ABSTRACT

Traditionally, analyzing more than one active pharmaceutical ingredient (API) with UV spectrophotometry poses a challenge as both species often absorb over the same spectral region, causing deviations from Beer’s Law. This linear relation between absorbance and the absorbing species is used to calculate concentration values based on the measured absorbance at a specific wavelength. Separation techniques such as HPLC are often reverted to when analyzing mixtures with more than one API due to the concentration calculation errors caused by the spectral overlap. However, Multicomponent Analysis (MCA) algorithm and complete spectral profiles collected using a fiber optic UV-disolution analyzer overcome these obstacles. This is accomplished using the Classical Least Squares form of Multiple Linear Regression to analyze the two spectrally overlapping components. The algorithm uses a calibration matrix of extinction coefficients derived from the spectra of multiple standard solutions to calculate component concentrations in an unknown mixture. This study demonstrates the MCA algorithm capability, used in tandem with in-situ fiber optics, to accurately monitor and quantify the dissolution profile of a commercial product containing two APIs, eliminating the need to draw samples for HPLC analysis.

INTRODUCTION

This poster explains the theory behind the MCA algorithm methodology. Then, used in tandem with in-situ fiber optics, the accuracy of the technique is demonstrated by recovering the concentration of two APIs in known mixed solutions. Finally, a example is given of accurately monitoring and quantifying the dissolution profile of an actual commercial product containing two APIs, demonstrating the elimination of the need to draw samples or to perform HPLC analysis for many of these type of products.

UV spectrophotometry combined with MCA has been demonstrated to yield accurate analysis of the absolute concentrations of each component in two component mixtures. The technique has been also successfully applied to measuring the separate dissolution rates of two APIs in a commercial available product. These results demonstrate the method can accurately quantify two components with highly overlapping spectra without the need for a separation step. The key to this process is using large data sets consisting of spectral data of over 200 absorbance maxima per point. This rich data set collection is enabled by the use of in-situ sampling utilizing fiber optic probes which analyze the sample within the vessel. This circumvents the limit of the speed of moving the liquid from vessel to the analyzer that encumber traditional methods such as HPLC or conventional UV spectroscopy. An additional benefit of the instantaneous data collection of in-situ probes is that they allow near real-time dissolution analysis.

As an example of the ability of this method to measure the concentrations of components in a mixed solution, known mixtures of two compounds found in common OTC products, Acetaminophen and Caffeine, were prepared. The spectra of pure standards of Acetaminophen and Caffeine were measured. The spectra of pure standards of Acetaminophen and Caffeine were shown in Figure 3. The technique was then used to analyze data collected using the Distek Opt-Diss 410 Fiber Optic Dissolution System from five mixtures with varying amounts of Acetaminophen and Caffeine. The computed values produced by the Opt-Diss 410 MCA software are compared to the actual values in the Table 3 and represented graphically in Figure 2. One can clearly see that the method accurately quantitates the amounts of Acetaminophen and Caffeine in mixtures with an error well less than 2%. To illustrate the applicability of the tech-