Mean Kinetic Temperature - and Relative Humidity? A Reappraisal

By **William R. Porter Aug 28, 2017 7:00 am EDT**

Abstract

The concept of “mean kinetic temperature” for pharmaceutical liquid products is extended to include the effects of changes in relative humidity on the degradation kinetics of pharmaceutical solids using different approaches to model the effect of water vapor on degradation rates. The Arrhenius model for the effect of temperature on reaction rates in solution can be modified to incorporate the effects of moisture on solid reactants by approximations using relative humidity as a surrogate for water activity. Alternate approaches to defining a set of mean kinetic temperature and relative humidity isokinetic pairs are developed assuming that degradation rates are linearly proportional to either the relative humidity or its natural logarithm and are shown to be essentially equivalent over the range of relative humidity encountered in accelerated stress degradation experiments and that both are good simplifying approximations to an alternate model based on the GAT adsorption isotherm.

Key Points

- Mean kinetic temperature, as used in regulatory guidance, really applies only to pharmaceutical liquid products. The concept is not meaningful for solid pharmaceutical products in the case where degradation is influenced by changes in relative humidity.
- Different authors have proposed alternative formulations of an expanded Arrhenius model for the degradation of solid pharmaceutical products so as to incorporate the effects of changes in relative humidity.
- The concept of a unique mean kinetic temperature is replaced by the concept of a continuous set of isokinetic mean kinetic temperature and mean kinetic relative humidity values to describe the degradation kinetics of solid pharmaceutical products.