

Physico-chemical, antimicrobial and antioxidant properties of gelatin-chitosan based films loaded with nanoemulsions encapsulating active compounds

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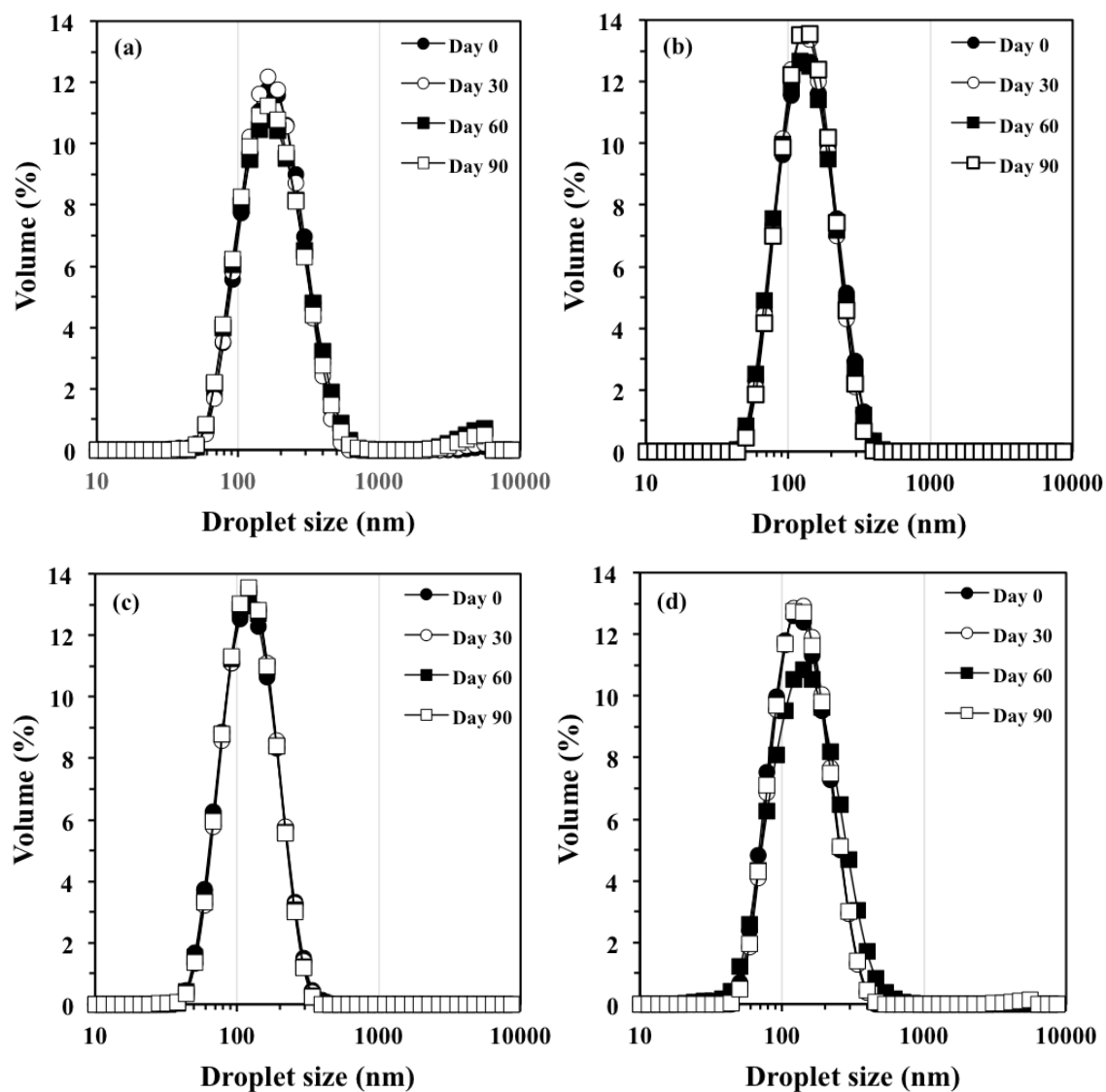


Figure 1. Droplet size distributions of O/W nanoemulsions containing encapsulated active compounds as a function of storage time (all systems stored at 4 °C). **(a)** Control (no encapsulated species); **(b)** α -tocopherol/cinnamaldehyde; **(c)** α -tocopherol/garlic oil; and **(d)** α -tocopherol/cinnamaldehyde and garlic oil.

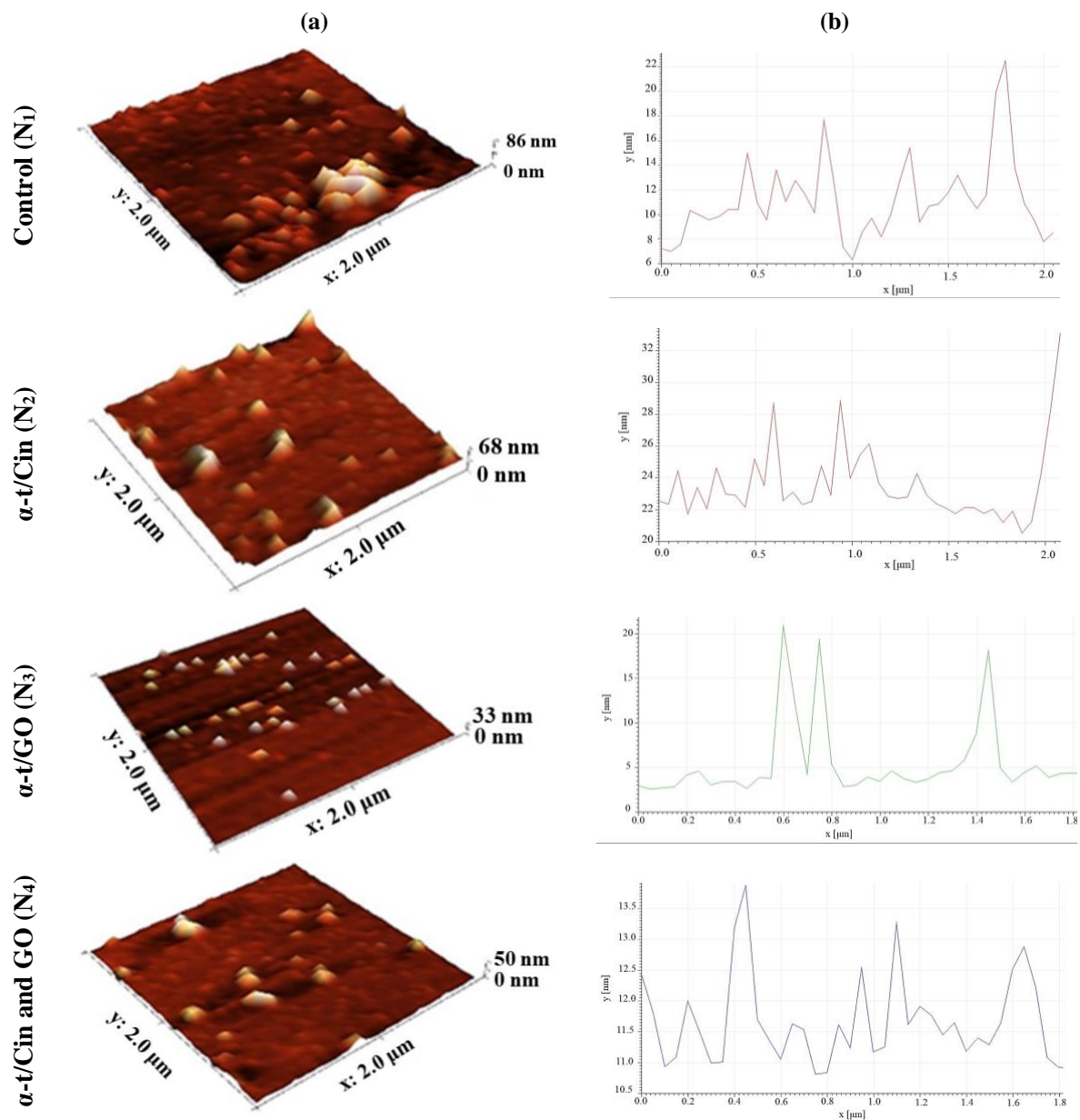


Figure 2. (a) 3-D AFM topographic images, and (b) profile of the height values along the sample in the marked area of 2D AFM images of O/W nanoemulsions containing encapsulated active compounds. * α -t: α -tocopherol, Cin: cinnamaldehyde, GO: garlic oil.

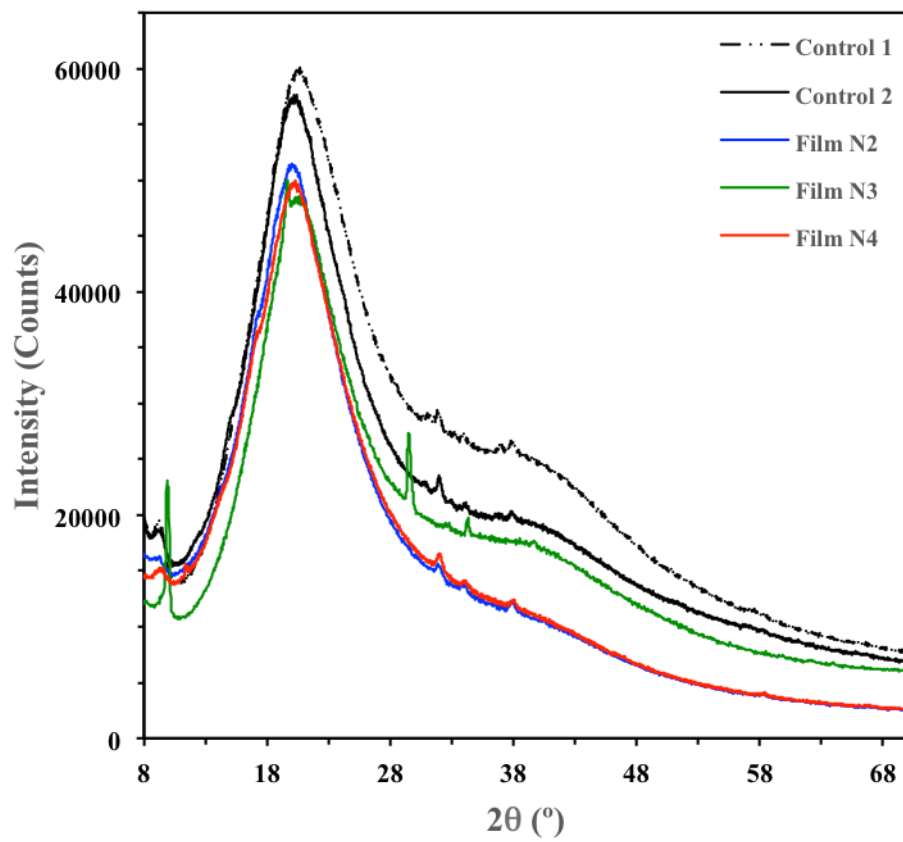


Figure 3. Diffractograms of gelatin-chitosan films loaded with O/W nanoemulsions containing encapsulated active compounds. N₀ - Control 1: film without nanoemulsion; N₁ - Control 2: film with control nanoemulsion (no encapsulated species); N₂: α -tocopherol/cinnamaldehyde; N₃: α -tocopherol/garlic oil; N₄: α -tocopherol/cinnamaldehyde and garlic oil-loaded nanoemulsion.

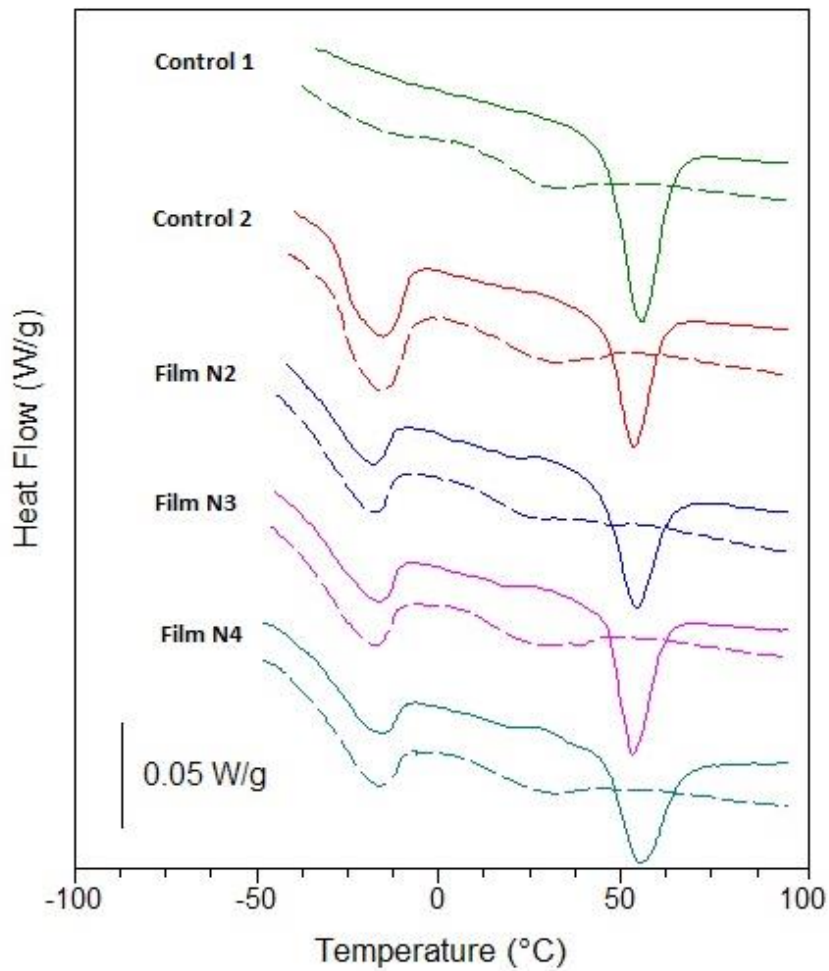


Figure 4. DSC thermograms of gelatin-chitosan films loaded with O/W nanoemulsions containing encapsulated active compounds. N₀ - Control 1: film without nanoemulsion; N₁ - Control 2: film with control nanoemulsion (no encapsulated species); N₂: α -tocopherol/cinnamaldehyde; N₃: α -tocopherol/garlic oil; N₄: α -tocopherol/cinnamaldehyde and garlic oil-loaded nanoemulsion. Straight traces correspond to the first scan and broken traces for the second scan.

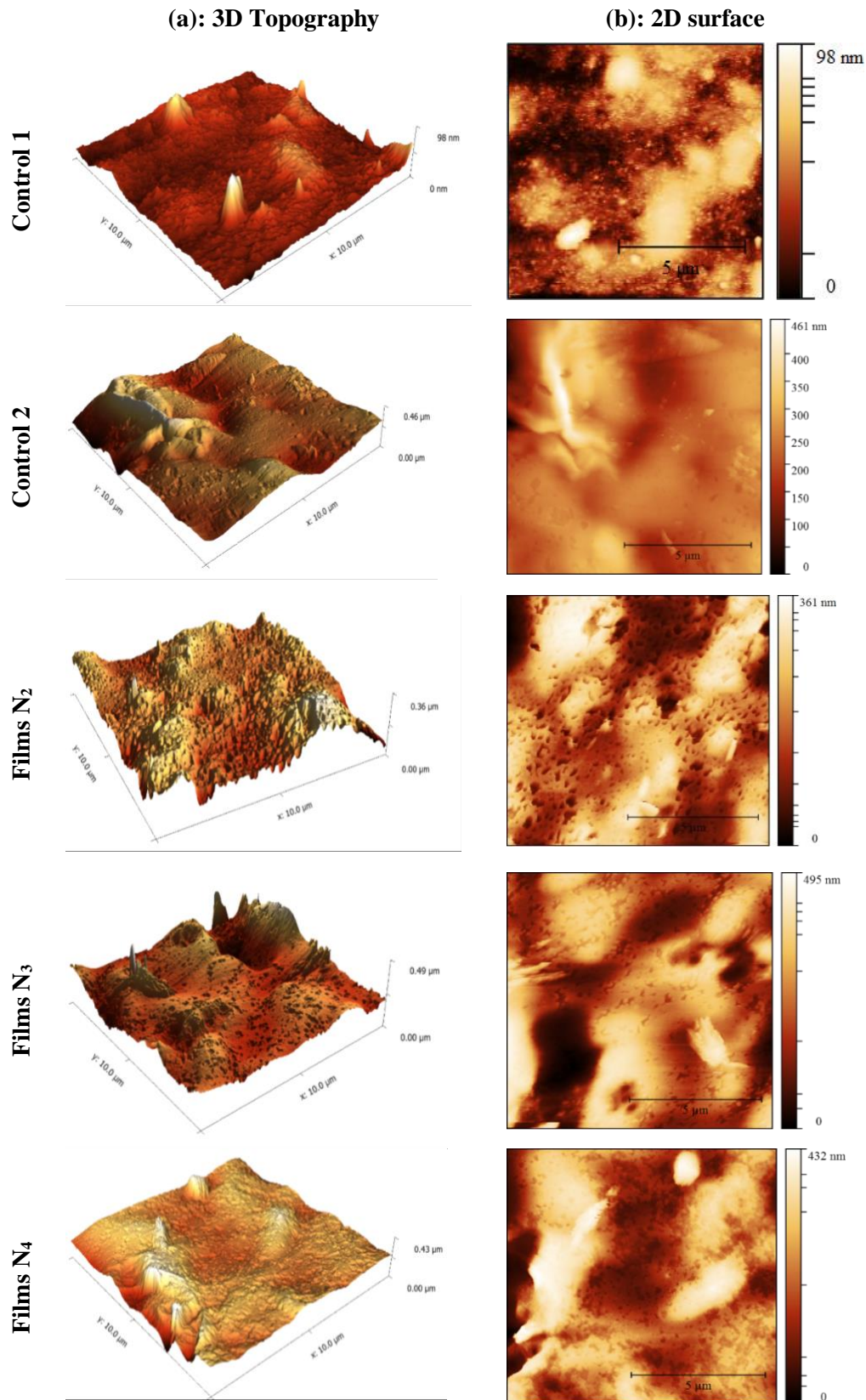


Figure 5. AFM micrographs of (a) 3D topography and (b) 2D surface of gelatin-chitosan films loaded with O/W nanoemulsions containing encapsulated active compounds. N₀ - Control 1: film without nanoemulsion; N₁ - Control 2: film with control nanoemulsion (no encapsulated species); N₂: α -tocopherol/cinnamaldehyde; N₃: α -tocopherol/garlic oil; N₄: α -tocopherol/cinnamaldehyde and garlic oil-loaded nanoemulsion.

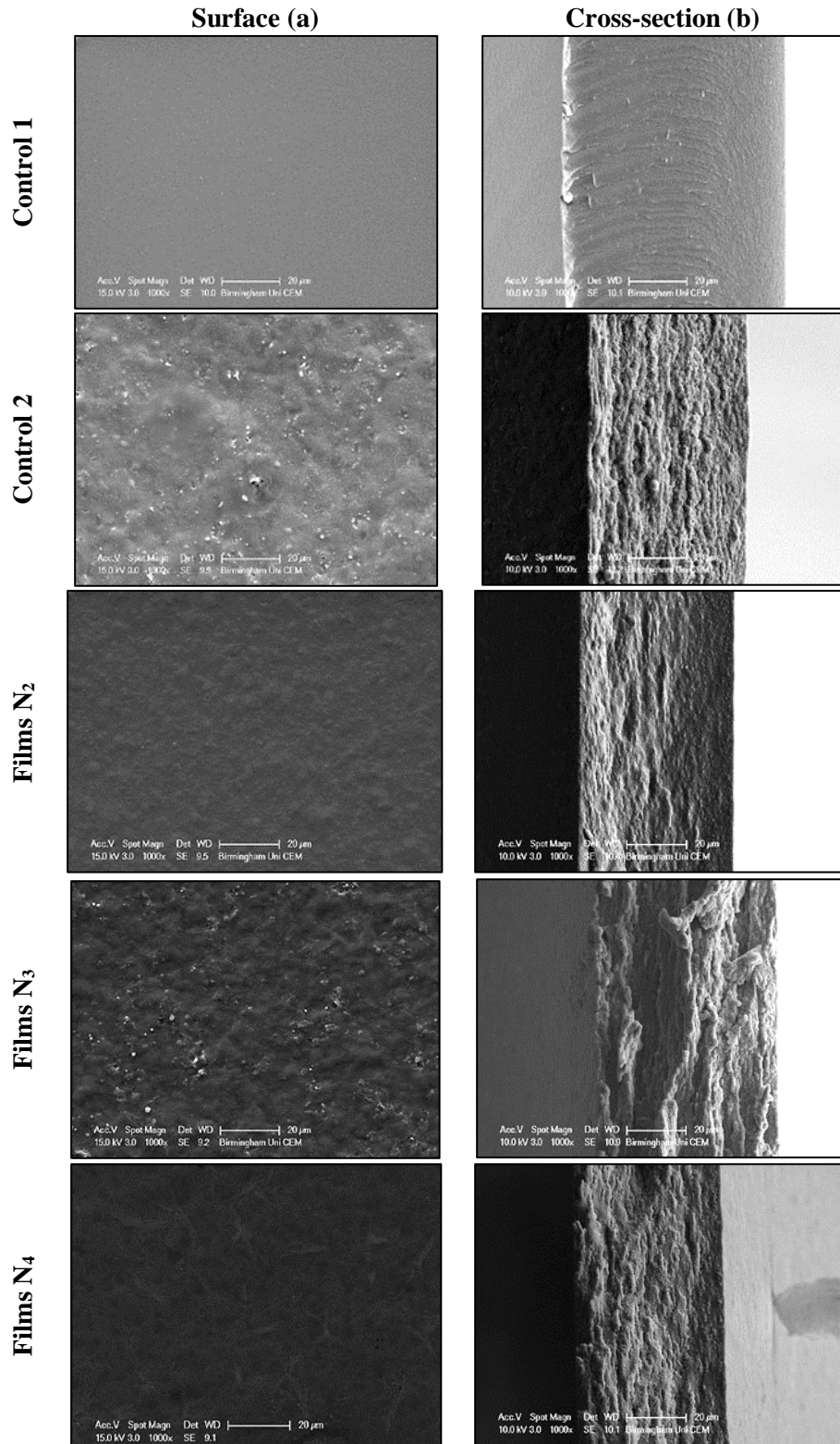


Figure 6. ESEM micrographs of the a) surface and b) cross section of gelatin-chitosan films loaded with O/W nanoemulsions containing encapsulated active compounds. N₀ - Control 1: film without nanoemulsion; N₁ - Control 2: film with control nanoemulsion (no encapsulated species); N₂: α -tocopherol/cinnamaldehyde; N₃: α -tocopherol/garlic oil; N₄: α -tocopherol/cinnamaldehyde and garlic oil-loaded nanoemulsion.