RECP Best Practice Catalogue

Dry ice condensing system

Developed within the framework of MED TEST II

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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

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Best Practice - Dry ice condensing system

SECTOR:	**Food & Beverage**
SUBSECTOR:	Manufacture of vegetable and animal oils and fats
PRODUCTS	Refined oils
CATEGORY	Technology upgrade/Eco-innovation
APPLICABILITY	Process

COMPANY NAME	---
COMPANY SIZE	Medium

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Description of the problem (Base scenario):	Edible oils contain various components (free fatty acids, tocopherols, flavors, dioxins, pesticide residue,…etc) that should be removed through the deodorization process. The deodorization process is a stripping process in which a given amount of stripping steam is passed for specific period of time through hot oil at a low pressure and high temperature. It is a multistep process comprising of: de-aeration, multistage heating, deodorization, de-acidification and multi stage cooling of the oil. The vacuum in the deodorizer is usually created by a combination of steam ejectors (boosters), vapor condensers and mechanical vacuum pumps. These quite robust systems typically reach pressure in the deodorizer between (2.5-5) mbar to allow steam condensation inside the deodorizer. Such technologies consume high amount of water and energy that reaches about 78% of total energy consumption and 38% of total water consumption in the oil refining plant.

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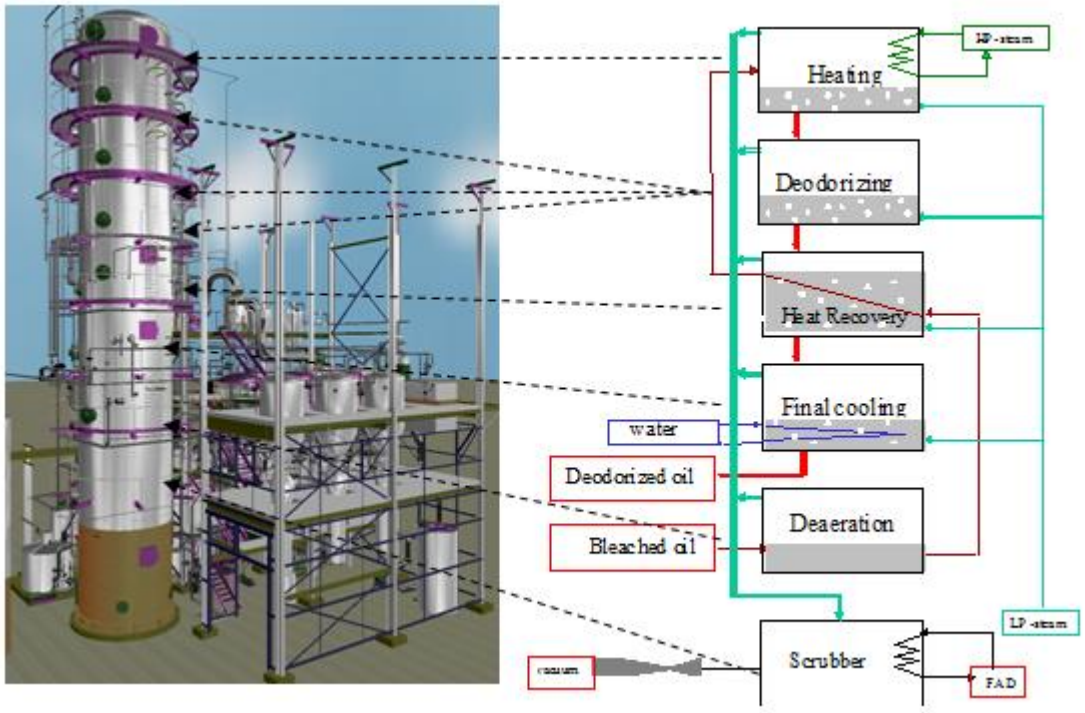
The traditional deodorizing system



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Description of the solution	Introducing the most recent techniques in oil deodorization using dry ice condensing system to replace the traditional system for vapor condensation in the deodorization process. This new system provides a simple, environmentally friendly, cost effective and low temperature way to replace the process vapor used for edible oil deodorization. It achieves very low absolute pressure (<1.5 mbar) and drastically reducing the running cost of the plant in terms of energy consumption and polluted water flow. In this system, the stripping steam is iced on surface condensers working alternately at extreme low temperature (-30 ^{o}C). The efficient solidification of steam and other volatile matter will strongly reduce odor emission. The new dry ice condensers reduces water and energy consumption but required extra electrical energy. Commercially available system consists of two or more freeze condensers containing the cooled tubes, a refrigeration plant for the generation of cold refrigerant which is evaporated in the tubes and a vessel with relatively warm water for defrosting and cleaning of the tubes after a period of freezing.

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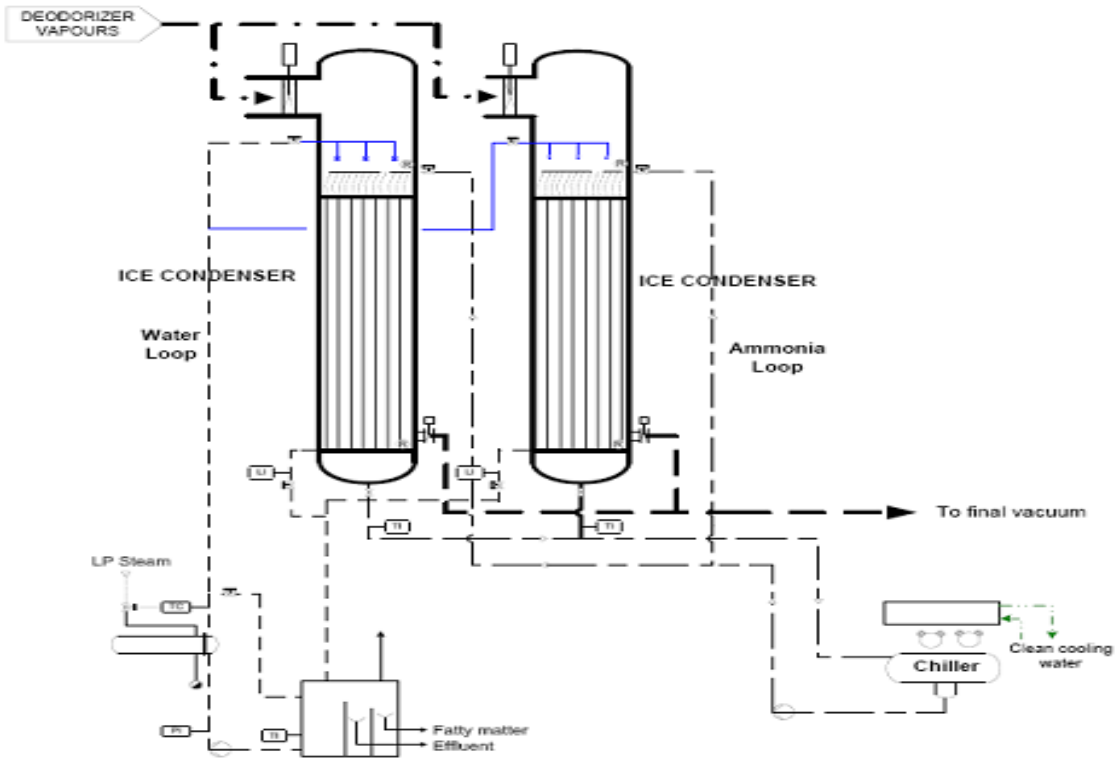
Dry condensing system operation principles



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Economic Benefits	The implementation of this measure will lead to a significant reduction of 3.8 million m^3 natural gas (90% energy) and 25,000 m^3/y (99% in water) needed for the deodorization process. Cost savings on energy are 655,500 Euro/y while cost savings on water are 7,000 Euro Total cost savings = 662,625 Euro/y
Environmental Benefits	Water consumption reduced by 25,000 m^3/y (99% from water consumed for the deodorization process and 36% from the original baseline). Energy consumption reduced by 3.8 million m^3 NG/y (90% from energy needed for the deodorization process and 60% from the original baseline). CO_2 emissions is reduced by 8,633 t/y

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Capital investments & financial indicators	Total investment costs are 1,000,000 Euro. Payback period is 1.5 year without considering the additional electrical energy needed to generate the ice. According to Korting company; typical payback period for such systems is 3 years.
Suppliers	Technology providers
Other aspects	The company did not fully accept this measure due to the high investment cost needed to implement this measure.
Implementation	This option is retained for further study, pending full feasibility study.

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Replicability sectors	The same concept can be replicated in: **Oil refining plants.**
Aspects to investigate for replicability	Steam and water consumed in the deodorization process.
Useful resources	