

Crude Oil Slop Tank Recovery

Challenge: Clean the Black Powder™ contamination from a 12,000 BBL crude oil slop tank with an estimated contamination level of 1 pound of Black Powder per barrel of oil. The Black Powder contamination analysis identified primarily iron oxides and iron sulfides ranging with an average particles size of 1.82 microns and range from 0.06 to 50.60 (see analysis). **The goal is to salvage as much of the oil as possible by filtering it to a cleanliness level suitable for refining.**

Solution: Implement BPS Magnetic Separators to remove Black Powder from the crude oil stream, using the Magnetic Separators as a kidney loop.



Figure 1: Magnetic Separator After 2 Hours of Run Time

Lab Results

The contamination removed from the Magnetic Separator during the first cleaning was sent out for lab analysis.

Photographs of the particles found in the solids sample were taken using a Scanning Electron Microscope and can be seen in Figure 2.

PSD analysis determined that 87% of the particles were below 4 microns in size, with 70% falling below 1 micron. It was determined that the average particle size was 1.82 microns with the largest particle being 50.6 microns.

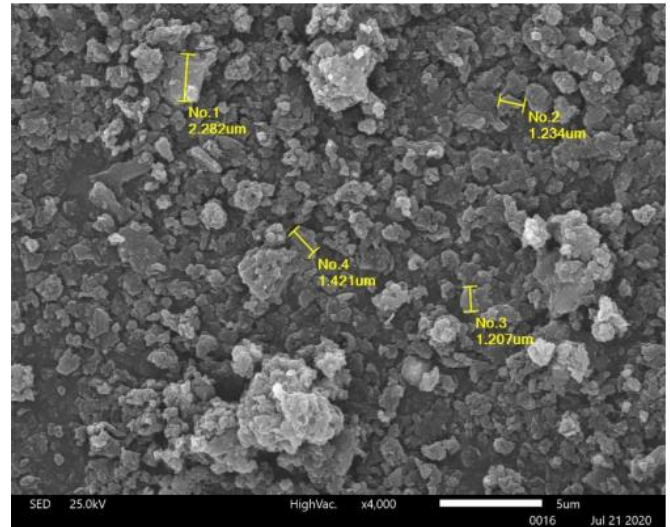


Figure 2: Scanning Electron Microscope Pictures at x4000 Magnification

XRD/EDS ANALYSIS RESULTS

XRD analysis was performed on the solids contamination that was removed from the BPS Magnetic Separator. XRD determined the compounds found in the sample and are summarized in Table 1.

Table 1: XRD Analysis Performed on Contamination from BPS Separator

Mineral Name	Compound Name	Chemical Formula	Weight
Greigite	Iron Sulfide	Fe ₃ S ₄	29.8
Calcite	Calcium Carbonate	Ca(CO ₃)	12.4
Magnetite	Iron Oxide	Fe ₃ O ₄	10.8
Kaolinite	Aluminum Silicate Hydroxide	Al ₂ Si ₂ O ₅ (OH) ₄	15.1
Pyrite	Iron Sulfide	FeS ₂	10.1
Quartz	Silicon Oxide	SiO ₂	5.0
Other	--	--	16.8
Total			100

SEM ANALYSIS RESULTS

Table 2: Statistical Values Determined from PSD Analysis

	SIZE (µm)	
	Before	After
Maximum	50.60	27.03
Minimum	0.06	0.09
Mean	1.82	1.08
Median	0.58	0.46
Range	50.54	26.94
Quartile1	0.26	0.26
Quartile3	1.58	1.17

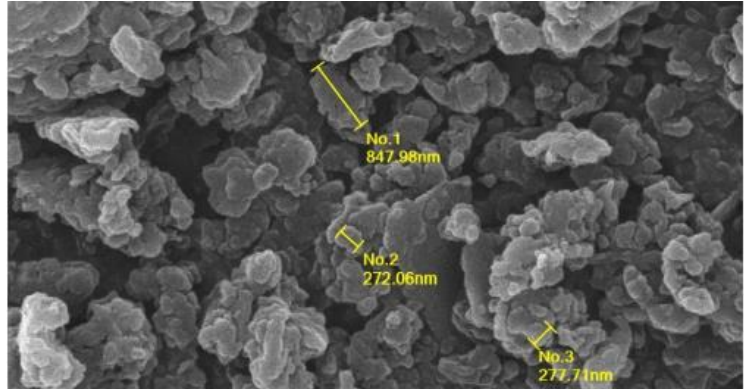


Figure 3: Scanning Electron Microscope Pictures at x15,000 Magnification

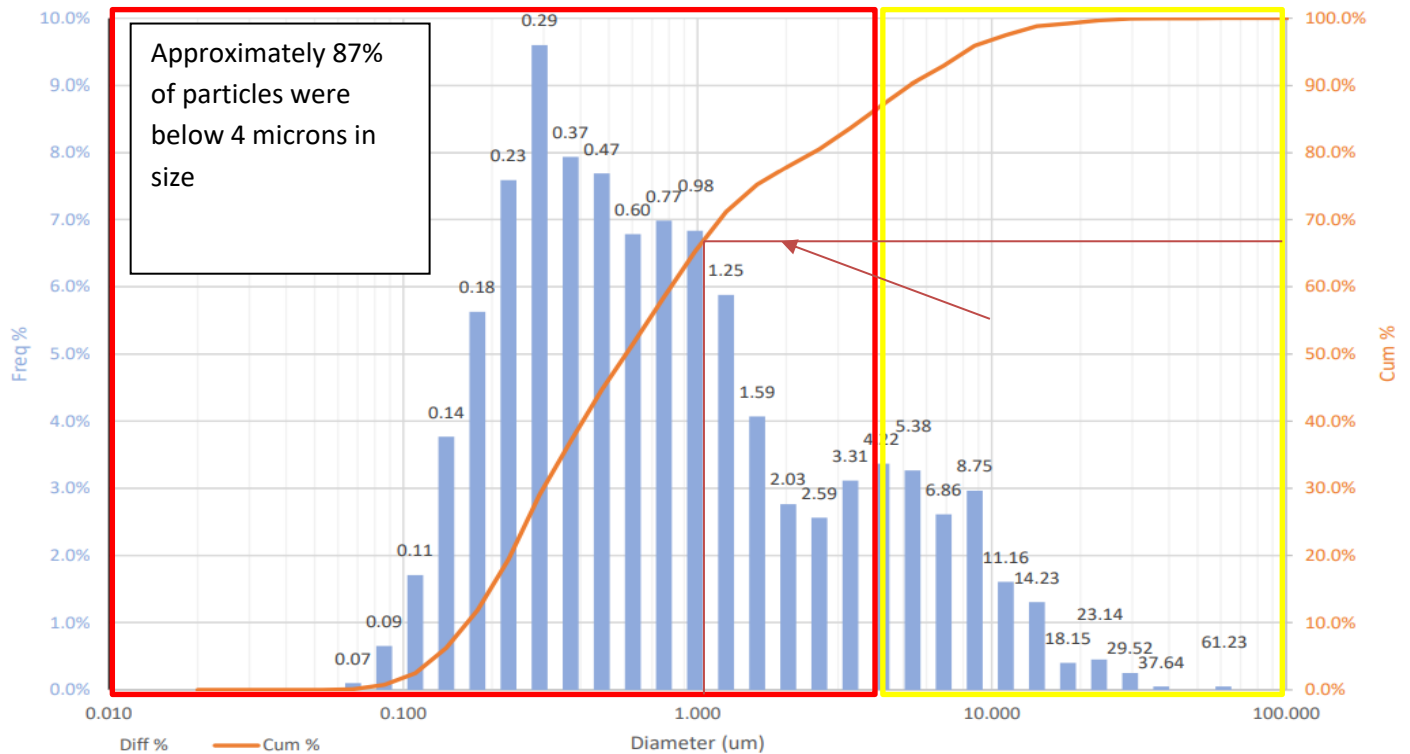


Figure 4: Particle Size Distribution for Before Filtration Sample

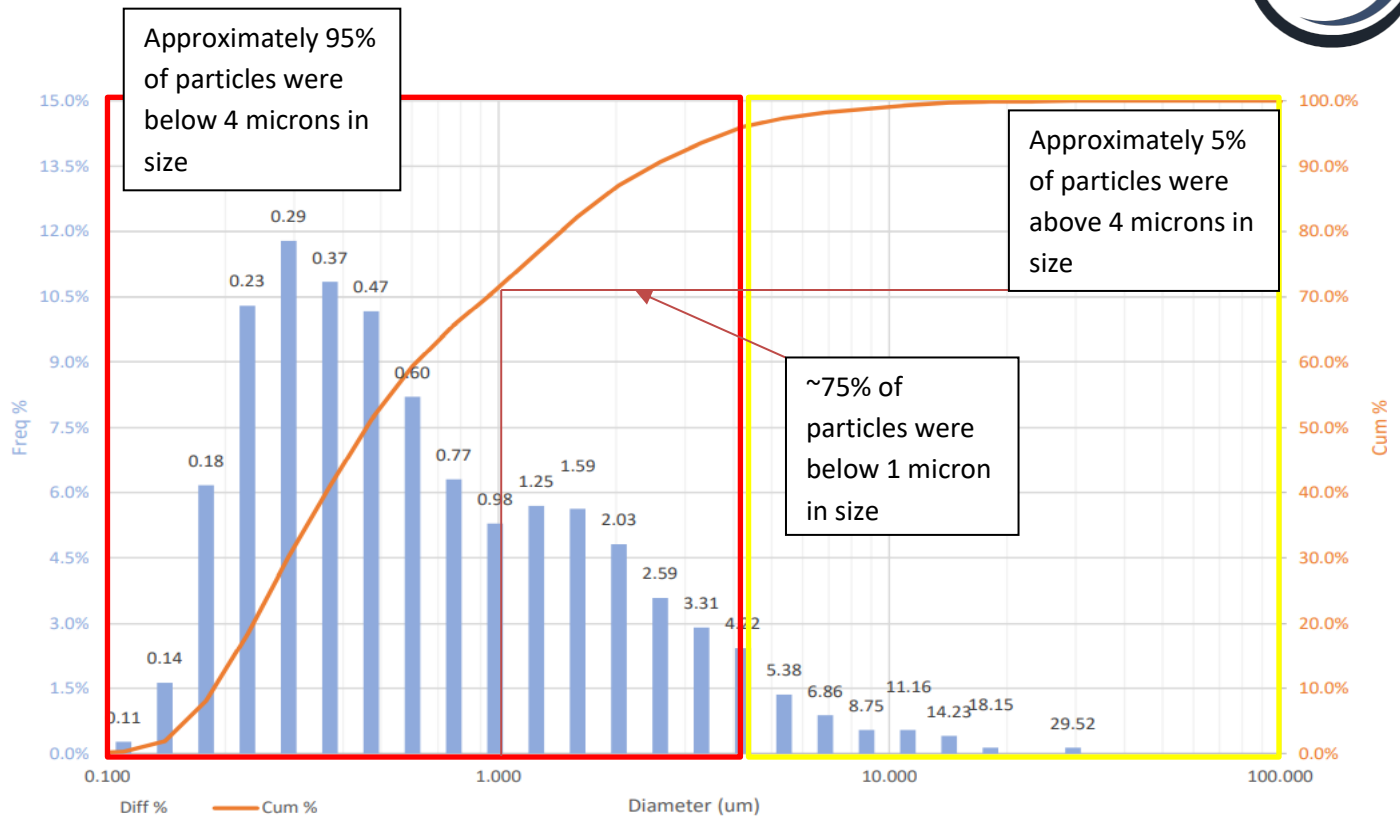


Figure 5: Particle Size Distribution for After Filtration Sample

SUMMARY

A test was conducted by BPS and an American oil and gas company to determine the filtration capacity of BPS Magnetic Separator on crude oil in their slop tank. The reservoir has a capacity of 12,000 BBL of crude oil. The goal of the project was to filter the crude oil to an acceptable cleanliness level for refining and resale. The project was deemed successful as the crude oil was filtered from 5000 PPM down to 1200 PPM and further augmented through blending of cleaner crude oil product with the filtered crude oil. The customer was able to capitalize on otherwise wasted crude oil product, enhancing revenue, and reducing their environment footprint.

XRD and PSD analyses were performed on the Solids Samples. PSD determined the average particle size found on BPS Magnetic Separator was 1.82 microns with the largest particle being 50.6 microns. XRD Analysis showed that over 50% of the compounds captured were iron and iron compounds. XRD also showed that more than 20% of the contamination by weight was greigite, and iron sulfide compound.

These results demonstrate the effectiveness of BPS Magnetic Separation Technology in filtering contamination down to the sub-micron level.