Reduction of pollutant emissions from Azzawia refinery

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Abstract

Distillation systems are energy and power intensive processes and contribute significantly to the greenhouse gases emissions (e.g. carbon dioxide). Reducing CO2 emissions is an absolute necessity and expensive challenge to the chemical process industries in order to meet the environmental targets as agreed in the Kyoto Protocol. A simple model for the calculation of CO2 emissions from heat-integrated distillation systems is introduced, considering typical process industry utility devices such as boilers, furnaces, and turbines. Furnaces and turbines consume large quantities of fuels to provide electricity and process heats. As a result, they produce considerable amounts of CO2 gas to the atmosphere. Furnaces are necessary for heating purposes; besides, they are also significant emissions contributors. The model is used in an optimization based approach to optimize the process conditions of an existing crude oil atmospheric tower in order to reduce its CO2 emissions and energy demands. An existing crude oil atmospheric unit is very expensive to modify due its complex configuration and interactions, and existing constraints of structure, limited space area, matches, bottlenecked equipments, etc. Thus, a few new crude distillation units are built and projects for revamping existing equipments are rather common. Revamping an existing plant is a difficult task, more complex than a new process design; many parameters must be considered and sometimes it is not possible quantify all of them. This paper presents a new methodology based on rigorous simulation and adding a preflash drum that addresses both the distillation column and the heat furnace simultaneously to decrease the (CO2, NOx , Sox) emissions. The methodology considers process change and structural modification together with the interactions between the existing distillation process and heat recovery system. The new method includes multiple objective functions such as energy savings, emissions reduction, capacity enhancement, and profit improvement. The distillation column at topping unit of Azzawia Oil Refinery Company (ARC) has been selected as a case study. The objective of this paper is to investigate the process feasibility and advantages of the new design of distillation with an additional a preflash drum.. The results of this work can be used as a guide for inserting the a preflash drum to reduce the energy consumption and CO2 emission for existing process. It has been shown by applying the new approach that crude oil atmospheric units can save energy by 5% and reduce emissions (CO2, NOx) by up to 6% and(Sox) emissions by 5% while the existing structure is fixed.. Utilizing a pre flash drum is a key modification for cutting down operational costs and emissions further. When a pre flash drum is used, a typical reduction of up to 5 % is achieved. It has been shown that new distillation columns with internal heat integration exhibits reasonably energy savings compared to traditional configurations. Savings can reach up to 6% of furnace duties.

Keyword: Crude distillation; Revamping; Energy savings; Preflash; Emissions