VARIATION OF SATURATION PRESSURE VALUES IN MISHRIF AND ZUBAIR RESERVOIRS IN RUMAILA OILFIELD, SOUTHERN IRAQ

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ABSTRACT

Reservoir fluid, pressure volume temperature properties such as bubble point pressure, gas solubility, oil and gas formation volume factors, and viscosities are important elements in the reservoir management and field development. Therefore, this study aims to distribute the bubble point pressure on the main oil reservoirs in the Rumaila oilfield, laboratories tests results from 103 pressure volume temperature reports were used, these tests were obtained from the Mishrif, Upper Shale and Main pay reservoirs. Pressure gradient in the study area was defined using Surfer14 software, and in order to avoid the variation of low-pressure areas in the future drilling wells plan, continuous monitoring and focus on these areas, pressure maps were drawn then reading graduation of pressure on these maps to obtain final formula to adopt a specific range of saturation pressures values and distribute them among Rumaila oilfield. The study also compares between the main sub-units of the Main pay reservoir and Mishrif reservoir in the North Rumaila and other reservoirs in the South Rumaila oilfield as well as to define other factors in pressure volume temperature reports such as gas oil ratio, viscosity and formation volume factor that contribute to the saturation pressure variation.

Keywords: Pressure volume temperature; Gas oil ratio; Formation factor

INTRODUCTION

Rumaila is the largest oilfield in Iraq, it is located 50 km west of Basra city, Southern Iraq (Fig. 1). Covering an area of 1,800 km². The field was discovered in 1953 and been operated in 1972, with oil reserves of about 17 billion barrels (Basra oil company 2016). Reservoir fluid, pressure-volume temperature (PVT) properties (such as bubble point pressure), gas solubility, oil and gas formation volume factors and viscosities are critical in the reservoir engineering management and computations (Vetter and Farone, 1987).

Fig. 1. (A) Location map of the Rumaila Oilfield after (Al-Mudhafar, 2017) (B) Rumaila structure map (Almayyahi and Aljaberi, 2018)

These PVT properties are required to obtain the initial hydrocarbons in place, optimum production schemes, ultimate hydrocarbon recovery, material balance calculations, well test analysis, design of fluid handling equipment, and reservoir volumetric estimates. Bubble point pressures (P_b) and gas solubility (R_s) are two of the most critical parameters used to characterize an oil reservoir (BP, 2013), as they play a vital role in the reservoir management and reservoir simulation. Therefore, the accurate determination of these properties is one of the main challenges in reservoir development and management. The oil formation volume factor is important in the primary and subsequent development of any oil field (Karim, 1992).

The Zubair reservoir consists of several zones of varying reservoir quality and compartment with unknown connectivity. Primary depositional factors-grain size and ductile content - are the main controls on reservoir quality within the Zubair Formation. It is important to note that these depositional factors are relative controls on reservoir quality, with mechanical compaction following deposition and burial responsible for the loss of initial porosity (Arif and

Khaffaf, 1979). The investigation studies and seismic surveys of the Mesopotamian Zone are carried by the Iraqi Oil Company demonstrated the existence of many subsurface structures generally N-S trending anticlines and synclines of different sizes (Morad et al., 1989). The Mishrif reservoir in Rumaila Oilfield is structurally trapped by an elongated double anticline, Northern trends N-S, the southern trends NNW to SSE, (BP, 2013). Change in orientation is likely to be related to a deep-seated fault in the saddle area. The two domes are separated by a saddle, which also roughly divides North Rumaila from South Rumaila. Structural dips are relatively low and do not exceed more than 5 degrees. Many wells were drilled in Rumaila oilfield since 1973 to determine the structural configuration and facies distribution of the reservoir rocks (BP, 2013). Rumaila oilfield represents a gentle anticline fold and the main producing formations in this field are Zubair, Nahr Umr and Mishrif formations (Al-Mimar and Awadh, 2019). The bubble-point pressure of a hydrocarbon system is defined as the highest pressure at which a bubble of gas is first liberated from the oil (Ahmed, 2018). The bubble-point pressure is a strong function of gas solubility, gas gravity, oil gravity, and temperature. (Al-Jafar and Al-Jaberi, 2019) mentioned that Zubair oil Field is one of the most important oil fields in the southern part of Iraq. It is an anticline structure which has a NNW – SSE trend axis. It has four domes from south to north (Safwan, Rafdhya, Shuaiba and Hammar) respectively as it is familiar in previous study. This study aims to distribute the bubble point pressure on the main oil reservoirs in Rumaila oilfield to avoid the low-pressure areas in future drilling wells plan, continuous monitoring and focus on these areas.

METHODOLOGY

The main steps of methodology for this research can be summarized as follows:

1. A database of 86 thermodynamic study and physical properties of the reservoir fluids for the wells in all Rumaila reservoirs have been prepared (Table 1) from 103 thermodynamic study and physical properties available, although they are repeated study about the same available wells, the latest study was adopted in this research.
2. Plot the bubble-point pressure, GOR, gas gravity γ_g , oil gravity API, Bo viscosity of oil and temperature tests for the Mishrif and main pay reservoir in North Rumaila and upper shale reservoir in South Rumaila, implemented for all those reservoir and sub-units of Main pay (DJ, LN, ABDJ, and ABDJLN).
3. Collecting and processing thermodynamic study and physical properties data to prepare mathematical relationships between (PVT) factors. Moreover, Surfer 14 software used for mapping the distribution of saturation pressure for all of the reservoir units.

Table 1. Physical laboratory test results for the identified reservoirs at wells drilled in Rumaila Oilfield (after unpublished report from Basra Oil Company)

well	Res.	Unit	Date	Depth (m) (KB)	Pr(psi)	Bo@ Psat.	Psat (psi)	API	GOR (SCF/STB)	Visco. (cp) @ Psat.	Sp.Gr@ Psat.	B.H.T (°C)
Ru-71	Mishrif		1976	2050		1.2914	2118.8	26.9	502.81	1.9848	0.843	76.7
Ru-29	Mishrif		1977	2320		1.354	2431.6	26.7	604.27	1.42	0.7699	79
Ru-105	Mishrif		1978	2487	3884.9	1.3082	1874.2	24.3	464.61		0.7796	86.7
R-097	Mishrif		1976	2248	3697.2	1.3081	2147.2	26.9	522.53	1.285	0.8296	78.9
R-041	Mishrif			2200	3597.7	1.3527	2545.4	25.5	594.72	1.709	0.7563	76.7
R-074	Mishrif			2170	3498.1	1.3344	2353.4	25.2	581.12	1.619	0.7508	76.7
R-088	Mishrif			2192	0	1.3468	2431.6	25.2	603.54	1.397	0.7807	76.6
R-020	Mishrif		1977	2136	0	1.3817	2424.5	27.3	872.36	1.047	0.7893	79.4
R-059	Mishrif		1977	2108	0	1.3635	2389	25.2	613.88	1.48	0.8363	79.4
R-081	Mishrif		1977	2286	3498.1	1.3099	2410.3	25.9	582.02	1.198	0.7778	76.7
R-081	Mishrif		1977	2182	0	1.3276	2488.5	27	591.63			
R-041	Mishrif		1978		3697.2	1.3129	2296.5	25.8	583.15	1.01	0.7704	76.7
R-140	Mishrif		1979	2180	2986.2	1.4076	2346.3	27.2	661.07	0.877		76.4
R-124	Mishrif		1979	2275	3199.5	1.3204	2040.6	24.9	512.36	1.325	0.7329	76.7
R-124	Mishrif		1979	2237.7	3469.7	1.3733	2061.9	25.6	532.81	1.14	0.7708	76.7
R-410	Mishrif		1986	2430	0	1.2477	1813.1	23.5	426.97	1.814	0.877	76.7
R-170	Mishrif		2007	2195	3953.2	1.023	2317.9	26.4	531.07		0.7441	75
R-334	Mishrif		2007	2295.5	2699	1.3052	2104.6	26.5	482.25		0.7379	77
R-046	Mishrif		1974	2235			2278		0			74
R-046	Mishrif		1974			1.37	2303		619.44	1.358		74
R-046	Mishrif		1975			1.3386	2365	26.3	589.1	1.4135		71
R-062	Mishrif		1975			1.3595	2320	25.1	589.83	2.155		72
R-083	Mishrif		1975					24.2	603.37	1.55		77
R-044	Zubair	DJ+LN	1977			1.3854	2104.6	28	550.56	0.85	0.8147	99
R-047	Zubair	DJ	1976	3141	3896.3	1.5763	2900.9	32.6	893.26	0.549	0.8548	99
R-049	Zubair	DJ+LN	1977		0	1.4116	2360.5	28	629.21	0.952	0.8025	99
R-051	Zubair	LN	1977	3243	3995.8	1.3698	2204.1	29	573.03	1.192	0.7903	99
R-052	Zubair	DJ+LN	1977		3498.1	1.433	2524.1	25	655.96	0.972	0.8001	99
R-056	Zubair	LN	1977		0	1.3563	2005	28	522.47	1.023	0.8065	99
R-057	Zubair	LN	1977	3189	0	1.3872	2666.3	26	640.45	0.922	0.772	99
R-059	Mishrif		1977		0	1.3635	0	25	613.88			79.4
R-062	Zubair	LN	1977		3697.2	1.3643	1898.4	26.6	526.97	1.133		98
R-070	Zubair	LN	1978	3227	0		2282.3	26	606.74	0.691		98.9
R-071	Zubair	AB+DJ	1978	3700	0	1.3532	1976.6	28.5	507.3	0.85	0.8188	98.9
R-072	Zubair	LN	1978	3242	0	1.3727	2111.7	28	538.76		0.7888	
R-076	Zubair		1978	3101	3500	1.6058	3171.1	34.2	991.85	0.409		98.9
R-077	Zubair	AB+DJ	1978	3157	3800	1.6307	3092.9	33.9	1016.9	0.374	0.8205	98.9
R-082	Zubair	LN	1977	3207.5		1.4852	2588	30.4	719.89	0.638	0.808	98.9
R-009	Zubair	AB+DJ+LN	1974	3249	4267	1.4919	2490	31	738.76	0.58	0.9611	99
R-030	Zubair	AB+DJ	1974	3194		1.5278	0	34	882.02			99
R-033	Zubair	AB+LN	1974	3194		1.458	2332.1		640.45			
R-036	Zubair	DJ+LN	1974	3091	4330	1.3637	2231.1	28.5	589.89	0.847		99
R-039	Zubair	DJ+LN	1975	3214	4300	1.4228	2315	32	643.76	0.586	0.7927	99
R-043	Zubair	AB+DJ+LN		3121	4370	1.3387	1868.5	27.6	470.22	0.866	0.785	99
R-045	Zubair	DJ	1974	3264	4150		2669.1	30.9	814.61	0.593	0.8135	
R-040	Zubair		1994	3188		1.4414	2246.8	32.7	658.99	0.502	0.7451	99
R-050	Zubair	DJ+LN	1976	3244		1.2909	2170	28.4	574.78	0.921	0.8249	99
R-051	Zubair	AB+DJ		3070	3948.9	1.5473	2175.7	34.1	847.87	0.572	0.8081	99
R-055	Zubair	LN	1976	3164.6		1.4144	2253.9	27.9	603.37	0.912	0.927	99
R-058	Zubair	DJ		3077		1.6344	2969.1	33.6	996.46	0.478	0.8053	
R-060	Zubair	LN	1976	3218.7		1.4206	2279.5	30.5	638.76	0.739	0.8025	99
R-061	Zubair	LN	1976			1.404	2325	30.9	621.74	0.72	0.7878	99
R-063	Zubair	AB	1975	3234		1.4799	2654.9	31.9	779.78	0.555	0.8489	99
R-065	Zubair	DJ	1976	3022		1.612	3074.4	34.2	986.97	0.433	0.8153	99
R-067	Zubair	LN	1975	3240		1.039	2104.6	28	559.49	0.957	0.8144	99
R-077	Zubair	LN	1975	3052		1.4149	2239.7		628.15	0.69	0.8168	
R-078	Zubair		1975	3253		1.6296	3169.6	32.8	976.4	0.638	0.8001	107
R-079	Zubair	LN	1976	3248		1.3844	2104.6	27.7	565.17	0.958	0.8059	99

R-040	Zubair	AB+DJ	1976	3226		1.6033	2954.9	32.9	934.61	0.464	0.8268	99
R-001	Zubair	AB+DJ	1991	3190		1.5264	2644.9	33.2	801.4	0.583	0.8467	99
R-002	Zubair		2000	3202		1.4587	2374.7	32.9	681.46	1.043	0.7683	99
R-013	Zubair		2000	3139.5		1.5148	2730.2	32.4	791.57	1.121	0.7211	99
R-013	Zubair	AB+DJ	2009	3140		1.5187	2744.5	32.7	806.74		0.7738	99
R-019	Zubair	DJ	1992	3234		1.4012	2545.4	31.8	704.1	0.84	0.7937	99
R-023	Zubair	AB+DJ	1978		3199.5		2808.5	32.3	780.9	0.595	0.8416	
R-035	Zubair	AB+DJ+LN	1992	3172		1.4196	2246.8	29	617.98	0.875	0.7828	99
R-037	Zubair	AB+DJ	1993	3170	4322	1.3665	2019.2	27.9	540.73	0.699	0.809	99
R-040	Zubair	AB+DJ	1994	3188		1.4434	2246.8	32.7	658.99	0.502	0.7451	99
R-042	Zubair		2000	3433	4670	1.3593	2118.8	28.2	522.02	1.08	0.7902	99
R-043	U.Sh.		1993	3109		1.3422	1933.9	27.5	478.93	0.866	0.7457	99
R-053	Zubair	LN	1978	3106	3200	1.3733	1993.6	28.8	528.2	0.832	0.8236	99
R-054	Zubair		2008		3863	1.0349	2189.9	33.5	644.78		0.7881	99
R-058	Zubair	AB+DJ	1994	3137		1.5443	2943.5	33.7	864.49		0.7799	99
R-065	Zubair	DJ	1994	3115		1.5173	2772.9	34	797.36		0.7785	99
R-066	Zubair	DJ	1978	3144	3299	1.444	2389	29.3	650.96		0.855	99
R-068	Zubair	DJ	1978		0	1.61	3071.5	35.3	966.29	0.533	0.8498	99
R-070	Zubair	AB	1993		2900.9	1.544	2900.9	34.4	878.48	0.452	0.7678	99
R-073	Zubair	DJ	1878	3214	0	1.5647	2922.2	33.6	897.75		0.8403	99
R-139	Zubair		1979	3110	3700	1.5837	3071.5	32.9	939.16	0.426	0.7872	99
R-114	Zubair		1979	3116	4095.4	1.2911	2110.2	25.3	411.8	1.132	0.7652	99
R-163	Zubair		1992	3141	4749.5	1.511	2701.8	33.7	836.8	0.3	0.7994	99
R-169	Zubair	AB+DJ+LN	1994	3289	0	1.5546	2787.1		870.1		0.7686	99
R-188	Zubair	AB+DJ	1993	3179	4365.5	1.5525	2957.8	33.5	938.03	0.867	0.8302	99
R-199	Zubair	AB+DJ+LN	1994	3185	0	1.4213	1948.1	31.8	586.12	0.425	0.7641	99
R-201	Zubair	DJ	1993	3133	0	1.5566	3043.1	33.6	948.37		0.7872	99
R-220	Zubair	AB+DJ	1993	3204	4577.4	1.4348	2374.7	31.2	675.67	0.798	0.8183	99
Ru-009	Zubair	U.SH.M	1984	3045.5		1.4273	2147.2	29.4	510.11	0.642	0.7743	99
Ru-015	Zubair	U.SH.M	1984		0	1.3993	1535.8	26.3	465.34	1.02	0.7615	99
Ru-023	Zubair	DJ	1977	3200	0	1.4452	2602.3	30.8	739.61	0.651	0.8152	99
Ru-32	Zubair		1978	3100	0	1.5937	2872.4	33.1	930.45	0.421		
Ru-063	Zubair	LN	1977		0	1.5045	2580.9	33.3	780.39	0.561	0.789	99
Ru-64	Zubair	AB+DJ	1984	3141	0	1.4985	2374.7	32.1	673.09	0.523	0.8154	99
Ru-065	Zubair	USM+mp		3140	0		2488.5	32.4	702.64			99
Ru-65	Zubair	U.SH.M	1977	3100	4921.5	1.4862	2545.4	31.7	738.71	0.62	0.8296	99
Ru-067	Zubair	U.SH.M	1978	3100	5033.9	1.4042	2417.4	32.3	0	0.65	0.7905	99
Ru-072	Zubair	L.ss.m			0	1.4992	2559.6	27.7	682.58	0.705	0.8144	104
Ru-074	Zubair	U.SH.M	1978	3155	4271.1	1.5356	2552.5	30.9	782.02	0.81	0.732	99
Ru-078	Zubair	U.SH.M+AB	1978	3150	3799.6	1.4636	2275.2	29.7	646.91	0.659		99
Ru-129	Zubair	U.SH.M	1982	3170	3734	1.4964	2573.8	32.8	779.33	0.601	0.8002	99
Ru-157	Zubair	AB+DJ+LN		3170		1.5327	2616.5	34	814.78	0.511	0.7941	99
Ru-196	Zubair	U.SH.M		3231		1.3329	2047.7	27.3	482.58	1.021	0.8584	99
Ru-227	Zubair	LN	1993			1.4729	2403.2	33.3	701.07	0.298	0.7639	100
Ru-029	Mishrif		1979	2318	3638	1.3229	2403.2	26.4	563.6	1.4	0.7453	76

RESULTS AND DISCUSSION

Fourteen wells were used to conduct the study in the Mishrif reservoir in North Rumaila oilfield, these thermodynamic studies were collected in the 1970s by South Oil Company, the owner of the field. It was noticed from all the Mishrif samples that saturation pressures vary between 1800 to 2350 psia covering the 14 used wells, In Fig. 2, saturation pressure graduate from the lowest values in the east flank (1800-1900 psi) to the highest values in the west flank (2300-2350 psi) however the crest of the reservoir has been moderate values of saturation pressure (2150-2000 psi). Physical fluid properties were confirmed as presented in Figs 3, 4, 5, and 6. Therefore, some areas around the flank are observing significant aquifer movement (>25m True

vertical depth (TVD) in R-474) western North Rumaila, and some areas indicate an immobile aquifer (R-451, R-363) eastern North Rumaila Maybe sort of local diagenesis in the aquifer (relatively high Saturation Pressure (P_s) observed at Oil-Water Contact (OWC) in R-363, not observed in R-451) despite both the region-allied in the same spot area. The observations and monitoring area on the eastern flank, shows some areas have aquifer movement whereas other areas show an immobile aquifer. In addition, aquifer monitoring in the east flank and absence of any significant water production, suggests the absence of an active aquifer (BP, 2013) that Maybe be causing the lower pressure on the eastern side gradient to increase in the western side.

Fig. 2. Saturation pressure gradient of the Mishrif-North Rumaila and wells location

Fig. 3. P sat. vs. GOR for the Mishrif Reservoir-North Rumaila

Fig. 4. GOR vs. Bo for the Mishrif reservoir -North Rumaila

Fig. 5. Psat. vs. Visco. For the Mishrif reservoir -North Rumaila

Fig. 6. Psat. vs. gas Sp.Gr. For the Mishrif reservoir -North Rumaila

With more wells covering a larger area of the field and no significant aquifer pressure support, only the extremities of the field retain high pressure, and pressure at the crest of North Rumaila is close to the bubble point (~2500psi). Recently (2Q 2013) gas has been observed in the mA of three crestal wells over North Rumaila. The extent of this potential gas cap is being investigated and various plans to reduce pressure loss and potentially re-pressurize should be considered. Fig. 7 showing Shut-in bottom hole pressure (SBHP) reaches saturation pressure (Psat.) On the bases of Psat. of North Rumaila Mishrif Reservoir. However, saturation pressure (Psat.) In the figure equal with the saturation pressure in the west side of Mishrif reservoir in North Rumaila.

Fig. 7. SBHP vs. Psat. For the Mishrif reservoir-North Rumaila

Due to the limited number of PVT tests for the Mishrif Reservoir in South Rumaila, it is not possible to fully describe the saturation pressure behavior. However, the average value of pressure (2150 psi) was used in this study. Value of average pressure from two PVT samples in AB unit within Main pay reservoir, North Rumaila is (2770 psi). Nine samples of thermodynamic study and physical properties obtain in DJ unit, all these measurements are located in the crest that indicates saturation pressure greater than (2800) psi (Fig. 8). The similarity of laboratory physical properties (Pb, gas Sp.Gr, and API) for AB & Dj units are shown in Table 1.

Fig. 8. DJ unit saturation pressure graduate and wells location

Fourteen samples of thermodynamic study and physical properties are available in the deepest LN unit, by mapping distribution of the saturation pressure, it observed that the pressure gradient starts from the northeast side of the north field that records a value of approximately 2000 psi to the southwest side to reach the highest value 2250 psi (Fig. 9).

Fig. 9. LN unit saturation pressure graduate and wells location

DJ unit in north Rumaila has values of P_{sat} and GOR higher than LN unit in the same reservoir (Fig. 10). However, according to the stratigraphy, LN unit is deeper than DJ unit, which indicate there is not sufficient change of properties with depth especially P_{sat} . AB unit has intermediate values of P_{sat} . However, the same result for GOR vs. Formation volume factor and other properties (Figs. 10, 11, 12 and 13).

Fig. 10. P_{sat} . Vs. GOR for the Main pay unit

Fig. 11. GOR. Vs. Bo for the Main pay unit

Fig. 12. Psat. Vs. Viscosity for the Main pay unit

Fig. 13. Psat. Vs. Gas (Sp.Gr) for the Main pay unit

Eleven fluid samples of (PVT) merge AB with DJ units, the pressure values appear to be similar in the opposite regions, whereas the pressure rises in the north-east and south-west regions, while falling sharply in the south-east and north-west regions (Fig. 14). Five samples well thermodynamic study and physical properties obtain AB, DJ and LN simultaneously that cannot conduct a plot to describe pressure behavior in the reservoir extension, however, through the five tests, it is possible to give a moderate value of saturation pressure 2270 psi. six samples of wells laboratory physical properties occupy DJ with LN units obtain a moderate value of pressure 2280 psi. 9 samples of thermodynamic study and physical properties are available in the upper shale reservoir, south Rumaila. all these samples collect in the ultimate southeast part of Rumaila, by dropping the pressure values on the map, the saturation pressure is set to approx. 2300psi (Fig. 15).

Fig. 14. Saturation pressure graduate for ABDJ unit and wells location

Fig. 15. Saturation pressure gradient, Upper shale reservoir, South Rumaila and wells location

In Figs. 16 and 17 plotting P_{sat} vs. GOR for two fields (south and north Rumaila) Mishrif, Main pay reservoir show that all data follow one straight line indicated that all fluid behaves as an admixture of one oil type. In the Mishrif reservoir, the saturation pressure in North Rumaila is higher than in the south that the extent of the Mishrif oil accumulation over Rumaila is regarded as a stratigraphic trap. In the Mishrif of the southernmost part of the Rumaila structure, the reservoir carbonates are regarded as tighter. Therefore, the distribution of oil is related to the maximum extent of shallow carbonate deposits with reservoir quality. The best reservoir quality carbonates are restricted to the northern Rumaila, reflecting the extent of the shallow water platform at the time (Al-Mimar and Awadh, 2019). PVT analysis on fluid samples shows the presence of undersaturated oil phase, without a gas cap, before field production started. Oil samples from individual wells reveal saturation pressures that range from 1800 to 2570 psia. This is in comparison with an initial reservoir pressure of ~3900 psia. The high temperature in the reservoir will increase the pressure and contribute to the fluid movement (Ahmed, 2018)

the temperature of the reservoirs included in the research is constant for all studied wells, although oil gravity is constant, which represented as API. Table 1 shows the main and sub reservoir of Rumaila oil field with reservoir temperature.

Fig. 16. Psat vs. GOR for south and north Rumaila Mishrif reservoir

Fig. 17. Psat vs. GOR for south and north Rumaila Main pay reservoir

Table 2. Temperature and API oil gravity (BOC report unpublished)

Reservoir	Field	Temperature (°C)	API
Zubair Fm. Main pay unit	North Rumaila	98.9	28-33
	South Rumaila	99	33
Mishrif	North Rumaila	76	25.5
	South Rumaila	81	26
Zubair Fm. Upper shale member	South Rumaila	99	30

CONCLUSIONS

1. With many wells covering a large area of the field that depleted original reservoir pressure and no significant aquifer pressure support, such as the North Rumaila Mishrif reservoir, the reservoir pressure is close to the bubble point pressure (~2350), particularly in the west flank.
2. The saturation pressure of the North Rumaila Mishrif graduates from the lowest values in the east flank to the highest values in the west flank.
3. In the Mishrif reservoir, the saturation pressure in west flank North Rumaila is higher than in the south, the extent of the Mishrif oil accumulation over Rumaila is regarded as a stratigraphic trap.
4. North Rumaila main pay units are AB, DJ, LN, DJ has higher P_{sat} than the LN unit.

RECOMMENDATIONS

For the purpose of covering the whole field and depleted pressure areas with physical properties, new tests are suggested to take in some wells distributed according to reservoir type as shown in (Table 3), Resumption the research by studying the geologic nature and reason for moderate bubble point pressure within the same layer.

Table 3. Suggested wells for the future thermodynamic study and physical properties

Field	Reservoir	Well no.	Easting	Northing
North Rumaila	Mishrif	442	722365.36	3375545.51
		430	718721.55	3386408.46
		353	725917.95	3388211.4
		228	729522.15	3395413.4
		391	718719.62	3396312.66
		412	723185.7	3392711.04
		627	718683.8	3398363.3
		217	728620.63	3399014.35
	Main pay	517	722023	3377822
		635	721389.8	3383166.8
		172	723070	3394761.92
		86	721485.82	3406012.66
		564	725470.6	3396945.9
		49	721061.79	3398158.72
		582	723091.1	3391843.6
		547	723027.23	3385089.19
		635	721389.8	3383166.8
South	Mishrif	417	728156.8	3346497.48
		128	731046.74	3350700.23
		322	723216	3358513
		431	728021.93	3367569.83
	Main pay	148	724975.39	3365222.67
		442	730485.1	3349820.2
		416	730872	3342992
		33	730499.25	3338356.9
		258	734991.84	3337481.85

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