DIVIDED WALL COLUMNS

The main tasks in refineries are to increase the processing depth and, at the same time, to save on utilities and energy. Distillation columns are among the largest energy consumers worldwide. Numerous measures such as the optimum schemes, the use of heat pumps, efficient column internals and optimized controls, ensure high savings.

EFFICIENT HEART CUT WITH DIVIDED WALL COLUMNS

However, in the case of multicomponent distillation, less attention is paid to the remixing of components. This effect is taken into account to a high extent when using divided wall columns and thus offers further opportunities to save operating and plant costs. Divided wall columns can efficiently be used to separate the heart cut (benzene) in a reformate splitter.

EFFICIENCY

Compared to traditionally used distillation sequences the following savings can be achieved:

Cost savings compared to a column with side draw-off

- CAPEX approx. 10%
- OPEX approx. 20%

Cost savings compared to a two-column system

- CAPEX approx. 20%
- OPEX approx. 30%

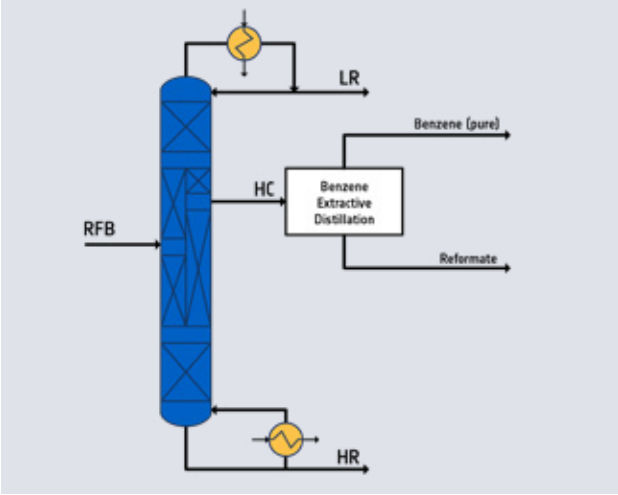

Fig. 1: Distillation with divided wall column/Benzene extractive distillation

TECHNICAL ADVANTAGES OF DIVIDED WALL COLUMNS

- Benzene content of the heart cut may reach up to 75% w/w
- Residual benzene content of light reformate (LR) and heavy reformate (HR) from 1 to 0.5% w/w is possible
- Benzene separation in a benzene extractive distillation unit

Abbrevations: RFB: Reformate · HR: Heavy Reformate · LR: Light Reformate · HC: Heart Cut · DWC: Divided Wall Column

TECHNICALLY OPTIMUM SCHEME

A traditional distillation sequence can be implemented by a two-column system in direct or indirect connection. Owing to the plant costs, a distillation unit is usually provided with a side draw-off (Fig. 2).

If a high percentage of remixing of less light and less heavy components, particularly in case of multicomponent systems, is be reached, a pre-fractionation column with two product distillation columns (Fig. 3) describes the technically optimum solution. High plant costs of this scheme finally led to a complete thermal linkage of the systems, in form of the PETLYUK sequence with a pre-fractionation column and a main fractionation column (Fig. 4 and 5).

The physical integration of the pre-fractionation column into the main fractionation column directly results in a **divided wall column** (Fig. 1). The heart cut may be split into high-purity benzene and reformed gasoline in a downstream benzene extractive distillation unit.

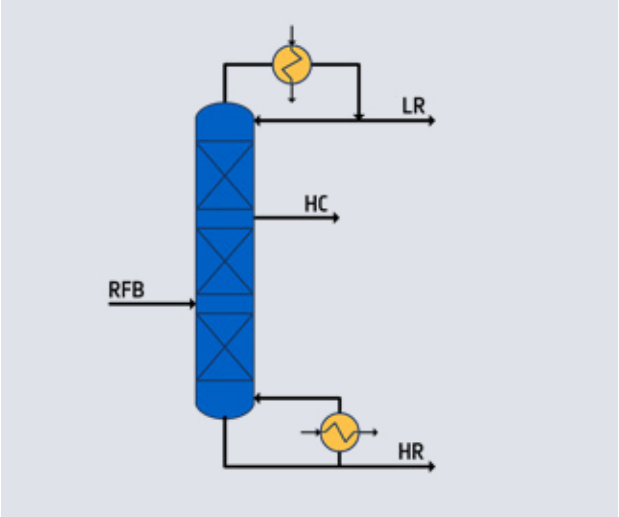

Fig. 2: Reformate distillation with side draw-off

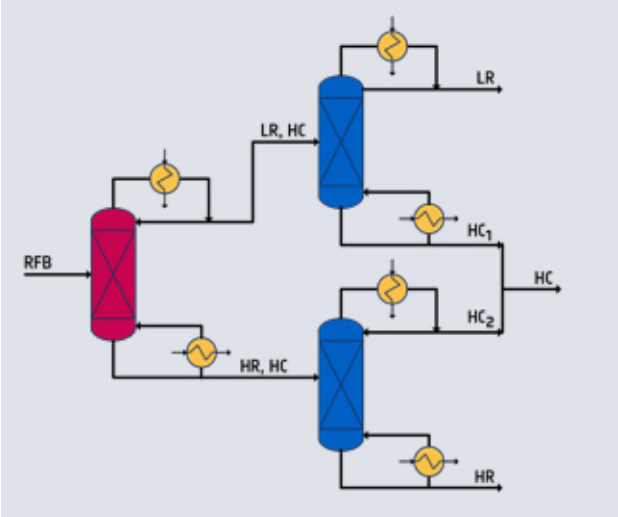

Fig. 3: Pre-fractionation with product distillation in two columns

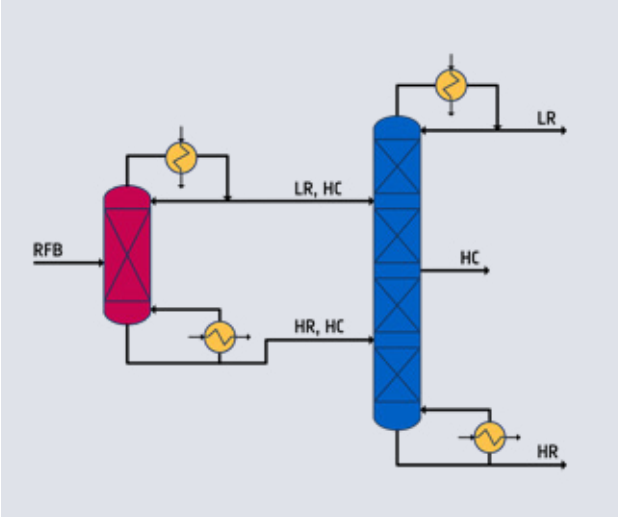

Fig. 4: Pre-fractionation and product distillation with side draw-off

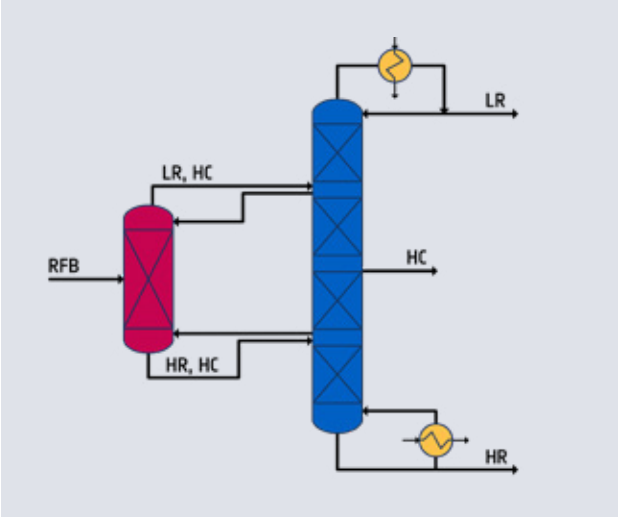

Fig. 5: PETLYUK sequence: pre-fractionation and product distillation with side draw-off

Abbrevations: RFB: Reformate · HR: Heavy Reformate · LR: Light Reformate · HC: Heart Cut · DWC: Divided Wall Column

CALCULATION AND DESIGN OF DIVIDED WALL COLUMNS

A divided wall column is calculated and designed based on a process simulation with the optimization of the number of trays, reflux ratio and the feed tray of the column system in Fig. 3 as follows:

- Optimization of the traditional number of trays and reflux (Chart 1)
- PINCH analysis through “Grand Composite Curve” of the columns (Chart 2)
- Vernier adjustment and optimization of the process simulation of the PETLYUK sequence as per Fig. 5 (Chart 3)
- Advanced internals such as packings, trays as well as liquid distributors and collecting systems for divided wall columns

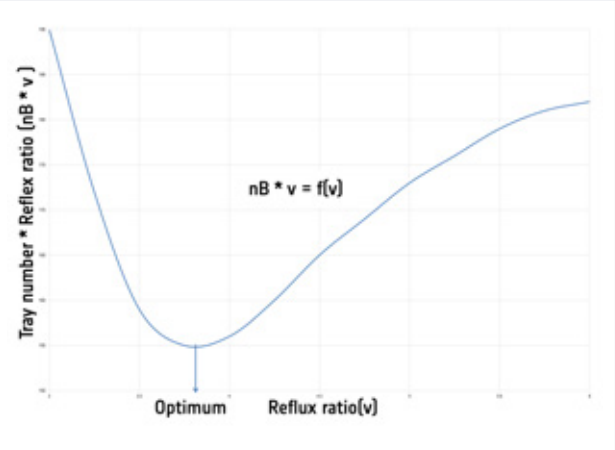

Chart 1: Optimization of the number of trays and reflux

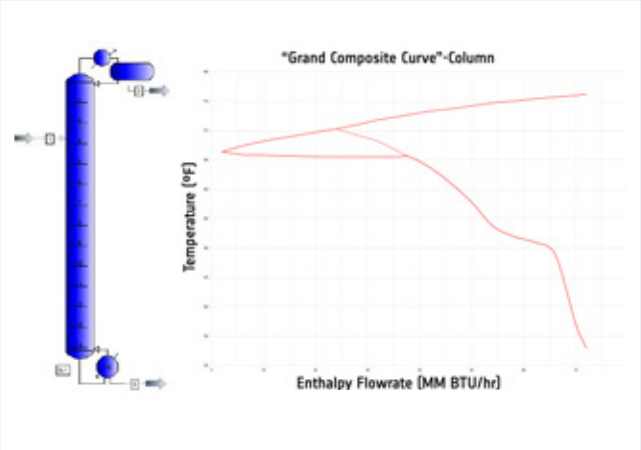

Chart 2: PINCH analysis “Grand Composite Curve” of the column

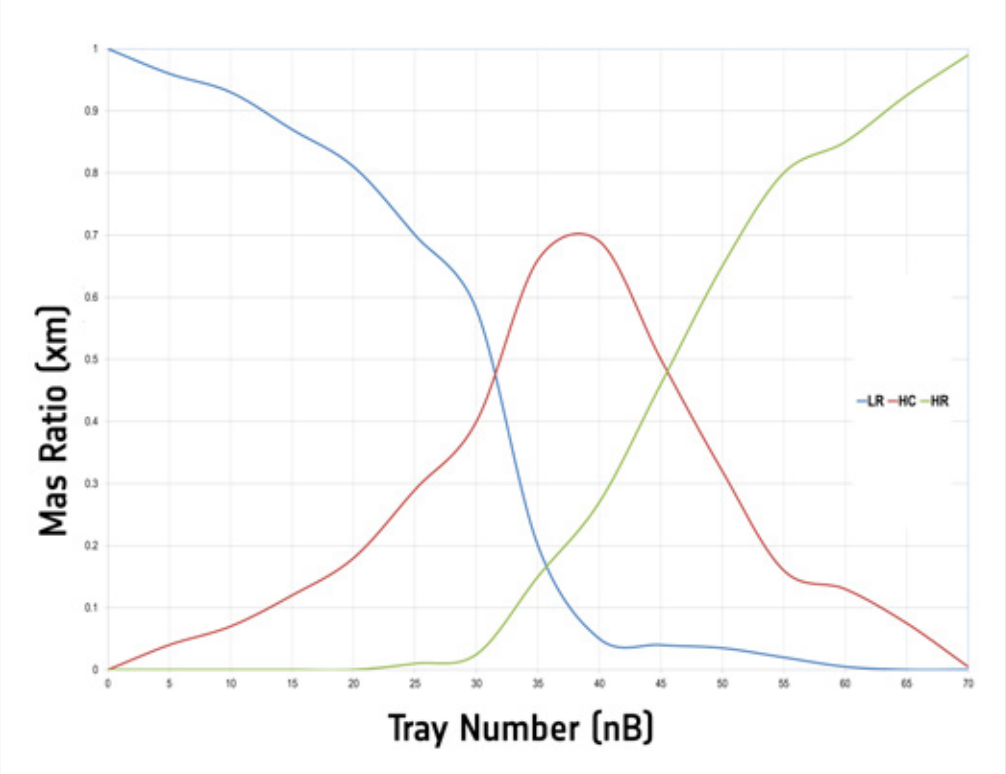

Chart 3: Optimization of the number of trays and reflux

Abbrevations: HR: Heavy Reformate · LR: Light Reformate · HC: Heart Cut

INNOVATIVE REVAMP OPTION FOR REFORMATE SPLITTER

In a revamp, the segment in the middle of the reformate splitter column can be replaced by a divided wall column. In doing so, the column head and bottom system including the existing peripheral equipment can be retained (Fig. 6). When using this option the advantages are as follows:

- Investment and operating cost savings while product quality increases
- Minimization of revamp and shutdown times
- Minimization of plant revamps
- No further space requirements

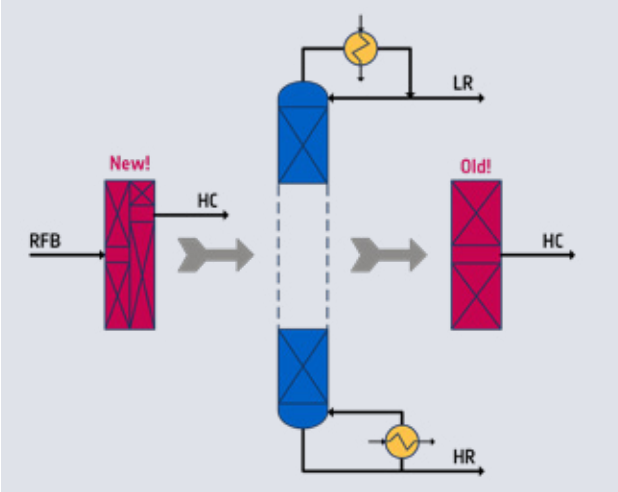

Fig. 6: Revamp option for reformate splitter

EDL SERVICES

- Studies for the use of divided wall columns with efficiency analysis
- Basic and extended basic engineering
- Detail engineering
- Construction supervision
- Commissioning

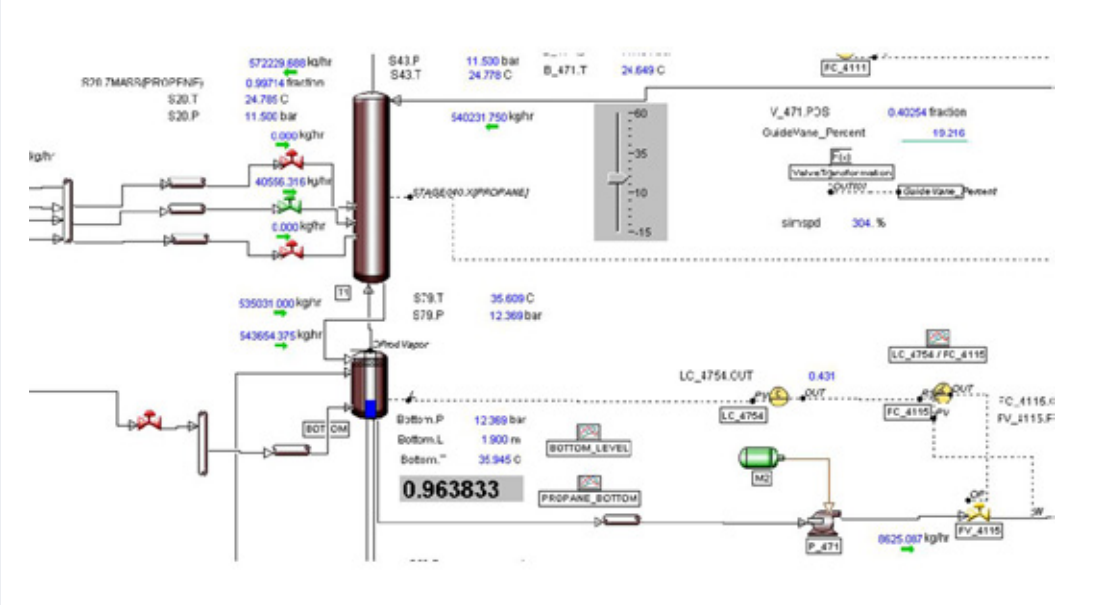

Fig. 7: Dynamic simulation

EDL Anlagenbau Gesellschaft mbH
Lindenthaler Hauptstr. 145
D-04158 Leipzig

Phone: +49 341 4664 400
Fax: +49 341 4664 409
Email: gf@edl.poerner.de

www.edl.poerner.de