Abstract

Prediction of dissolution profile of tablets for tuberculosis using near infrared spectroscopy and multivariate calibration

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Introduction

This work used NIR spectroscopy and multivariate calibration to determine dissolution profiles of four active ingredients (isoniazid, rifampicin, ethambutol, pyrazinamide) in tablets for the treatment of pulmonary tuberculosis produced by UFRN. The analytical methods used conventionally in quality control (dissolution profile) of drugs by the pharmaceutical industry are mainly high-performance liquid chromatography (HPLC). These methods are slow, destructive and invasive, have a high cost of operation and maintenance and generate waste chemicals harmful to the environment.

Materials and Methods

NIR reflectance spectra (in triplicate) of 38 samples were measured using an FT-NIR Bomem MB 160 spectrophotometer in the 800-2500 nm range. Each measured spectrum was the average of 50 scans obtained at a resolution of 8 cm^{-1}. No sample preparation was needed since the entire tablet was analysed by diffuse reflectance. Spectra and calibration set, full cross-validation tests were treated and correlated with the dissolution profiles results by using The Unscrambler® 9.8 from Camo (Trondheim, Norway). Three tablets from each batch were evaluated for dissolution profile by using an Erweka dissolution apparatus. The dissolution testing was performed in 900 mL 0.1 N chloride acid at 37 ± 0.5°C and the percentage of drug dissolution from each tablet was measurement at the same time interval (45 min), at pH 6.8. For the measurement of isoniazid, rifampicin, ethambutol, pyrazinamide, HPLC (Shimadzu - Japan) was performed using an isocratic system (LC-20AT, SPD-M20A) dual absorbance detector and SIL-20A auto sampler. The influence of various spectral pre-treatments [Savitzky-Golay smoothing, multiplicative scatter correction (MSC), first derivative (D1), second derivative (D2) separately and combined]and regression methods (PLS1 and PLS2) on prediction error are compared.

Results and Discussion

The squared correlation coefficients for the plots of dissolution from the laboratory equipment (dissolution apparatus and HPLC determination) versus the predicted values (NIR) varied from 0.88 to 0.98. Prediction errors (RMSEP) using PLS2 models varied between 9.99% for isoniazid, 8.63 for rifampicin, 8.57 for ethambutol and 9.97 for pyrazinamide.

Conclusion

These results indicate that the NIR diffuse reflectance spectroscopy method is an alternative, non-destructive tool for measurement of drug dissolution in tablets.

Reference paper as:
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