

# The Development of Non-Destructive Testing Techniques for Transdermal Drug Delivery System Characterization

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## ABSTRACT

The applicability of microwave non-destructive testing (NDT) technique in characterization of matrix property and drug content of polymer films for use as transdermal drug delivery system (TDDS) was investigated. Hydroxypropylmethylcellulose (HPMC) was selected as model matrix polymer, polyethylene glycol (PEG) 3000 as plasticizer, with loratadine and chlorpheniramine maleate as model drugs. Both blank and drug loaded HPMC as well as HPMC-PEG 3000 films were prepared using the solvent-evaporation method. The films were conditioned at the relative humidity of 25, 50 and 75% prior to drug content assay and physicochemical characterization using established methods such as ultra-violet spectrophotometry, differential scanning calorimetry and Fourier transform infrared spectroscopy, as well as, novel microwave NDT technique. The absorption and transmission characteristics of both blank and drug loaded films for microwave NDT technique varied with the state of polymer-polymer, polymer-plasticizer, and/or drug-polymer interactions. The measurement of microwave NDT test at 8 GHz was sensitive to the chemical environment involving polar functional group such as O-H moiety while it was greatly governed by the less polar functional group such as C-H and aromatic C=C moieties in test conducted at 12 GHz. The measurement could also serve as an indicator in quantification of drug content via the measurement of power transmission coefficient (quadratic regression model:  $r = -0.87$ ,  $p < 0.05$ ) of the TDDS. The results reported in this study show that microwave NDT technique is potentially suitable for the characterization of matrix property as well as drug content of polymer films for use as TDDS.