



HAL
open science

On the combustion of terpenes biofuels

Philippe Dagaut, Zahraa Dbouk, Nesrine Belhadj, Maxence Lailliau, Roland Benoit

► **To cite this version:**

Philippe Dagaut, Zahraa Dbouk, Nesrine Belhadj, Maxence Lailliau, Roland Benoit. On the combustion of terpenes biofuels. INFUB-14, CENERTEC, Apr 2024, Algrave, Portugal. hal-04528441v1

HAL Id: hal-04528441

<https://hal.science/hal-04528441v1>

Submitted on 1 Apr 2024 (v1), last revised 30 Apr 2024 (v2)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Public Domain

On the combustion of terpenes biofuels

Philippe Dagaut, Zahraa Dbouk, Nesrine Belhadj, Maxence Lailliau, Roland Benoit

Limonene and α -pinene were oxidized in a jet-stirred reactor at atmospheric pressure, in the cool flame regime, under fuel-lean conditions. Samples of the reacting mixtures were collected, dissolved in acetonitrile, and analyzed by high-resolution mass spectrometry. Direct flow injection or chromatographic separation by ultra-high-performance liquid chromatography and \pm heated electrospray ionization and \pm atmospheric pressure chemical ionization were used to characterize the oxidation products. H/D exchange using D_2O were performed for probing the presence of hydroxy and hydroperoxyl groups in the products. Reaction with 2,4-dinitrophenylhydrazine was used to assess the presence of carbonyl functions in the products. A large set of oxidation products, including highly oxygenated organic products with five and more oxygen atoms, was observed. Aromatic and/or polyunsaturated products were detected. Van Krevelen plots, computed oxidation state of carbon and degree of unsaturation in products were used to rationalize the results.

The kinetics of combustion of terpenes involve the study of the rate at which terpenes react with oxygen to produce carbon dioxide, water, and other combustion byproducts. Terpenes are a class of organic compounds that are commonly found in plants and have a distinct odor.

The combustion process of terpenes is typically exothermic, releasing heat and light. The kinetics of this combustion reaction can be influenced by several factors, including temperature, pressure, concentration of reactants, and the presence of catalysts.

The reaction rate of terpene combustion can be described by various kinetic models, such as the Arrhenius equation or the Eyring equation, which relate the rate of reaction to temperature and activation energy. These equations can be used to determine the rate constant and activation energy of the combustion reaction.

The combustion of terpenes is generally a complex process due to the large number of possible reaction pathways and the presence of multiple reaction intermediates. The reaction mechanism can vary depending on the specific terpene compound and the conditions under which the combustion occurs.

Understanding the kinetics of terpene combustion is important for various applications, including the development of cleaner and more efficient combustion processes, as well as the study of air pollution and its environmental impacts

Yes, terpenes can be used as liquid fuel. Terpenes are organic compounds that are naturally found in plants, including cannabis, pine trees, and citrus fruits. They have a variety of uses, including as flavor and fragrance additives, as well as potential applications in fuel production.

Terpenes can be extracted from plants and processed into a liquid form that can be used as a renewable fuel source. They have a high energy content and can be used as a substitute for traditional fossil fuels. Additionally, terpenes are considered to be more environmentally friendly compared to conventional fuels, as they are derived from renewable sources and produce fewer emissions when burned.

However, it's important to note that terpenes alone may not be sufficient as a standalone fuel. They would typically need to be blended with other substances or undergo further processing to meet the necessary specifications for use as a liquid fuel.

Cool flames are low-temperature flames that occur at temperatures below the typical ignition point of a substance. Unlike regular flames, cool flames do not emit much light and are not as hot. They are characterized by a blue or greenish-blue color and can sometimes be difficult to detect.

The exact mechanisms and properties of terpene cool flames are still being studied, and there is ongoing research to better understand this phenomenon. However, it is believed that the cool flame behavior of terpenes is due to their unique chemical structure and combustion properties.