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Thermogravimetric and Differential Thermal Analysis of Sea Buckthorn from The Netherlands Compared to Common US Shrubs in Fire-Prone Ecosystems

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Abstract

In recent years, wildfires have become more frequent in Northwestern Europe, including the Netherlands, prompting greater interest in hazardous fuels reduction. In February 2019, Wolf Fire Safety, a private Netherlands wildland fire safety contractor, conducted a prescribed burn on the island of Terschelling targeting hazardous fuels near coastal recreation areas and discovered that sea buckthorn (*Hippophae rhamnoides*) burns with great intensity. To confirm this observation, this study sought to compare the fundamental thermal behavior of sea buckthorn with fire-prone shrubs of the US that included yaupon (*Ilex vomitoria*), a southeastern shrub, and chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos* spp.), and buck brush (*Ceanothus cuneatus*), common California chaparral shrubs. Simultaneous thermal analysis was used to estimate ignitability based on differences in heat capacity and change in heat from the onset of the first primary differential thermogravimetric (DTG) peak to roughly 280°C, maximum mass loss rate (MMLR) served as a proxy for combustibility, primary peak decomposition times approximated sustainability, and mass loss fractions for the first and second primary DTG peaks estimated consumability. Net heat content (NHC) was also assessed with oxygen bomb calorimetry. Sea buckthorn yielded comparable ignitability to chamise and produced the greatest combustibility based on gas-phase MMLR (GP-MMLR). Conversely, sea buckthorn produced the least sustainability (< GP-decomposition duration), consumability (< GP-mass loss fraction), and NHC. Although sea buckthorn yielded lower sustainability, consumability, and NHC indices, greater ignitability and combustibility estimates may potentially increase fire spread and intensity, especially in dense, contiguous stands.

Keywords: Flammability, Wildfire, Chaparral, Yaupon, Wildland fuel

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