Gelatin-based nanocomposite films: a study on dispersion methods and concentration of montmorillonite

C.H.C. Flaker; R.V. Lourenço; A.M.Q.B. Bittante; P.J.A. Sobral

FZEA-USP, Brazil
Biodegradable Films

• An alternative to replace synthetic by biodegradable materials for food packaging is the development of films based on biopolymers.

• Gelatin is a biopolymer which has an excellent film-forming property.
  
  ✔ Mechanical properties
  ❌ Water vapor barrier
Nanoparticles as reinforcement

- Montmorillonite.
  - Mechanical properties
    - (RAO 2007; BAE et al. 2009).
  - Water vapor permeability
    - (TUNC et al. 2003).
  - Thermal stability
    - (ZHENG et al. 2002).

- Reinforcement limited by the dispersion state in the biopolymer matrix.
Objectives

• To study the quality of the dispersion of nanoparticles (montmorillonite) in water (used as solvent for film production).

• To analyze the effect of the concentration of montmorillonite (MMT) on some physical and functional properties of gelatin films.
Dispersion of MMT in water

- Distilled Water
- Montmorillonite [Nanomer® clay‖, PGV, Sigma] (MMT)

• MMT Dispersion (30 min)
  - Mechanical Homogenizer [T25, IKA] (UT)
  - Ultrasonic Processor [750W, Sonics] (US)
  - Colloidal Mill [SPEX Type] (CM)

• Characterizations
  - Particle size by PCS & ζ-potential [ZetaPlus, BIC]
  - Atomic Force Microscopy [NT-MDT]
  - Scanning electron Microscopy [TM3000, Hitachi]
Nanocomposite films

- Pigskin gelatin (30 g/100 g Solution)
- Glycerol (30 g/100 g Gelatin)
- MMT Dispersion (1, 3, 5 & 7 g/100 g Gelatin)
- Control films (without MMT)

[Spread Casting; Speed II, TKB Erichsen]  [Air Drying, 30°C/24 h]  [Conditioning, 58% RH/7 Days]
Films characterization

[NGL 20/60, Rhodopoint]  Contact angle  [TM3000, Hitachi]

AFM  [TA.XT icon, SMS]  Water vapor Permeability
Final Remarks

• The dispersion method used had a slight influence on the quality of dispersions.

• The critical concentration of montmorillonite as reinforcement seemed to be limited to 5 g of MMT/100 g of gelatin.
Acknowledgment

• To the FAPESP for the grant (13/07914-8) and MS fellowship (11/15784-1) of the first author.
Questions?

Thank you!

Christian H. C. Flaker
USP-FZEA

crisflaker@hotmail.com