Advanced Core for Energetics, Hiroshima University Vol. 34

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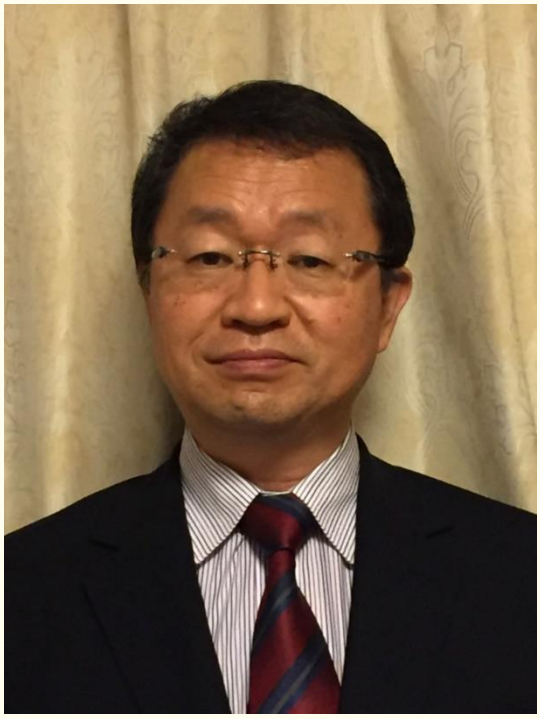
Activities of the Core

Oct. 1, 2019	HU-ACE became an independent core.
Oct. 1, 2019	The 37th HU-ACE Steering Committee Meeting
Oct. 1, 2019	Lectures of Advanced Bioresource, Advanced Biofuel Engineering, and Biomass Utilization, provided by HU-ACE started.
Oct. 1, 2019	Prof. Aki appeared in the radio program "Cool Choice Now“ by FM Higashi-Hiroshima.
Oct. 7, 2019	The 78th Biomass Evening Seminar (co-organization)
Oct. 17, 2019	Report on supercritical water gasification was made in NEDO Project Outcome Report 2019.
Oct. 31, 2019	The 38th HU-ACE Steering Committee Meeting



Prof. Keiya Nishida, Heat of HU-ACE

HU-ACE became an independent core.

We appreciate your cooperation on the activities of HU-ACE. This advanced core was started as an incubation core for 3 years until the end of September, 2019. Depending on the achievement during this period, it is decided if it can continue as independent core, and the final interview was made on Aug. 30, 2019. As the result, HU-ACE successfully became an independent core. It owes a lot to your cooperation, and we are very much grateful. We will continue the research activities and International Symposium of ISFE will be held, too. We will make much more achievement. We would like to ask for your further cooperation.

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Research Topics

Burning amino acids powders —Combustion characteristics in dust explosions

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Research fields: Energy engineering, Safety engineering
Keywords: Combustion, Explosion, Dust combustion, Hydrogen, Safety

Abstract

Background

Amino acid fine powders are widely used as nutritional supplements in the pharmaceutical industry, and exhibit a potential hazard in terms of causing dust explosions. Since the combustion characteristics of the powders are not currently available, Hiroshima University, Ajinomoto Co., and National Institute of Occupational Safety and Health investigated the ignition and electrostatic characteristics of the powders.

Methods

The minimum ignition energy (MIE) was determined using the MIKE3 apparatus according to International Electrotechnical Commission (IEC) standards. The minimum explosion concentration (MEC) was measured in a specified tube apparatus, in accordance with the Japanese Industrial Standard. The pyrolyzates were analyzed using a Py-GCMS. The electrostatic characteristics of the powders, such as the volume resistivity, charge-to-mass ratio were tested.

Results

MIE and MEC of L-isoleucine, L-leucine, and L-valine, which are the branched chain amino acids (BCAAs), were much lower than those of the other amino acid powders. In particular, constant MEC values for the BCAAs were obtained for different particle sizes. This indicated that the BCAA powders must undergo a risk assessment for dust explosions. A number of flammable materials were formed from the BCAAs by pyrolysis, and BCAAs were found to be sensitive to electrostatic discharge [1-3]. The flame propagation mechanism of dust explosions have not been elucidated due to various problems such as complexity of combustion mechanism and difficulty of combustion experiments in a gravitational field. The present research investigates the combustion characteristics and flame propagation mechanism of dust explosions, by the microgravity experiments under the collaboration with JAXA/ISAS.

Table 1. Summary of MIE and MEC.

	MIE (mJ)		MEC (g/m^3)	
Particle size (μm)	15~28	123~614	15~28	123~614
L-Isoleucine	4	8	40	45
L-Leucine	4	22	50	55
L-Valine	4	26	50	45
L-Threonine	25	> 1000	95	810
L-Alanine	55	> 1000	70	> 2000
Glycine	540	> 1000	180	> 2000
L-Serine	700	> 1000	180	> 2000

Fig. 1. Typical sequence of L-isoleucine dust explosion

References

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