NIPPON STEEL ENGINEERING

News Release

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Nippon Steel Engineering Co., Ltd.

NSE Starts Construction of a Second-generation Bioethanol Production Facility which has been Commissioned by the Research Association of Biomass Innovation for Next Generation Automobile Fuels

Nippon Steel Engineering Co., Ltd. (Representative Director and President: Yukito Ishiwa; Head Office: Shinagawa-ku, Tokyo; hereinafter "NSE") has started construction of a second-generation bioethanol production※1 facility (scheduled to start operation in October 2024) commissioned by the Research Association of Biomass Innovation for Next Generation Automobile Fuels※2 (Chairman of the Board: Koichi Nakata, Headquarters: Town of Okuma, Futaba County, Fukushima Prefecture; hereinafter "the Research Association").

The Research Association seeks to achieve a carbon-neutral society through research on the use of biomass and the efficient production of bioethanol fuel for automobiles by optimizing the circulation of hydrogen, oxygen, and CO_2 during bioethanol production. Bioethanol fuel is a promising option for achieving a carbon-neutral society, but most bioethanol fuel is based on "first-generation" production technologies that produce ethanol directly from sugar and starch using edible biomass such as corn and sugarcane as feedstocks. However, "second-generation" production technologies that use non-edible biomass such as agricultural residue and inedible plants as feedstocks are required to spread in order to avoid competition with food production and to ensure stable procurement.

NSE has jointly developed and optimized a second-generation bioethanol production process with an automobile company※3 and a consumer goods and chemicals manufacturer※4. NSE has also been commissioned to conduct a project to substantiate non-edible biomass production in the Philippines, and NSE has acquired a variety of knowledge through construction and operation of that facility. In addition, NSE has been studying technologies to utilize high levels of CO_2 from biomass and process residues such as lignin generated in the fermentation process. This knowledge and these technologies have been highly praised, leading to commissioned design, procurement, and construction of a facility for integrated second-generation bioethanol production.

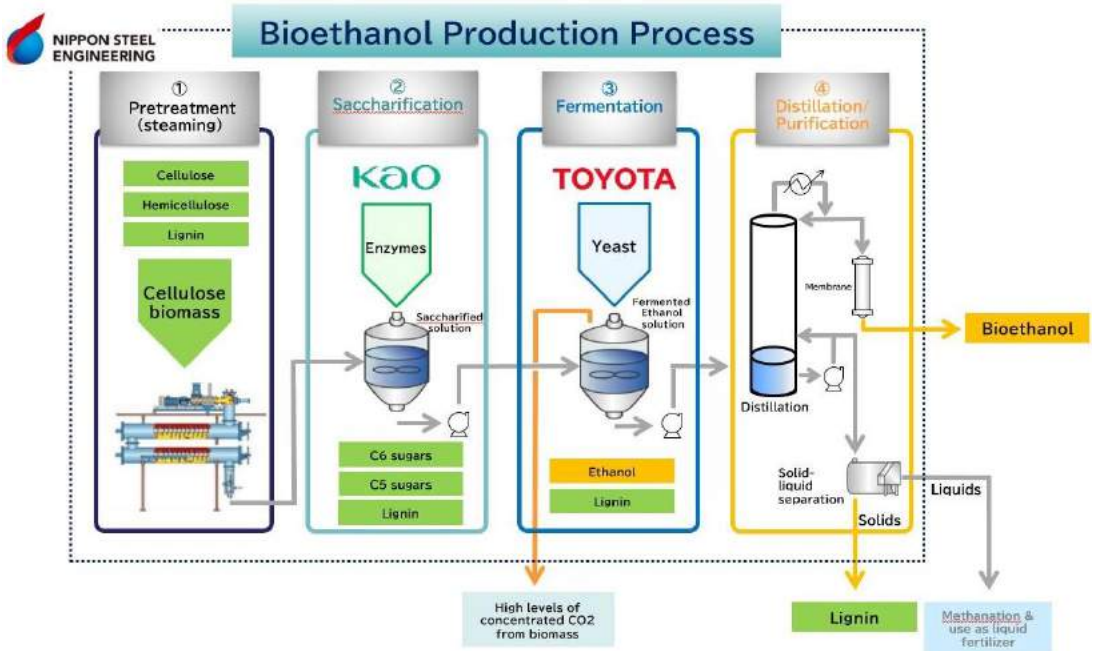
NSE will continue to enhance our efforts to achieve a sustainable carbon-neutral society and to promote the spread and increase the use of renewable energy.

※1: The second-generation bioethanol production process uses herbaceous non-edible biomass, which consists mainly of cellulose, hemicellulose, and other polysaccharides that are difficult to decompose, as feedstocks. Thus, the process requires pretreatment and saccharification of the feedstocks. The process of second-generation bioethanol production can be roughly divided into four steps.

※2: An Overview of the Research Association of Biomass Innovation for Next Generation Automobile Fuels

- Date of establishment: July 1, 2022
- Members: ENEOS Corporation, Suzuki Motor Corporation, Subaru Corporation, Daihatsu Motor Co., Ltd., Toyota Motor Corporation, Toyota Tsusho Corporation, and Mazda Motor Corporation
- URL for reference: https://global.toyota/en/newsroom/corporate/38999570.html

(1) Pretreatment: **Raw biomass is pretreated** through a combination of steaming and steam explosion
(2) Saccharification: Pretreated **biomass is saccharified by enzymes**
(3) Fermentation: A saccharified solution is fermented by yeast to produce a fermented ethanol solution
(4) Distillation and purification: A fermented ethanol solution is distilled and purified



※3: To pretreat non-edible biomass feedstocks ((1) in the figure), NSE has established an optimal method of pretreatment by evaluating and developing various methods of pretreatment with Toyota Motor Corporation (hereinafter "Toyota"). In fermentation ((3) in the figure), Toyota XyloAce™ developed by Toyota is used to efficiently ferment xylose, which natural yeast has difficulty fermenting. This enables the use of most of the sugar derived from herbaceous non-edible biomass material (cellulose) as ethanol.

※4: For saccharification ((2) in the figure), NSE has been collaborating with Kao Corporation (hereinafter "Kao") to jointly develop an on-site enzyme production technique using enzyme-producing bacteria that can efficiently decompose inedible biomass. The new bioethanol production facility will use saccharification enzymes developed by Kao that can efficiently saccharify inedible biomass.
https://www.kao.com/global/en/newsroom/news/release/2023/20230621-001/

The efforts in ※3 and ※4 are expected to increase the yield of bioethanol and reduce its production cost.

[For more information, please contact the following]
https://www.eng.nipponsteel.com/english/contact/index.html