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## Method to Upgrade Bio-oils to Fuel and Bio-crude

This invention relates to the method and device to produce esterified, olefinated/esterified, or thermochemolytic reacted bio-oils as fuels.

### Advantages

- Upgraded bio-oil more competitive as liquid fuel than is raw bio-oil
- Low ash content eliminates a source of deposition on boiler parts
- Esterified bio-oil can be utilized as a space heating and boiler fuel

### Technology

This technology is a development of a bio-oil sonification and esterification process that reduces bio-oil water content and acidity while significantly increasing higher heating value (HHV). The increase in HHV moves bio-oil to an energy level of 80% of No. 2 fuel oil, making the upgraded bio-oil much more competitive as a liquid fuel than is raw bio-oil. The ash content of raw bio-oil is a very low 0.04% and upgraded bio-oil maintains this level. Low ash content eliminates a source of deposition on boiler parts.

### IP Protection

**Issued U.S. Patent:** 8,603,199; *Method to Upgrade Bio-oils to Fuel and Bio-crude*

### Inventors

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