



PROCESSING AND ENVIRONMENTAL CATALYSIS

CLEAN ENERGY TECHNOLOGIES

BIO-OIL DIESEL MIXTURE FUELS



The BDM Process™

Until the invention of the BDM Process™, the use of bio-oils in conventional heat and power generation systems required major modifications. These bio-oils were usually more viscous than conventional diesel fuel, harder to ignite, strongly acidic, and had low calorific values compared to conventional petroleum-based products. The BDM Process™ overcomes these difficulties by producing a stable bio-oil/diesel fuel mixture with properties similar to those of No. 2 fuel oil. CETC-Ottawa invites you to become a licensee of this process.

Bio-oils are produced from the pyrolysis of various biomass feedstocks such as hardwoods and softwoods, grasses, agricultural wastes, etc.

Mixing Bio-Oils and Diesel Fuel: the BDM Process™

It used to be that bio-oils were insoluble in No. 2 diesel oil. Mix the two and they formed two separate phases (see Figure 2). Now an effective process for mixing them is available: the BDM Process™, (see Figure 1). Once mixed by this process, the two oils form a blend that is stable, less corrosive and easy to ignite. Laboratory evaluation of bio-oil/diesel fuel mixtures (see Table 1) according to ASTM and ISO standard test methods attest to these properties.

The BDM Process™ produces a bio-oil/ diesel fuel mixture with properties similar to those of conventional diesel fuel (see Figure 3). Most boilers, turbines and power generation stations can use this blended fuel without major modifications. Significant capital savings can be realized where a site conversion is planned.



Above: Figure 1: Operational Bench Scale Unit



Right: Figure 2: (left to right) Ensyn bio-oil only; diesel fuel only; immiscible Ensyn bio-oil/diesel mixture (two phases); BDM Process™ fuel (single phase)

The benefits of using a bio-oil/diesel mixture include:

- comparable combustion performance efficiencies;
- fuel savings;
- only minor adjustments to combustion equipment and fuel;
- lower emissions of NO_x, SO_x and CO₂.

Plans for further development include:

- testing and blending proprietary biomass-derived oils produced from pyrolytic processes;
- optimizing BDM Process™ to improve or customize fuel physical properties, and making further enhancements to the combustion characteristics of the fuel.

The BDM Process™ has also been used effectively to blend heavier fuel oils, such as No. 4, with bio-oils. This added benefit will greatly accelerate the penetration of blended bio-oil fuels into existing oil-fired facilities used to generate electricity. Formulated BDM Process™ fuels could save a power utility hundreds of thousand dollars every year in fuel savings alone, depending on the fuels blended and their relative proportions. Savings accrued will depend primarily on site specifics, e.g., on avoidance or containment of retrofitting costs.

Parameters	ASTM Test	Diesel Fuel Grade 2	Bio-Oil/Diesel Fuel Mixtures (Wt%)					
			5	10	20	30	40	
Flash Point (°C)	(Open Cup)	O-92	92	86	95	82	82	90
	(Closed Cup)	O-93	68	70	71	74	72	75
Fire Point (°C)	O-92	94	90	94	98	94	98	
Heat of Combustion (cal/g)	ISO-1928	10738	10511	10274	9754	9253	9501	
Pour Point (°C)	O-97	-15	NA	-18	NA	-49	NA	
Cloud Point (°C)	D-5773	-18	NA	23	NA	22	NA	
Corrosion (Cu 3h@100°C)	D-130	1b	NA	1a	NA	1a	NA	
Ash (%Wt)	D-482	0	NA	0.02	NA	0.13	NA	
Water & Sediment (%Wt)	D-1796	0	NA	0.1	NA	0.2	NA	

Table 1: Similarities between Grade-2 Diesel Fuel and Some Bio-Oil/Diesel Fuels

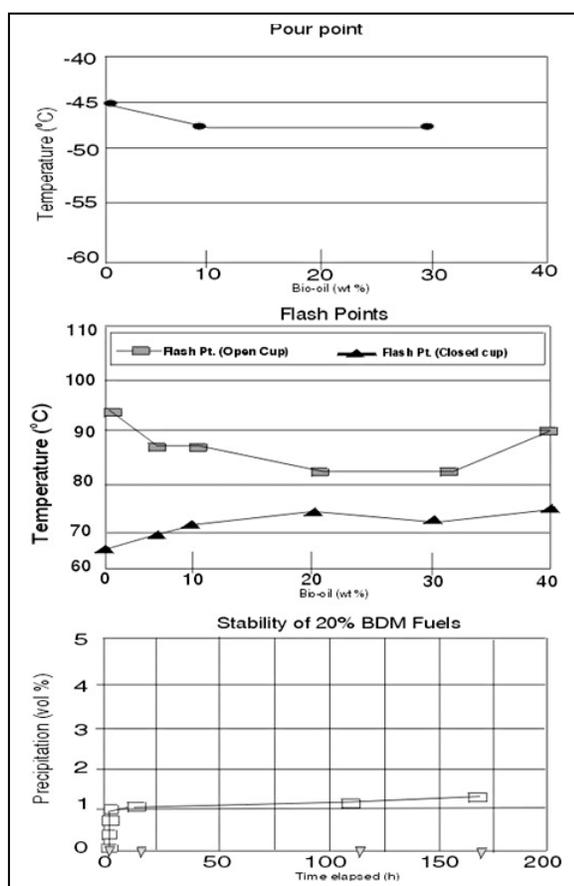


Figure 3: Physical Properties of Ensyn Bio-Oil/Diesel Mixture Fuels

Your Invitation to Work with Us

We are interested in collaborating with you. Please contact the Business Office to discuss your particular needs.

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