

2. The simulation, synthesis and design of reactive and azeotropic distillation. Such topics still constitute a gap in the knowledge of distillation technology.
3. Investigation of complex configurations for batch distillation processes.
4. Use of optimization methods for obtaining optimal configuration and design of batch and continuous distillation processes.
5. Online optimization and control of columns.

See also: ■ **Distillation**: Batch Distillation; Theory of Distillation; Vapour-Liquid Equilibrium; Correlation and Prediction; Vapour-Liquid Equilibrium; Theory.

### Further Reading

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## Packed Columns: Design and Performance

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### Use of Packing in Distillation

Use of packing in mass transfer has its origins in the early 1800s for simple applications such as alcohol distillation, and in sulfuric acid plant absorbers. Glass balls, coke or even stones were used as packing materials. Nevertheless packings for distillation were not established until the 1930s with the use of regular shape materials such as ceramic Raschig rings and Berl saddles, as well as the availability of distillation calculations such as the McCabe-Thiele and Ponchon-Savarit methods. Early in the second half of the century, the use of packing for distillation went through a transformation, producing the second-generation packings (see Table 1). Regular and improved shape of packings, such as pall rings, became available with larger open areas that permitted a substantial increase both in capacity and column efficiency. In the 1960s Sulzer introduced the wire-mesh packings with very high efficiency (low height equivalent to a theoretical plate, HETP), resulting in a new transformation in the use of packings. In the 1970s

and 1980s all major mass-transfer equipment manufacturers developed structured packings. Compared to the traditional tray columns spectacular improvements in plant capacity were achieved, but also some projects were pitfalls, when the expected benefits did not materialize. Manufacturers started realizing that liquid distributors had to be improved, but there was no coherent understanding, nor correlations, that could lead to a safe distributor-column system design. Many manufacturers returned to trays, producing new improved designs, using the area under the downcomer for vapour flow: these trays are offered with new names that indicate their increased vapour flow capacity (Maxyflow, Supertrac, etc.). The need for good distribution and its effect on the column efficiency are now well understood, allowing safe design and efficient applications for random and structured packings in large industrial columns.

### General Concepts

Distillation separation is based in relative volatility that makes it possible to concentrate the more volatile components in the vapour phase while the less volatile ones remain in the liquid phase. Distillation columns are countercurrent vapour-liquid mass-transfer devices, where the required separation and purification of components is achieved.

# Packed Columns Design And Performance Peter Heft

**Richard Bailey**



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