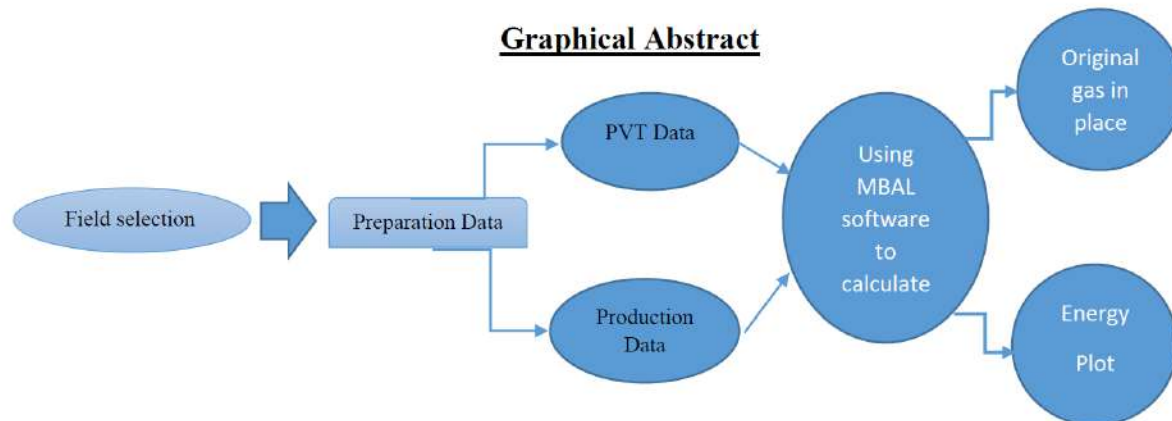
Project 24

The impact of the cluster spacing on the performance of unconventional reservoirs depleted by multiple hydraulic fractures.

سجاد منديل حسين و حيدر اسعد عبدالكاظم

أ.د. سلام الربيعي

Abstract: Focusing deep insights on the impacts of the spacing between parent and child wellbores and between hydraulic fractures on the performance of the unconventional reservoirs. The target is developing a quantitative approach for determining these impacts on pressure responses, flow regimes, and productivity indices during the entire production life of these reservoirs. The motivation of this study is the willing to set-up and define clearly the criteria for the optimum spacing between wellbores and fractures that could give the maximum productivity considering different reservoir configurations and wellbore types. The performance of unconventional reservoirs depleted by multiple hydraulic fractures can be affected by various factors, including the cluster spacing between the fractures. This Project aims to investigate the impact of cluster spacing on reservoir performance through numerical simulation. The simulation is performed for different cluster spacing between the fractures, while keeping other parameters constant. The performance of the reservoir is evaluated in terms of production rate and ultimate recovery. In addition, the simulation results show that the impact of cluster spacing on reservoir performance depends on the reservoir properties, such as permeability and porosity. Higher permeability and porosity reservoirs are less sensitive to cluster spacing compared to lower permeability and porosity reservoirs. In conclusion, this study demonstrates that the cluster spacing is an important parameter that affects the performance of unconventional reservoirs depleted by multiple hydraulic fractures. The findings of this study can help optimize the design of hydraulic fracturing operations and improve the performance of unconventional reservoirs.

Graphical Abstract

Fig.1. Hydraulic Fracture

Fig.2. The contribution of each hydraulic fracture for three and seven wellbores
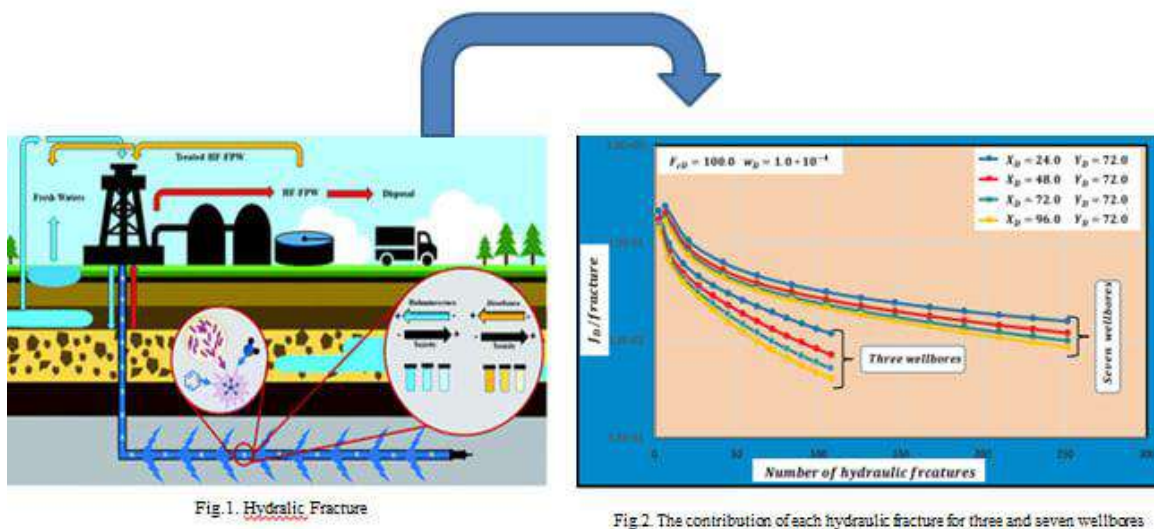
Project 25

Using well logging data in well completion

ليث حسين عبيد و مهدي اياد موسى

أ.د.فاضل سرحان كاظم و أ.م.د. غزوان نوري

Abstract : In this paper, we took into consideration the objective of using well logging in well completion specifically for detection of well perforation interval.   Perforation interval detection is a delicate activity that must be carried out precisely since incorrect detection results in waste of time and effort. As a result, one of the most crucial studies that cannot be ignored is carried out by using methods that are highly accurate in identifying the perforating interval. The objective of the paper is to detect the optimum perforation interval by using well logs data. Detected process done by using well logging data with IP software.

Graphical Abstract
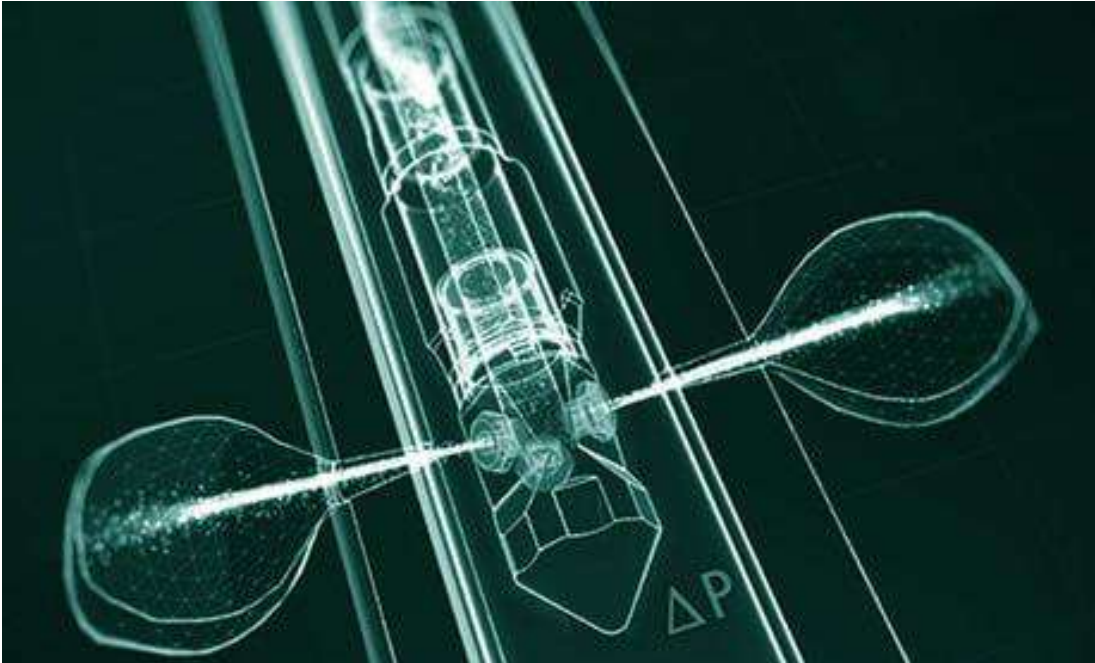
Project 26

Live design of Darcy law

حيدر علي عبد و احمد فهد اسد وابراهيم حيدر خالد
م.د جهاد حسين

Abstract: The live design of Darcy's Law is an innovative concept which aims to enhance our understanding of fluid flow within porous media. This multidisciplinary approach not only involves various fields such as hydrogeology, reservoir engineering, and environmental science, but also leverages computational simulations and experimental data in a live, dynamic setting. By creating a more interactive and adaptive design process, practitioners can gain valuable insights into the underlying principles governing fluid flow in porous media.

Graphical Abstract

Project 27

Type curve analysis for an Iraqi field

مصطفى كريم محيسن و كرار حسين عليوي
م.د جهاد حسين و م. د. وسام عيسى

Abstract: We used an well test interpretation method based on the analysis of the derivative of pressure with respect to the appropriate time function –natural logarithm of time or Horner/superposition time function to determine some parameters like permeability, skin factor, additional pressure drop due to formation damage and well bore storage. This method considers the response as a whole, from very early time data to the last recorded point, and uses the type curve matching technique. It provides a description of the flow behavior in the reservoir, but with the logarithmic derivative, it is also emphasizes the infinite radial flow regime, of prime interest in well test interpretation. The approach is an extension of the Horner method to analyze well test data. Use of the pressure derivative vs. time is mathematically satisfying because the derivative is directly represented in one term of the diffusivity equation, which is the governing equation for the models of transient pressure behavior used in well test analysis. Thus, the derivative response is more sensitive to small phenomena of interest that are integrated and hence diminished by the pressure vs. time solution. The pressure derivative well test assumes a simple, homogeneous, and isotropic reservoir compared with conventional method. The accuracy of the pressure derivative well test depends on the quality of the data collected during the test. However, pressure measurements and the computer processing technologies now available at well sites allow pressure derivative analysis. The results showed the good agreement between gringaten and conventional method. It give us indication there is formation damage into reservoir due to positive skin factor (S =+8) so the stimulation method is required. Also, there is well bore storage effect at early time region (C = 0.0091 bbl/psi).

Graphical Abstract
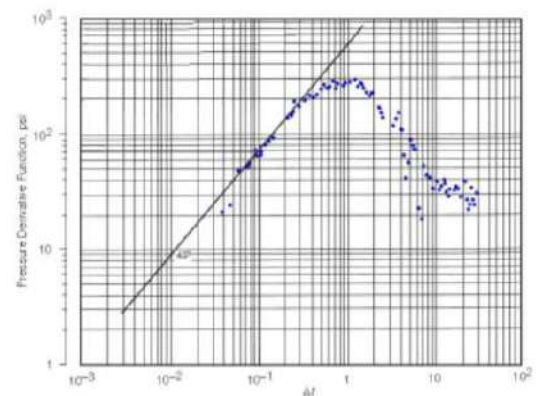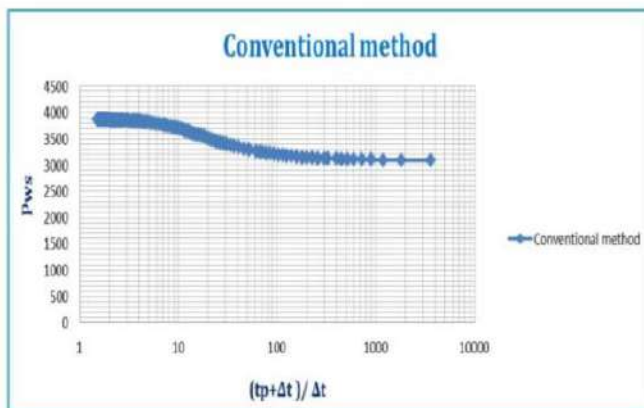
Pressure transient test from conventional method and pressure derivative.