DEVELOPMENT OF ANALYTICAL METHODS TO TEACH SEPARATIONAL ASPECTS IN LABORATORY EDUCATION

By

KAPILA SARATH UPULVAN NAVARATNE

Dissertation submitted in partial fulfillment of the requirements for the degree of MASTER OF PHILOSOPHY of the UNIVERSITY OF COLOMBO, SRI LANKA.

May, 2000

University of Colombo
Sri Lanka.

Abstract

In modern industrialized society, the analytical chemist has a very important role to play. Thus, most manufacturing industries rely upon both qualitative and quantitative chemical analysis to ensure that the raw materials used meet certain specifications, and to check the quality of the final product. One of the major decisions to be made by an analyst is the choice of the most effective technique to determine the amount of analyte present in a given sample. Frequently, there are substances present that prevent direct measurement of the amount of a given analyte, referred as interferences. The selection of methods for separating the interferences from the substance to be analyzed are as important as the choice of the method of determination. Hence, it is important to introduce the concepts of separational techniques for the students who are trained to be analytical chemists in their laboratory courses. Several analytical methods have been designed to teach separational aspects in teaching laboratories.

Colorimetric and spectrophotometric methods have been designed to introduce important aspects of ion exchange chromatography and solvent extraction. In the design of these methods, a highly stable, coloured 1,10-phenanthroline system was used as a chromogenic reagent. Important aspects of ion exchange chromatography and ion exchange resins; the determination of breakthrough capacity, the effect of operating conditions and total capacity have been introduced using Colorimetric and spectrophotometric techniques.

The fundamental principles of solvent extraction; the determination of patrician coefficient of an analyte, the effect of experimental conditions on the extraction of neutral ion association complexes and the extraction spectrophotometric determination of an analyte of interest have been introduced using model experiments.

The effectiveness and the analytical applicability of the designed methods were evaluated by comparing with the available methods. The results of the designed methods were in good agreement with those obtained from the available methods. The designed model experiments can be used successfully to introduce the aspects of separational techniques in teaching laboratories. Simplicity, short experimental duration, reduced cost, reduced waste generation and the visual approach of the model experiments make them ideal for teaching laboratories. Extraction spectrophotometric experiments designed for the determination of the active ingredient in aspirin tablets and total fatty matter in soap can be used in analytical laboratories for routine analysis.