Abstract

As an important separation unit, distillation column is widely applied in petrochemical and other process industry. It is reported that there are over 40,000 distillation columns all over the world[1]. Well, despite its flexibility and widespread use, one important concern on it is its considerable energy consumption, which can account for more than 50% of plant operating cost[2]. Therefore, many research efforts have been concentrated on energy-efficient distillations in terms of both individual column and distillation sequence.

For the separation of multicomponent mixtures, distillation is conducted sequentially in industry. Distillation sequence is usually evaluated by number of distillation subproblems, subgroups and distillation sequences. Distillation sequence has been well studied based on simple column assumption, i.e. in each column one feed is separated into two streams without component mixing between two output streams, which is defined as sharp split[3].

Dividing wall column (DWC), as a thermally coupled distillation column, has been proposed and applied in distillation sequence[4], and it is reported that about 30% energy and equipment investment cost can be saved by DWC[5]. It is an atypical distillation column for separating a multicomponent feed mixture into three output streams. Usually sharp split is also assumed in most literatures on DWCs. A distillation sequence with DWC will give more number of feasible sequences. It is important to estimate the total available number of distillation sequences theoretically.

In this work, a distillation sequence with both simple column and DWC are considered. Inferential deduction method has been used to explore the number of distillation sequences for multi-component sharp splits. With different assumptions, the corresponding numbers of distillation sequences are also discussed.