A simple distillation is incapable of significant purification if the boiling points of the components are too close. When the difference in boiling points is less than 100 °C, a modification is necessary, namely insertion of a fractionating column between the distilling flask and three-way adapter.

- **5.3A: Theory of Fractional Distillation**
  A simple distillation is incapable of significant purification if the boiling points of the components are too close. The distillate of a simple distillation is always enriched in the lower boiling compound. Every vaporization-condensation event (called a "theoretical plate") is similar to a simple distillation, and each event enriches the distillate in the lower boiling component.

- **5.3B: Fractionating Columns**
  The choice of what fractionating column to use for which application depends in part on availability and the task at hand. Different columns have different surface areas and numbers of theoretical plates, and thus differ in their ability to separate close-boiling components. They also differ somewhat in the quantity of compound that will be sequestered through wetting the column.

- **5.3C: Uses of Fractional Distillation**
  Fractional Distillation is used for both oil refining and purification of reagents and products. Fractional distillation is used in oil refineries (Figure 5.41) to separate the complex mixture into fractions that contain similar boiling points and therefore similar molecular weights and properties. Gasoline, diesel fuel, kerosene, and jet fuel are some of the different fractions produced by an oil refinery.

- **5.3D: Step-by-Step Procedures for Fractional Distillation**
  Other columns may be substituted. It is assumed that readers have previously performed a simple distillation, so in this section are described differences between simple and fractional distillation.

---

**Contributors**

- **Lisa Nichols** (Butte Community College). *Organic Chemistry Laboratory Techniques* is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. Complete text is available [online](#).