Exergy Analysis of a CO2 Recovery Plant for a Brewery

A large number of new and old breweries around the world experience increasing energy cost associated with the production of beer. Large heating and cooling demands in the brewing process and a wide use of utilities for assisting the processes necessitate a detailed analysis of individual efficiencies for processes and the different utility plants.

One considerable utility plant is the CO2 recovery plant, which purifies/purges the CO2 generated in the fermentation process in order to reuse it in the brewery site or sell it to customers who demand high quality CO2.

In the paper a detailed model of a 2000kg/h CO2 recovery plant for a brewery is presented, which is a typical plant capacity for a large CO2 self-sufficient brewery. The model includes all significant unit operation in the CO2 plant and a complete mass and energy balance of it. In order to prevent hidden loads and misleading analysis, the system is modeled as a final supplier solution, which is initially considered without heat and recovery integration even though this is commonly used. The following steps are presented. First step introduces the process and the component appearance followed by the energy requirements and corresponding loads. Consumptions and loads are compared with an existing plant at a corresponding capacity and are validated.

Energy and exergy analysis are used in order to illustrate the performance of each individual system component of the CO2 recovery plant.

A schematic overview of all exergy flows including destruction is presented and proves a clear understanding of the exergy inefficiencies associated with the plant. The highly detailed and validated model enables and prepares different holistic methodologies and analyses to be used, including thermoeconomic diagnosis and optimization of plant set points.

General information
Publication status: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Contributors: Nielsen, D. R., Elmegaard, B., Bang-Møller, C.
Number of pages: 15
Publication date: 2012

Host publication information
Title of host publication: Proceedings of ECOS 2012
Editors: Desideri, U., Manfrida, G., Sciubba, E.
Keywords: Energy analysis, Grassmann diagram, CO2 recovery plant, Utility plant
Electronic versions:
E2LA_ecos2012_072.pdf
URLs:
Research output: Chapter in Book/Report/Conference proceeding → Article in proceedings – Annual report year: 2012 → Research