



National Biodiesel Board
605 Clark Avenue
P O Box 104898
Jefferson City, MO 65110-4898
(573) 635-3893 *phone*
(800) 841-5849
(573) 635-7913 *fax*
www.biodiesel.org

Bioheat Emissions Reductions

Biodiesel blended with heating oil reduces emissions that are harmful to human health and the environment. These include direct reductions in particulate matter, sulfur oxides, nitrogen oxides, carbon monoxide, aromatic hydrocarbons, and lifecycle reduction for carbon dioxide and equivalent greenhouse gases. Emission benefits increase with the percentage of biodiesel from 5% (B5), 10% (B10), and 20% (B20), and are significant even at low blend levels.

Carbon Dioxide (CO₂): 100% biodiesel reduces lifecycle greenhouse gases (primarily CO₂) by 81%^{1,2}. The corresponding reductions for B5, B10 and B20 blends of biodiesel would be 4%, 8%, and 16%, respectively.

Nitrogen Oxides (NO_x): Study results vary as nitrogen oxide emissions vary with the type of appliance as well as the blend of biodiesel. For residential space heating equipment, typical biodiesel blends (B0-B20) can produce NO_x reductions between 5 and 7.5%. Commercial boilers using higher blends can reduce NO_x by as much as 35% using B100³.

Sulfur Oxides (SO_x): Sulfur oxides are reduced 19.7% by using B20⁴. This reduction can also be assumed to be linear, resulting in 10% reduction for B10 and 5% reduction for B5. The percentage reduction of SO_x due to biodiesel will remain relatively the same with low-sulfur or high-sulfur heating oil. The net reduction in pounds of SO_x is significant when blending with low-sulfur heating oil. Unlike the percentage reduction, which will be nearly the same, the net reduction of pounds of SO_x will be much greater when biodiesel is used to replace high-sulfur heating oil.

Particulate Matter (PM_{2.5}): Practically all particulate matter emitted falls in the PM_{2.5} fraction. B20 reduces PM_{2.5} by 15.7%⁵. Neat biodiesel (B100) can reduce particulate matter by as much as 68%⁶.

Carbon Monoxide (CO): Carbon monoxide reductions due to 100% biodiesel in heating oil applications vary between 40% for commercial boilers and 16% for residential boilers. Residential application can expect 5% CO reduction using B10 and 9% reduction using B20⁷.

Hydrocarbons: Biodiesel is virtually free of aromatic hydrocarbons. These compounds are reduced by 80-90%⁸ in diesel exhaust. Similar reductions can be expected for boiler emissions, due to the lack of these compounds in biodiesel that are commonly found in petroleum.

1. Weighted average computed by NBB using 2015 EIA and USEPA EMTS feedstock data and the latest published studies on feedstock-specific lifecycle analysis. <http://www.eia.gov/biofuels/biodiesel/production/>
2. Pradhan, Shrestha, Van Gerpen, McAloon, Yee, Haas, Duffield; Reassessment of Life Cycle Greenhouse Gas Emissions for Soybean Biodiesel; American Society of Agricultural and Biological Engineers; 2012; http://www.researchgate.net/publication/234143981_Reassessment_of_Life_Cycle_Greenhouse_Gas_Emissions_for_Soybean_Biodiesel/file/d912f51234a621f896.pdf
3. Krishna, Biodiesel Blends in Space Heating Equipment; Brookhaven National Laboratory; NREL/SR-510-33579; 2004
4. Massachusetts Oilheat Council & National Oilheat Research Alliance, Combustion Testing of a Biodiesel Fuel Oil Blend in Residential Oil Burning Equipment, 2003, <https://www.bnl.gov/isd/documents/25281.pdf>
5. Natural Resources Canada, Laboratory Investigations on the Cold Temperature Combustion and emission performance of Biofuel Blends

6. Macor and Pavanello: performance and emissions of biodiesel in a boiler for residential heating; Energy; 2008
7. Krishna, Biodiesel Blends in Space Heating Equipment; Brookhaven National Laboratory; NREL/SR-510-33579
8. <https://www3.epa.gov/otaq/models/analysis/biodsl/p02001.pdf>