smaller gravel size (20/40 gravel) is recommended to minimize and/stop formation sand movements.

For screen selection that can hold the 20/40 gravel in place are based on the smallest of selected gravel size. The smallest gravel size is 40 mesh which about 0.017 inch. The spacing between the wires should be 0.5 to 0.9 (50% to 90%) times the diameter of the smallest pack sand grains. In this paper, the spacing between the wires is about 75% (0.75) of the smallest gravel sand. So the slot gauge of screen that recommended to hold 20/40 gravel in place is about 0.01275 inch or 12 gauge (a gauge = 0.001 Inch)

5. Conclusions

- The "minimum" distribution size is recommended to select proper gravel pack for controlling sand production.
- Most of population of formation sand samples relatively uniform, thats can be defined by their uniformity coefficient that are less than 5 ($Uc < 5$)
- By refer to Saucier's experimental results, if a gravel/sand ratio more than 6 invasion into the gravel caused the permeability ratio to decrease significantly. the 16/30 and the next smaller of comercial gravel size indicated will not be invaded by formation sand ($Kg/Kr \leq 6$) for all group of formation sand samples.
- if gravel 40/60 or next smaller gravel being used to control production sand, it will generate high pressure drop in the perforation tunnel, more than presure drop that occurred in reservoir (80.3161 psi). Using too small gravel will increase pressure drop significantly, however, will restrict well productivity.
- The production formation fluids rate before install gravel is about 391.3146 BOPD (Reservoir permeability=1.6 Darcy)
- Gravel pack placement creates a permeable down hole, the permeability increase to 2 darcy and increase well productivity about 1.3 compared to fluid rate without gravel installed.
- Using too large gravel (12/20 or larger comercial gravel) will increase permeability significantly, however, will permit invasion of the formation sand into the gravel and then result in lower permeability, restricted productivity, and increase draw dawn pressure /Pressure drops.
- Using too small gravel size (40/60 or next smaller comercial gravel) will increase pressure drop and significantly drop average permeability and well productivity.
- There is no significant differences between 16/30 and 20/40 gravel size in either production rate or average permeability.20/40 gravel size is recommended to control sand production as the next smaller comercial gravel size of 16/.30.
- The Screen gauge that can hold gravel in place is 12 gauge.

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ATTACHMENTS

Attachment 1 : Charateristics of Tyler Mesh and U.S Mesh

Tyler Mesh	U.S. Mesh	D - mm	D - in.	ϕ	Fall Rate in Water - ft/min
2.5	2.5	8.0	0.315	-3	-
3	3	6.73	0,265	-2.75	-
3.5	3.5	5.66	0.223	-2.5	-
4	4	4.76	0.187	-2.25	-
5	5	4.0	0.157	-2.0	-
6	6	3.36	0.132	-1.75	-
7	7	2.83	0.111	-1.5	-
8	8	2.38	0.094	-1.25	-
9	10	2.0	0.079	-1.0	35.8-49.2
10	12	1.68	0.066	-0.75	32.7-44.5
12	14	1.41	0.056	-0.5	29.5-39.8
14	16	1.19	0.047	-0.25	26.4-35.0
16	18	1.0	0.039	0.00	23.2-30.7
20	20	0.841	0.033	0.25	20.5-26.4
24	25	0.707	0.028	0.50	17.7-22.0
28	30	0.595	0.023	0.75	15.2-18.7
32	35	0.500	0.02	1.0	12.6-15.5
35	40	0.420	0.017	1.25	10.4-12.8
42	45	0.354	0.014	1.5	8.7-10.4
48	50	0.297	0.012	1.75	7.1- 8.7
60	60	0.25	0.0098	2.0	5.7- 6.9
65	70	0.21	0.0083	2.25	4.4- 5.5
80	80	0.177	0.007	2.5	3.5- 4.3
100	100	0.149	0.0059	2.75	2.8- 3.3
115	120	0.125	0.0049	3.0	2.2- 2.4
150	140	0.105	0.0041	3.25	-
170	170	0.088	0.0035	3.5	-
200	200	0.074	0.0029	3.75	-
250	230	0.063	0.0025	4.00	-
270	270	0.053	0.0021	4.25	-
325	325	0.044	0.0017	4.5	-
400	400	0.037	0.0015	4.75	-

Ref: Carver, Robert E.: "Procedures in Sedimentary Petrology," Wiley-Interscience 1971

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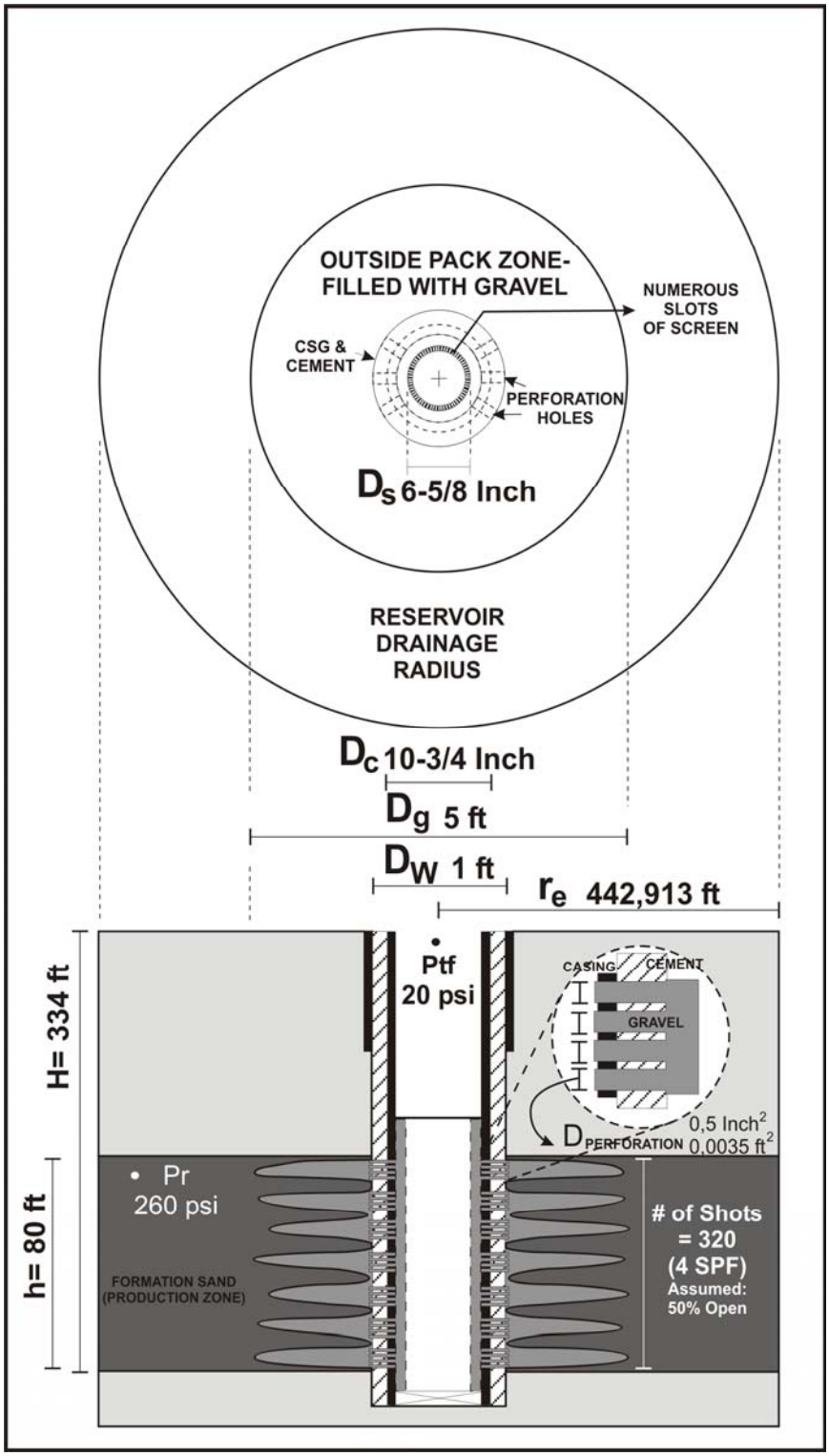
Attachment 2 : Wellbore Diagram and Constans Parameter Ilustration



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Attachment 3 : Abstract (BAHASA)

APLIKASI ANALISA PENGAYAKAN DI INDUSTRI PERMINYAKAN, MENENTUKAN UKURAN GRAVEL DAN SCREEN UNTUK MENGONTROL PRODUKSI PASIR

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Abstrak

Terproduksinya pasir formasi bersama dengan minyak dan/atau gas akan menimbulkan masalah yang berpotensial bahaya dan mahal (kehilangan produksi, kerusakan akibat erosi oleh pasir, pembuangan & penanganan pasir di permukaan, dan lain lain). Di industri perminyakan yang memproduksi minyak/gas, analisa pengayakan (Sieve Analysis) digunakan untuk menggambarkan populasi pasir formasi. Sieve analysis menjadi suatu metoda yang dapat diterima untuk mendeskripsikan pasir formasi dan pasir gravel yang kemudian digunakan sebagai media untuk mengontrol produksi pasir formasi. Gravel pack merupakan metoda yang paling sering digunakan dan paling sukses dalam mengontrol produksi pasir, sedangkan penyaring/Screen akan menjaga pasir gravel tetap di tempatnya. Adapun tujuan dari studi percobaan ini adalah, menggambarkan populasi pasir formasi, menentukan koefisien keseragaman masing masing sample pasir formasi, menentukan ukuran gravel yang dapat meminimalkan dan/atau menghentikan pergerakan pasir formasi dan ukuran screen yang dapat menahan gravel tetap di tempatnya.

Studi percobaan ini dimulai dengan aktifitas Coring. Sampel core/ pasir formasi diambil pada kedalaman yang berbeda dari 2 sumur baru, Sumur A dan Sumur B yang terletak di Utara lapangan minyak Duri. Sampel pasir formasi dari Sumur A diambil di kedalaman 521', 547', 601' dan 608' (ft). Sedangkan sampel pasir formasi dari Sumur B diambil di kedalaman 623', 637', 650', 664', 690' dan 710' (ft). Sebelum dilakukan analisa ayak, setiap sampel pasir formasi harus dibersihkan dari zat pengotor menggunakan Ekstraksi Soxhlet dan Toluen digunakan sebagai pelarutnya. Kemudian sampel pasir dikeringkan, ikatan antara partikel pasir di pisahkan menggunakan Mortar, tujuannya bukan untuk memecahkan tapi hanya memisahkan ikatan antar partikelnya. Selanjutnya, sampel pasir formasi yang sudah diketahui beratnya, dilewatkan pada set ayakan yang ukuran bukaannya (mesh) diketahui.

Berdasarkan pada interpretasi dan data perhitungan, diperoleh beberapa kesimpulan antara lain: semua populasi sampel pasir formasi relative seragam, ditandai dengan koefisien keseragaman di bawah 3, ukuran gravel pack yang sesuai untuk menghentikan dan/atau mengurangi produksi adalah +20-40 (membandingkan total kehilangan tekanan masing masing ukuran gravel – persamaan Darcy), sedangkan bukaan/lubang penyaring yang digunakan untuk menahan gravel adalah 12 gauge (0,012 Inch)

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Kata Kunci: Sieve Analysis, Sand Control, Coring, (Soxhlet) Extraction, Uniformity Coefficient, Screen gauge, Particle size distribution.

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Attachment 4 : Well A Experimental Data

Sieve Analysis		Sample #A1 (521 ft)			Sample #A2 (547,7 ft)			Sample #A3 (601,9 ft)			Sample #A4 (608,8 ft)		
[U.S. Sieve]	[inches]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]
16	0.0460	4.79	4.80	4.80	6.81	6.80	6.80	0.61	0.61	0.61	3.53	3.56	3.56
20	0.0328	3.68	3.69	8.48	1.78	1.78	8.58	2.71	2.72	3.33	3.40	3.43	6.99
25	0.0276	2.85	2.86	11.34	1.18	1.18	9.77	1.53	1.54	4.86	3.57	3.60	10.59
30	0.0232	2.54	2.54	13.88	2.21	2.21	11.98	0.22	0.22	5.08	2.50	2.52	13.11
35	0.0195	4.84	4.84	18.72	4.98	4.98	16.96	0.76	0.77	5.85	3.50	3.53	16.63
40	0.0164	4.85	4.86	23.58	6.53	6.53	23.49	0.86	0.87	6.71	4.37	4.41	21.04
45	0.0138	8.45	8.46	32.04	8.41	8.41	31.89	1.86	1.87	8.58	8.52	8.59	29.63
50	0.0116	10.77	10.79	42.82	10.11	10.10	41.99	3.33	3.34	11.92	11.55	11.66	41.29
60	0.0098	15.47	15.50	58.32	20.05	20.04	62.03	7.51	7.54	19.45	14.71	14.84	56.13
70	0.0083	12.21	12.23	70.55	16.65	16.64	78.68	13.13	13.17	32.63	10.19	10.28	66.41
100	0.0058	13.03	13.05	83.60	12.26	12.26	90.93	42.77	42.92	75.55	15.34	15.47	81.88
140	0.0041	6.36	6.37	89.97	4.09	4.09	95.02	15.92	15.97	91.52	8.99	9.06	90.94
200	0.0029	4.10	4.10	94.07	2.23	2.23	97.25	3.09	3.10	94.62	3.49	3.52	94.47
270	0.0021	2.28	2.28	96.36	1.24	1.24	98.49	1.54	1.54	96.17	2.04	2.06	96.52
325	0.0017	0.82	0.82	97.18	0.71	0.71	99.20	0.94	0.94	97.11	0.79	0.80	97.32
PAN	0.0015	2.82	2.82	100.00	0.80	0.80	100.00	2.88	2.89	100.00	2.66	2.68	100.00
Total		**99.86**			**100.07**			**99.65**			**99.13**		

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Attachment 5 : Well B Experimental Data

Sieve Analysis		Sample #B1 (623,5 ft)			Sample #B2 (637,6 ft)			Sample #B3 (650 ft)			Sample #B4 (664,3 ft)			Sample #B5 (697 ft)			Sample #B6 (710 ft)		
[U.S. Sieve]	[inches]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]	Weight [gr]	Weight [%]	Cum Weight (d) [%]
16	0.0460	0.19	0.19	0.19	2.04	2.06	2.06	3.93	3.95	3.95	8.50	8.54	8.54	1.59	1.72	1.72	3.50	3.69	3.69
20	0.0328	0.39	0.39	0.58	2.97	2.99	5.05	6.13	6.17	10.12	3.25	3.27	11.81	10.42	11.31	13.03	1.71	1.81	5.50
25	0.0276	0.34	0.34	0.92	3.21	3.23	8.28	4.08	4.11	14.22	1.95	1.96	13.77	4.74	5.14	18.17	1.43	1.51	7.01
30	0.0232	0.35	0.35	1.27	3.03	3.05	11.33	2.16	2.18	16.40	1.36	1.37	15.14	3.60	3.91	22.08	1.19	1.25	8.26
35	0.0195	1.09	1.10	2.37	5.54	5.57	16.90	3.42	3.44	19.84	2.81	2.82	17.96	4.08	4.42	26.51	3.02	3.19	11.45
40	0.0164	2.10	2.12	4.48	5.43	5.46	22.36	3.37	3.39	23.24	2.49	2.51	20.47	3.68	3.99	30.50	4.13	4.35	15.80
45	0.0138	6.91	6.95	11.44	7.87	7.92	30.28	5.11	5.15	28.38	4.73	4.76	25.23	5.02	5.45	35.95	8.68	9.15	24.95
50	0.0116	11.78	11.86	23.29	7.00	7.05	37.33	5.27	5.30	33.68	5.16	5.19	30.42	5.92	6.42	42.36	11.74	12.37	37.32
60	0.0098	18.95	19.08	42.37	7.59	7.64	44.97	8.57	8.62	42.30	6.13	6.17	36.59	9.23	10.01	52.38	16.32	17.20	54.52
70	0.0083	17.39	17.51	59.89	6.28	6.32	51.29	9.45	9.51	51.81	4.98	5.01	41.60	9.01	9.78	62.16	13.50	14.23	68.75
100	0.0058	22.34	22.50	82.39	14.08	14.17	65.46	12.46	12.54	64.36	11.44	11.50	53.10	11.28	12.24	74.40	16.79	17.70	86.45
140	0.0041	9.48	9.54	91.93	17.29	17.40	82.86	6.81	6.85	71.21	16.09	16.18	69.27	5.96	6.47	80.87	6.68	7.05	93.50
200	0.0029	2.90	2.92	94.85	7.55	7.60	90.47	8.88	8.93	80.14	8.88	8.93	78.21	4.75	5.15	86.02	3.13	3.29	96.79
270	0.0021	1.44	1.45	96.30	3.18	3.21	93.67	9.15	9.21	89.35	4.88	4.91	83.12	3.29	3.57	89.59	1.00	1.06	97.85
325	0.0017	0.41	0.41	96.72	1.29	1.30	94.97	2.84	2.86	92.21	2.72	2.74	85.85	1.56	1.69	91.28	0.31	0.33	98.18
PAN	0.0015	3.26	3.28	100.00	4.99	5.03	100.00	7.74	7.79	100.00	14.07	14.15	100.00	8.03	8.72	100	1.73	1.82	100
Total		**99.30**			**99.35**			**99.38**			**99.45**			**92.16**			**94.86**		