



Biomass Carbon Powders for HDD / Offshore Drilling Fluids & Fluid Loss Prevention Additive

Non-activated biomass Carbon Products vary widely in quality and commercial availability for industrial & commercial applications. As more industries look to organic carbon products as potential alternatives to traditional carbon powders, biomass carbon powders possess distinct advantages; both chemical and mechanical properties. enviraPAC-Monticello, located in Monticello, AR USA produces *Carbon Powders* and *Carbon Granules* from sustainable biomass feedstock (wood) not exposed to any chemicals and produced through a patented process utilizing a proprietary, CO₂ neutral, auto-thermic technology production. The biomass carbon powder is milled to target PSD specs and is available in a range of purities commercially produced using clean energy.

enviraPAC carbon products are not graphitic nor akin to carbon blacks, yet possesses a bulky, anisotropic morphology with high resiliency and strength ideal for high stress applications or low spring back applications such high load industrial and drilling fluid / fluid loss prevention applications. The CO₂ neutral, auto-thermic technology converts the biomass into pure carbon with ash values ranging from 4.5% to ≤1.75% and very low Sulphur content of < 0.05%.

Any impurities are surface bound not imbedded within the carbon particle as is common with macro or microcrystalline carbons or carbon blacks. Moisture is controlled through an inert gas, closed loop system. EnviraPAC carbon powders are anisotropic morphologically with a dense particle structure displaying a propensity for a consistent / uniform high surface area (> 426 m²/g BET). The higher than average BET compared to other carbon powders is due to the high level of micro-porosity within the carbon particle. The SEM's below (*Exhibit A*) of enviraPAC's BIO RE-Lube[®] Powder shows the particle distribution and morphology in high resolution detail.

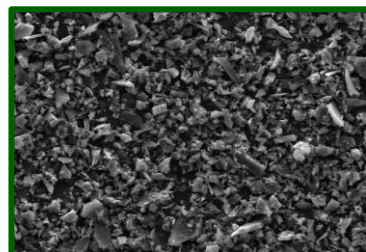
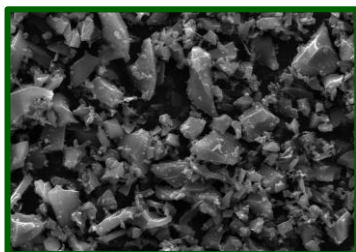


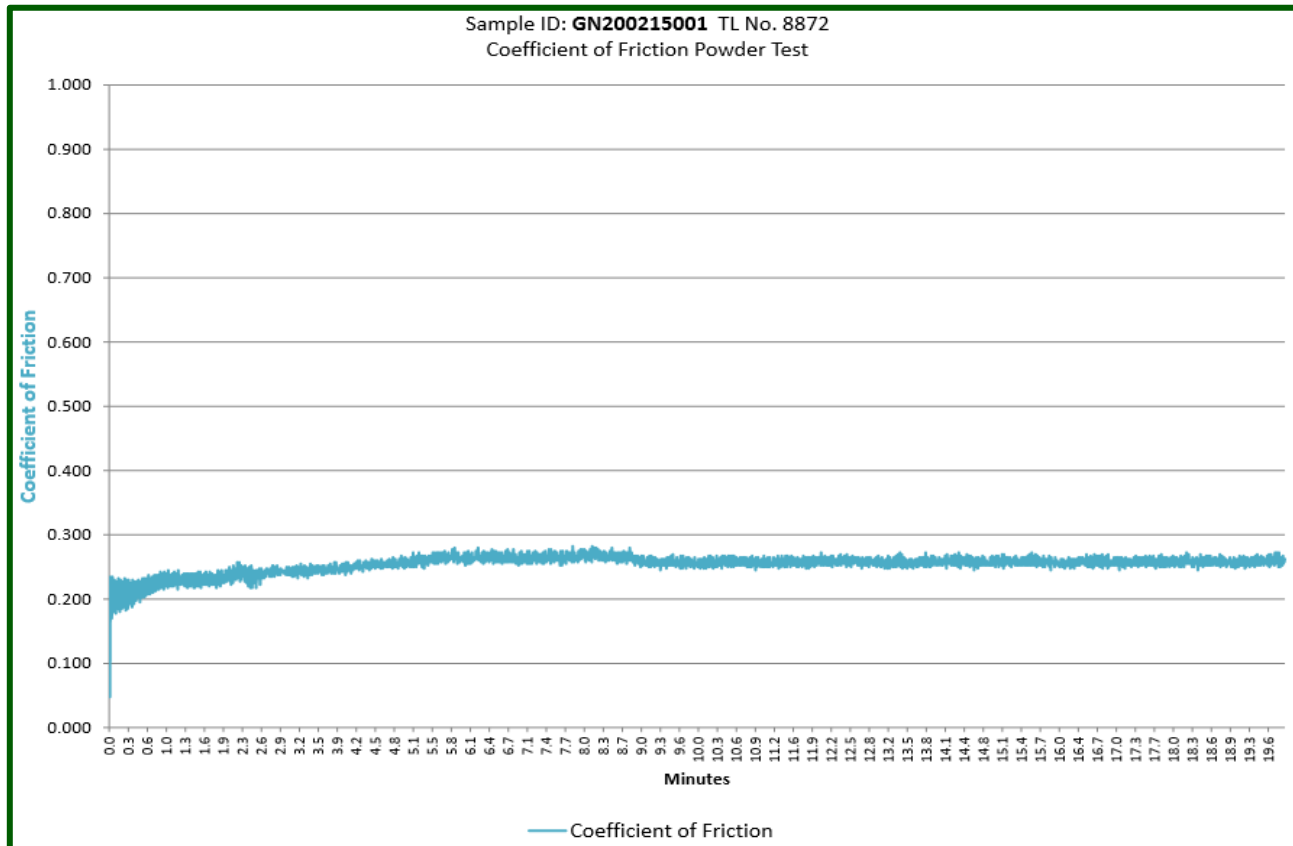
Exhibit-A: EnviraPAC Carbon Powder SEM's

As shown in Exhibit A above, there is no defined layering or crystallinity as seen with natural or synthetic graphite or other carbon powders with a defined / aggregate / agglomerate particle structure. Stronger particles with jagged shapes would possess greater resistance to applied forces and generated higher kinetic friction forces generated in high torque, centrifugal drilling operations.

These key factors lend to a very unique carbon powder ideal for drilling fluid lubricant additives or as a fluid loss prevention additive to improving wellbore stability drilling fluid retention. Other key aspects of enviraPAC biomass carbon powders as a drilling fluid additives are pH neutrality and the ability to absorb 0.79 H₂O/g of carbon powder. Biomass carbon powders provide for a more consistent drilling mud for both inland and offshore operations and especially for HDD operations.

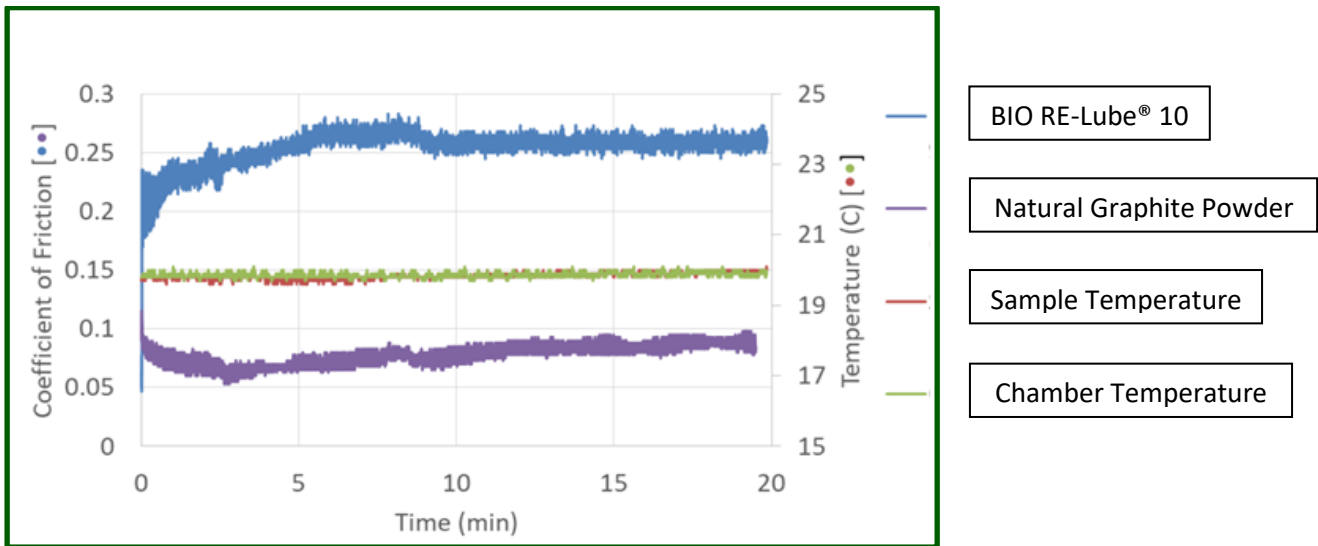
The Coefficient of Friction Test below in *Exhibit C* shows enviraPAC carbon powder performance as consistent and constant performance rate under high loads. The ability and potential use of a biomass carbon powders in drilling fluids can improve durability, increasing drilling efficiencies and overall demonstrates resilience of biomass carbon powders under high loads.

Table C: Coefficient of Friction / Function of Test Time Test time: 20 min under 4 lbs. of load at 30 rpm.



Below is another comparison chart of enviraPAC *BIO RE-Lube® 10 Carbon Powder* to natural flake graphite (macrocrystalline) with the sample load conditions to arrive at the COF values is depicted below in Exhibit D.

Exhibit: D – RE-Lube Carbon Powder / Natural Graphite COF Comparison



Additional attributes of a biomass carbon powder drilling fluids is higher IAN number (ASTM D1510) (>270 g/kg) for enviraPAC carbon powders leads to a higher performance drilling mud and uniform coating of the wellbore. Biomass carbon powders can potentially absorb up to 80% of its weight in drilling fluids depending on the type of liquid, hence a more robust drilling mud formulation where biomass carbon powders can enhance efficiencies and reduce fuel consumption, and is environmentally friendly in nature. Biomass carbon powders are compatible with any number for drilling fluid chemistries and is an excellent potential fluid loss prevention additive due to its high adsorption / retention values to improve wellbore integrity.

Biomass carbon powders can be used in conjunction with other minerals, such as calcium carbonate, bentonites, or mica and can be part of a bridge material or lost circulation prevention plan. Biomass carbon powders have good thermal conductivity and thermal properties allowing it to be used in high temperature, deep well drilling applications. Oxidation occurs above 450° C.

Below in *Table A* shows the typical ash composition values by specific elements:

Table A: BioMass Carbon Powder Ash Composition Analysis

Al	<160 ppm
As	<0.01 ppm
Ca	<2300 ppm
Co	<0.5 ppm
Cr	<10 ppm
Fe	<620 ppm
Mo	<1.0 ppm
Ni	<2.0 ppm
Pb	<0.01 ppm
Sb	<0.1 ppm
Si	<1300 ppm
Ti	<20 ppm

V	<0.3 ppm
S	<1.0 ppm

Biomass carbon based drilling fluids are increasing in demand and a viable, high quality / consistent Biomass carbon powder alternative is required to meet that demand. Biomass based carbon products today are mainly activated carbons or biochar for agriculture, yet a higher purity, higher quality biomass carbon powder is required to develop new advanced and environmentally friendly Bio based products.

A wide range of particle distributions are required to meet various specifications for drilling fluids using PSD's including D90-10 Micron; D90-20 Micron; D90-45 Micron; and D90-75 Micron biomass carbon powders. Biomass carbon powders exhibit higher levels of resiliency, durability, and strength not seen with other traditional carbon powders, and are environmentally friendly and are an excellent option as a fluid loss prevention / well bore stability additive. The goal of producers today is to meet market demand and increasing the presence of biomass based drilling fluid options in today's environmentally conscious society.

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