What is SFC?

Chromatography is a process in which a chemical mixture, carried by a mobile phase, is separated into components as a result of differential distribution of the solutes as they flow over a stationary phase. The distribution is the result of differing physical and/or chemical interactions of the components with the stationary phase. On a very basic level, chromatography instrumentation consists of (1) a delivery system to transport the sample within a mobile phase, (2) a stationary phase (the column) where the separation process occurs, (3) a detection system that identifies or distinguishes between the eluted compounds, and (4) a data collection device to record the results (see Fig. 1).

The choice of which chromatographic method to use depends on the compounds being analyzed. In gas chromatography (GC), the mobile phase that carries the sample injected into the system is a gas. GC is generally a method for volatile and low molecular weight compounds. High-performance liquid chromatography (HPLC) is primarily used for analysis of nonvolatile and higher molecular weight compounds. A combination of desirable characteristics from both of these methods can be obtained by using a supercritical fluid as the mobile phase. A supercritical fluid is a substance above its critical point on the temperature/pressure phase diagram (see Fig. 2). Above the critical point, the fluid is neither a gas nor a liquid, but possesses properties of both.

The advantage of SFC is that the high density of a supercritical fluid gives it the solvent properties of a liquid, while it still exhibits the faster physical flow properties of a gas. In chromatographic terms, supercritical fluids allow the high efficiency and detection options associated with gas chromatography to be combined with the high selectivity and the wider sample polarity range of high-performance liquid chromatography. Applications that are unique to SFC include analysis of compounds that are either too polar, too high in molecular weight, or too thermally labile for GC methods and are undetectable with HPLC detectors. Another benefit of SFC over LC is the reduction of toxic solvent use and the expense associated with solvent disposal. This aspect has become increasingly important as environmental awareness becomes a larger issue.

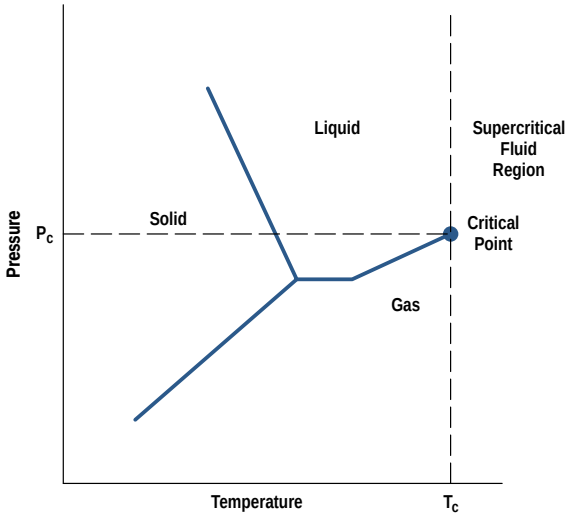

Fig. 2. Phase diagram with critical point and supercritical region.

Hewlett-Packard developed and manufactured its first SFC instrument in 1982. For the past decade, SFC has primarily been used in R&D laboratories. The market has now expanded to include routine analysis for process and quality control as SFC is continuing to gain acceptance as a complementary technique to GC and LC.

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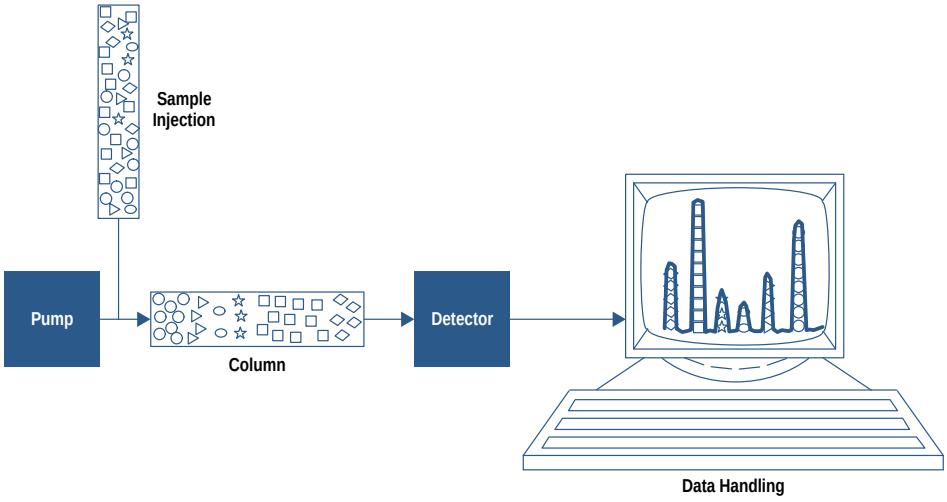

Fig. 1. Basic components of a chromatographic system.