Modeling, simulation and optimization of refinery crude atmospheric and vacuum distillation unit

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ABSTRACT

Petroleum refining begins with crude distillation followed by subsequent processing such as chemical treating, catalytic reforming, hydrotreating and fluid catalytic cracking. A crude desalter is normally regarded as one of the facilities that constitute atmospheric distillation. Crude oil is first processed by the desalter to remove salts, solids and water. The desalted crude oil is then separated into intermediate petroleum such as naphtha, kerosene, gasoil and atmospheric residue by the atmospheric distillation unit. The whole or a part of the atmospheric residue is usually separated further into vacuum gasoil and vacuum residue by vacuum distillation. Tighter environment regulations, higher energy costs and growing competition have increased the drive for making distillation system more efficient. Complex columns offer a great opportunity for improving efficiency by using them instead of a series of simple columns. Different aspects of crude distillation unit have been considered in this study and effect of various operating and design conditions on yield and quality of products monitored.
Keywords: crude distillation, heat exchanger network, desalting, water management

Introduction

Petroleum refining begins with crude distillation followed by subsequent processing such as chemical treating, catalytic reforming, hydrotreating and fluid catalytic cracking. A crude desalter is normally regarded as one of the facilities that constitute atmospheric distillation. Crude oil is first processed by the desalter to remove salts, solids and water. The desalted crude oil is then separated into intermediate petroleum such as naphtha, kerosene, gasoil and atmospheric residue by the atmospheric distillation unit. The whole or a part of the atmospheric residue is usually separated further into vacuum gasoil and vacuum residue by vacuum distillation. Figure 1 shows a block flow diagram of a typical crude oil refinery complex(extracted from **www.uop.com**).

Tighter environment regulations, higher energy costs and growing competition have increased the drive for making distillation system more efficient. Complex columns offer a great opportunity for improving efficiency by using them instead of a series of simple columns. Crude distillation is energy intensive. It consumes fuel at the equivalent of 2% of the crude processed. the conventional design used these days, consisting of a column with side strippers and pumparound circuits., which consists of an atmospheric distillation unit and a vacuum distillation unit.