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News Release

**World's First Practical Use of Innovative Energy Saving Distillation System
- Approximately 50% energy savings compared to conventional systems -**

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Toyo Engineering Corporation

Toyo Engineering Corporation (TOYO, President and CEO Katsumoto Ishibashi) has been awarded a contract to commercialize an energy-saving distillation system, called ***SUPERHIDIC***[®], that was patented in 2011. The contract is for a distillation column in a methyl ethyl ketone (MEK) production plant to be constructed by Maruzen Petrochemical Co. Ltd. (Ichihara City, Chiba, Japan).

The distillation operation that is generally used in oil refineries and petrochemical plants is a thermal energy intensive process, where the bottom of distillation towers is heated using a reboiler and, at the same time, overhead gas is cooled using a condenser. To save energy in the distillation operation, a range of technologies has been proposed to date. Since the concept of Heat Integrated Distillation Column (HIDiC) was announced in the 1970s as a process promising ultimate energy-saving performance, HIDiC has been studied worldwide; however, practical application of the process has not yet taken place.

Advancing the concept of HIDiC and applying well proven distillation and heat-transfer technologies, TOYO has developed ***SUPERHIDIC***[®], a distillation system that produces high economic efficiency while retaining the maintainability of normal distillation columns. ***SUPERHIDIC***[®] enables 40%-60% energy savings in many cases within the distillation process by providing optimal internal heat exchange.

Taking this opportunity to carry out commercialization, TOYO will strive to expand the application of ***SUPERHIDIC***[®] to various distillation columns, thus helping reduce energy usage in oil refineries and petrochemical plants.

Contract Summary

- Client: Maruzen Petrochemical Co. Ltd.
- Contractor: Toyo Engineering Corporation
- Site: Ichihara City, Chiba, Japan
- Facilities: Distillation column in methyl ethyl ketone (MEK) production plant
- Scope: Provision of ***SUPERHIDIC***[®] technology and basic engineering

For inquiries, contact:

Toyo Engineering Corporation

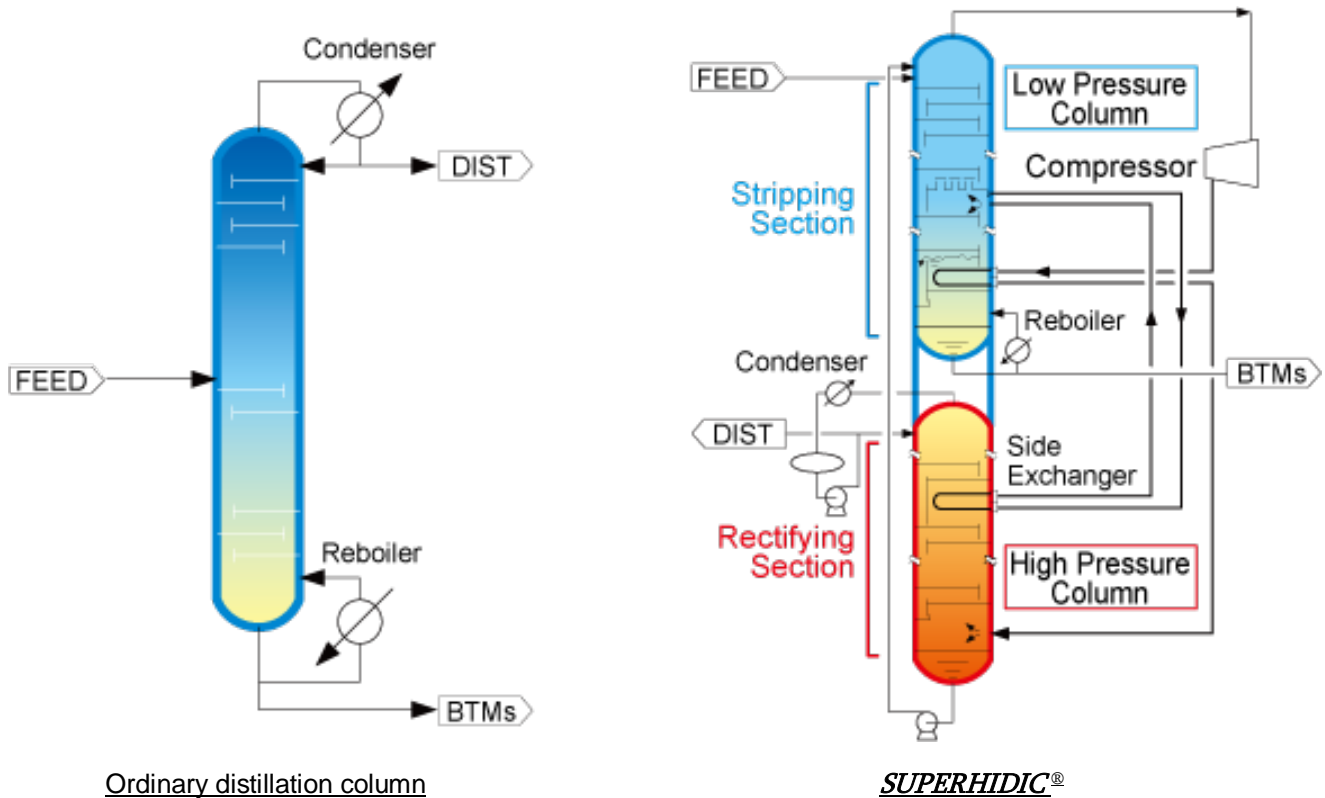
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Note: For the concept of HIDiC, ***SUPERHIDIC***[®] conceptual diagram, etc., please refer to the supplemental information.

[Supplemental Information]

<Conceptual diagrams of ordinary distillation column and *SUPERHIDIC*[®]>



Ordinary distillation column

SUPERHIDIC[®]

Energy saving: If the energy consumption of an ordinary distillation column for a reboiler equals 100, the energy consumption of *SUPERHIDIC*[®] is 40 for the compressor (converted to primary energy) and 10 for the reboiler, totaling approx. 50. This means *SUPERHIDIC*[®] creates energy savings of approximately 50%.

<Concepts of HiDiC and *SUPERHIDIC*[®]>

HiDiC is based on the following energy-saving concept: The distillation column is separated into a stripping section and a rectifying section, and a compressor is set up between the sections. The temperature of the rectifying section is increased while its pressure is increased slightly, and heat is transferred from the rectifying section to the stripping section to significantly reduce the amount of thermal energy to be supplied to the reboiler.

As a way to realize the HiDiC concept, a structure that utilized concentrically arranged rectifying and stripping sections was proposed in the 1990s. Some problems related to this method included difficulty in carrying out maintenance and a lack of flexibility in terms of the ability to combine heat-exchange locations. The heat duty depended only on the difference in temperature between the locations. In this manner, there was room to improve the structure to boost energy-saving performance. *SUPERHIDIC*[®] provides superior energy-saving performance by optimizing heat distribution inside the column with conventional stabbed-in type heat exchangers.

- Regarding equipment positioning, *SUPERHIDIC*[®] is co-licensed jointly with the National Institute of Advanced Industrial Science and Technology, and the engineering methodology has been developed jointly with Prof. Shinji Hasebe's PSE Lab, Dept. of Chemical Engineering, Kyoto University
- *SUPERHIDIC*[®] received the 2014 Nikkei Global Environmental Technology Award of Excellence.