

## Modification of Underwood's Equation to Calculate Minimum Reflux Ratio for Column with One Side Stream Upper Than Feed

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**Abstract :** Distillation is one of the most important and utilized separation methods in the industrial practice. There are different ways to design of distillation column. One of these ways is short cut method. In short cut method, material balance and equilibrium are employed to calculate number of tray in distillation column. There are different methods that are classified in short cut method. One of these methods is Fenske-Underwood-Gilliland method. In this method, minimum reflux ratio should be calculated by Underwood equation. Underwood proposed an equation that is useful for simple distillation column with one feed and one top and bottom product. In this study, Underwood method is developed to predict minimum reflux ratio for column with one side stream upper than feed. The result of this model compared with McCabe-Thiele method. The result shows that proposed method able to calculate minimum reflux ratio with very small error.

**Keywords :** minimum reflux ratio, side stream, distillation, Underwood's method

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