

An Advanced Process Analysis System for Improving Chemical and Refinery Processes

Abstract

An advanced process analysis system has been developed to perform comprehensive evaluations on chemical plants and refineries for process improvements. The system integrates programs for on-line optimization, chemical reactor analysis, flowsheeting, pinch analysis and pollution indices. These programs are used interactively and share plant data through a database. Results from applying the system to a Monsanto/IMC Agrico contact process for sulfuric acid include an increased profit, reduced emissions and improvements in the chemical reactors and heat exchanger network which demonstrates the applicability of the system for pollution prevention.

Keywords: on-line optimization, chemical reactor analysis, pinch analysis, pollution index

Introduction

An advanced process analysis system has been developed which is to be used by process and plant engineers to develop innovative and economically viable ways to optimize and modify processes significantly beyond their current capabilities. With this system, process engineers interactively and simultaneously use programs for on-line optimization, chemical reactor analysis, flowsheeting, pinch analysis and pollution indices. The results can be process modifications and controls that reduce wastes and energy consumption, in addition to increased profit and improved efficiency of operations.

An overview diagram of the advanced process analysis system is given in Fig. 1, and referring to this figure, the chemical reactor analysis program (Saleh, Hopper and Walker, 1995) evaluates modifications to have the best chemical reactor type and operating conditions. The flowsheeting program and the EPA pollution index methodology (Cabezas, et al, 1997) identifies pollutants and determines modifications to have the best configuration for separations equipment. The pinch analysis program, THEN, (Knopf, 1993) evaluates modifications to integrate the network of heat exchangers,

are shared by each program. The database structure is shown in Fig. 2.

The program has been developed with industrial and academic collaboration using the Monsanto designed, IMC-Agrico sulfuric acid contact plant. Support has been provided by EPA, and the program will be available through the EPA Technical Assistance Tools program. In the following paragraphs, a brief description will be given of the programs used in the system, and results of applying the program to the IMC Agrico plant will demonstrate the system's capabilities.

Flowsheeting

Process flowsheet development is through an interactive Windows interface. A detailed description is provided in the users manual (Telang, 1998). As the process flow diagram is

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