

PURPOSE

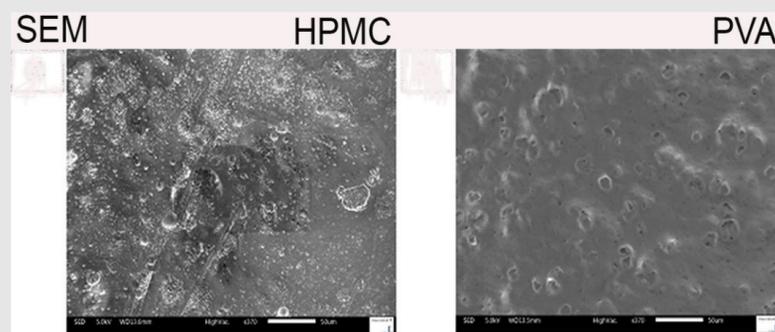
Drying controls physical and mechanical properties of polymeric films [1,2]. The objective of this work was to study and model drying kinetic of multicomponent films of two water soluble polymers; HPMC (amorphous) and PVA (semicrystalline).

METHOD

The multicomponent films were prepared by the solvent casting method using a film applicator. A laboratory convective drying oven and thermogravimetric analysis (TGA) methods were used to study the isothermal drying kinetics. Hill equation with three parameters (W_{max} , τ , n) was proposed to explain drying behaviour for the first time.

Moreover, polarization and hot stage-microscopy, scanning electron microscopy (SEM) and differential scanning calorimetry (DSC) were used to investigate in situ solid state of the polymeric films.

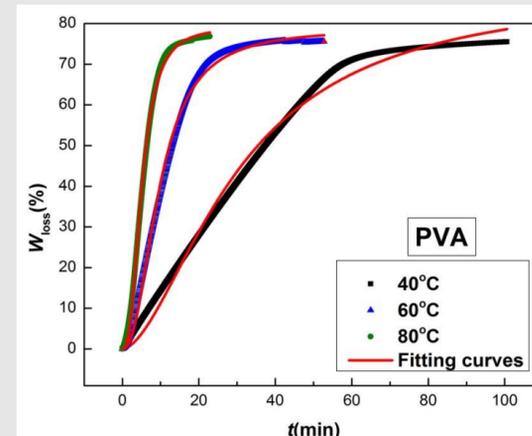
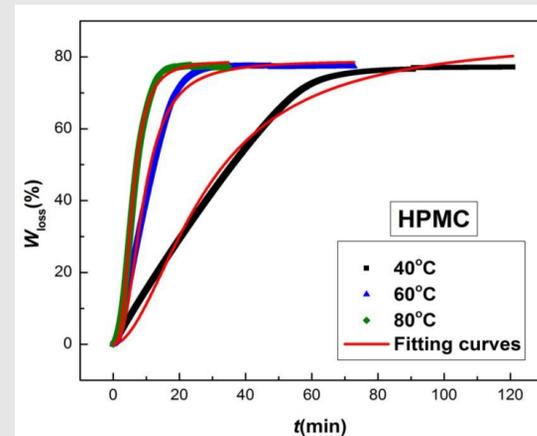
RESULTS



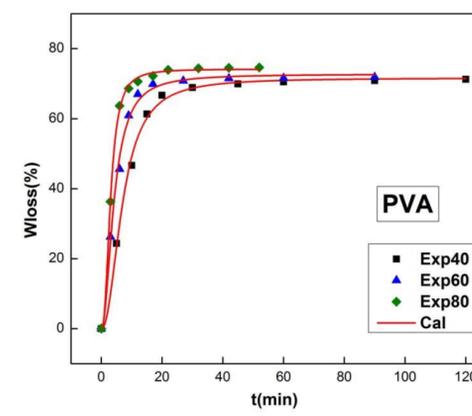
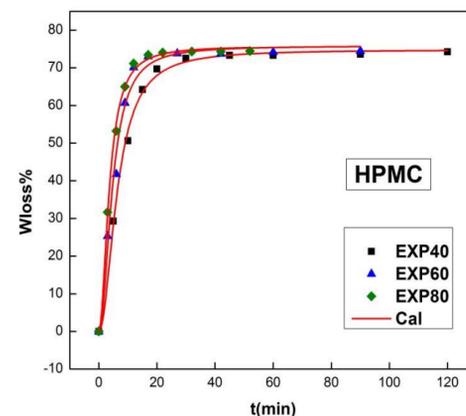
SEM of the post dried films of HPMC and PVA in TGA at 80°C for 60 min.

$$W_{loss} = \frac{W_{max} t^n}{\tau^n + t^n}$$

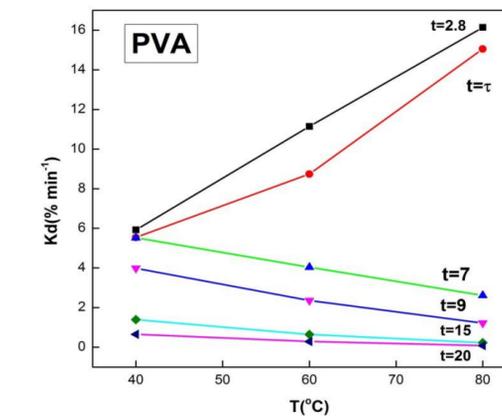
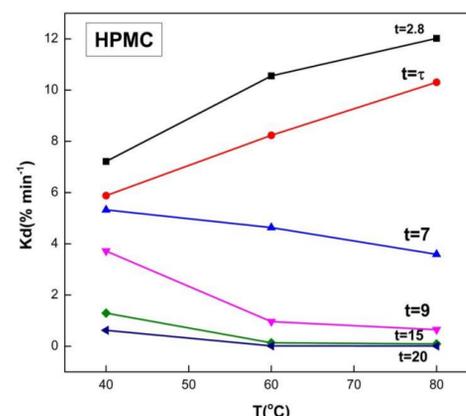
W_{loss} : Mass change during the dehydration process
 t : Time of the dehydration process
 W_{max} : Maximum value of weight loss during the time
 τ : Size parameter
 n : Shape parameter



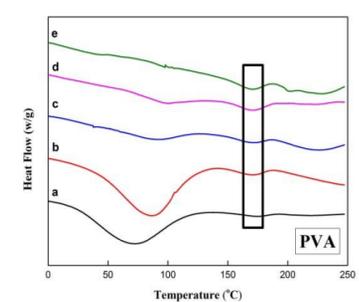
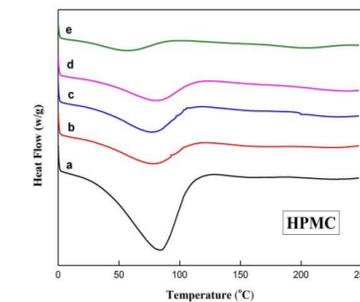
W_{loss} (%) vs time for HPMC and PVA films at various temperatures in TGA



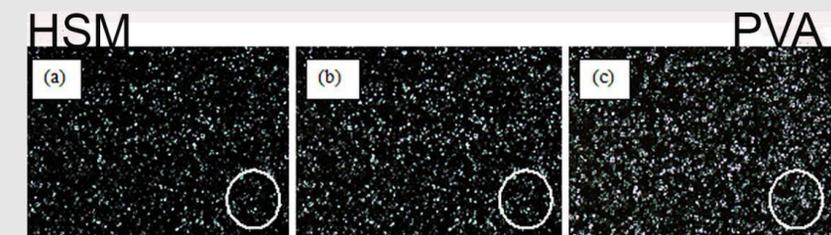
W_{loss} (%) vs time for HPMC and PVA films at various temperatures in oven



Drying rates (Kd) of HPMC and PVA films before and after the characteristic time (τ)



DSC of post dried HPMC and PVA films in TGA at 80°C for (a) 5, (b) 10, (c) 20, (d) 30, (e) 60 min drying.



HSM images of PVA at 80°C for (a) 10, (b) 30, (c) 60 min drying.

CONCLUSIONS

- TGA could be used as a simple tool to predict drying end points in drying processes like drying tunnels.
- Hill equation with three parameters well explained drying kinetics and diffusion mechanisms of the solvent in the polymeric films.
- Bi-phasic diffusion kinetics was observed (fickian/non-fickian).
- In situ solid state changes in the polymer was observed to effect drying kinetics of the films.

REFERENCE

- 1) Hoffmann EM, Breitenbach A, Breikreutz J., Expert Opin Drug Deliv. 2011;8(3):299-316.
- 2) Zhang H, Wang Q, Li L., Polym Int. 2009;58(1):97-104.