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Module 4

GRAIN SIZE DETERMINATION EXERCISE

CONTENT

- *Problem to be solved*
- *Graphical description*
- *Data and information*
- *Solution*
- *Interpretation of the results*

PROBLEM TO BE SOLVED

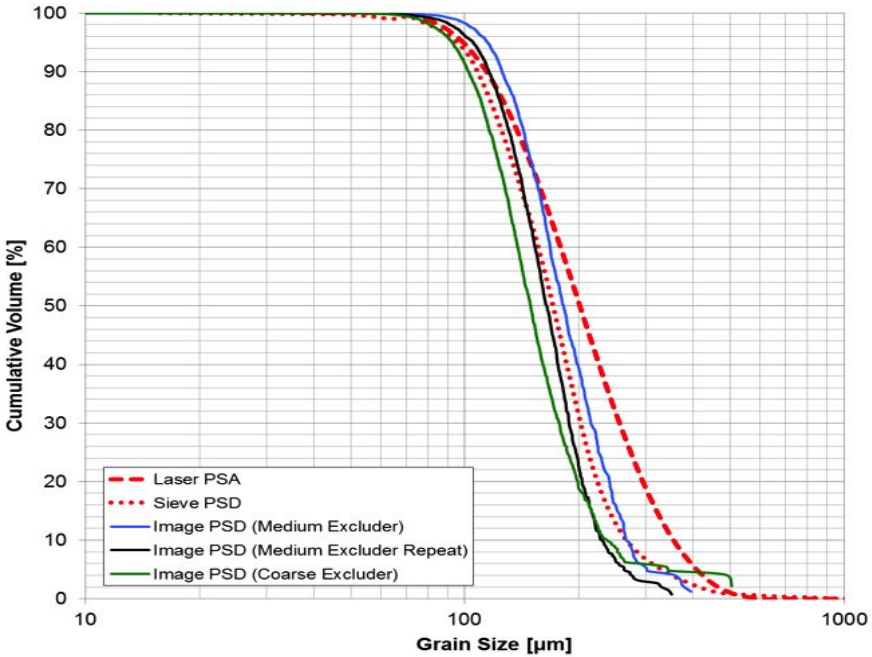
A sand management program is to be implemented due to the failure of a sand control completion in a well. Core samples were taken during drilling and grain size measurements were taken. Your are asked to:

1. Graph the data with the ***cumulative*** percent of the sample on the Y-axis and grain size in microns on the X-axis (Logarithmic scale)
2. Determine the mean grain size (D_{50}) representing the diameter of the 50% percentile of the sample
3. Determine the fines content (In percent)
4. Determine the quality of the sand sample using the formulas provided

GRAPHICAL DESCRIPTION

There are a number of ways to present the measured data for grain size. You are requested to use a semi-log graph (See sample). Keep in mind the following:

- X-axis is for grain size in microns
- X-axis is in a logarithmic scale
- Cumulative means the addition of each measurement (See table in next page) of the sample
- Y-axis is for the cumulative weight



DATA AND INFORMATION

Sieving was used to take the measurements

- Note that units are in inches and percentage
- Conversion factors from inches to microns are:

1.0 Inch = 25.4 mm
1.0 mm = 1000 microns

US Sieve No	Grain dia. in.		Weight Retained gms	Cumulative Wt %
8	.094		-	
12	.066		-	
16	.047		-	
20	.033		-	
30	.023		-	
40	.017		0	0
50	.012		0.1	0.1
70	.0083		1.9	2.0
100	.0059		1.0	3.0
140	.0041		3.0	6.0
200	.0029		14.0	20.0
270	.0021		50.0	70.0
325	.0017		28.0	98.0
400	.0015		1.0	99.0
PAN (residue)			1.0	100.0
Total			100.00%	100.00%

DATA AND INFORMATION (Continued)

Formulae for determination of sand quality

Sorting coefficient	D_{40} / D_{90}
Uniformity coefficient Uc	D_{10} / D_{95}
Fines fraction	< 40 microns

Guidelines:

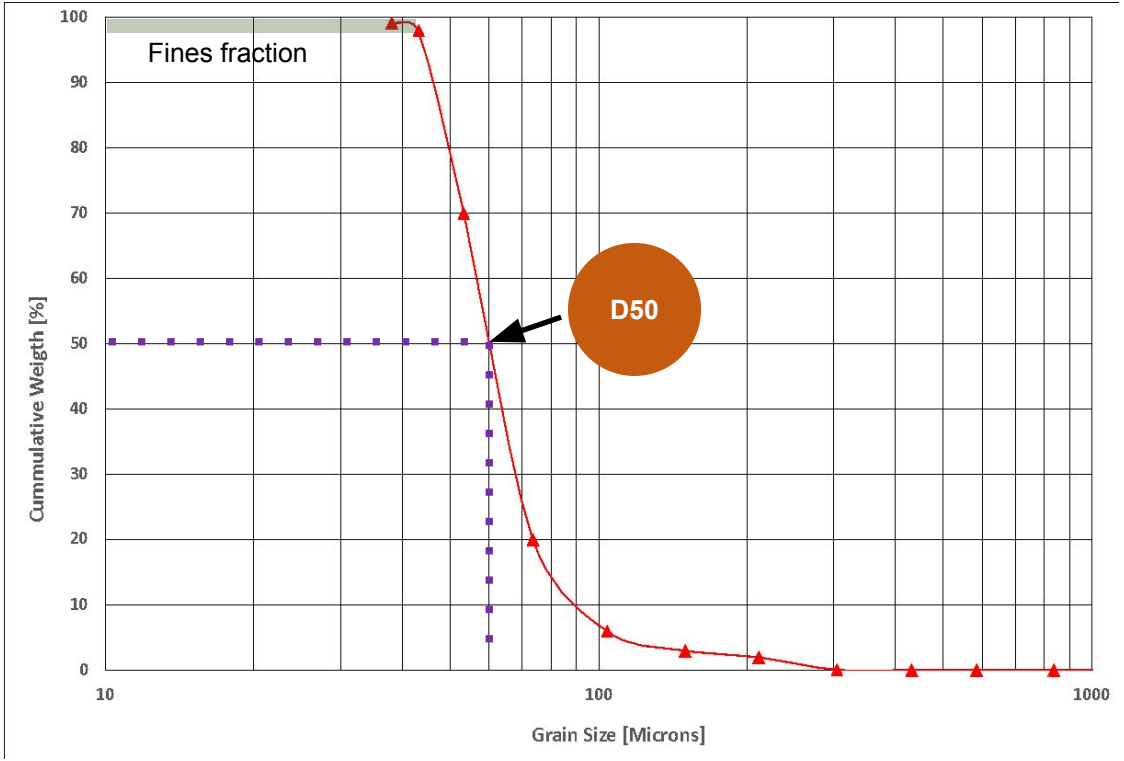
- Convert data in the table from inches to microns
- Plot the data in columns 2 and 4
- Quantify the fines fraction in the sample
- Determine the magnitude of the mean grain size D_{50}
- Determine the magnitude of the D_{10} , D_{40} , D_{50} , D_{90} , D_{95}
- Determine sand quality of the sample

GRAIN SIZE & SAND QUALITY

SOLUTION

SOLUTION

1. Fines fraction ~ 2%
2. D_{50} ~ 60 microns
3. Sorting = D_{40}/D_{90} ~ 1.44
4. Uc = D_{10}/D_{95} ~ 2.0



INTERPRETATION OF THE RESULTS

The following conclusions can be made from the results in the graph as follows:

- It appears to be a clean sand with a very low fines fraction
- Grain sizes are small probably indicating a well consolidated sand
- Sand quality is good which indicates small variations in grain sizes along the reservoir section. This can also be inferred from the slope of the curve

In sand management terms these conclusions indicate the following:

- Possible burst regime of sand production due to the strength of the rock, this has to be verified with the mechanical tests
- Smaller grains are easier to transport to surface and along the flowlines
- Smaller grains also indicate larger residence times in the separator and possible carry over problems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