Contribution ID: **116** Type: **Oral**

Electrospun nanofibers of polylactide (PLLA)/ polyglutamic acid (γ-PGA) blends and their use as ammonia detecting kits in intelligent meat packaging

Sunday 27 November 2016 15:50 (15 minutes)

Freshness of products is a key factor for food industry to monitor to ensure high quality products and retain customers'satisfactory. Integrity package is capable of pointing out the quality of the products, based on the reaction between indicator and metabolites of spoilage microorganisms. In these regards, detection of volatile compounds such as ammonia gas is one of effective approaches in monitoring meat freshness. Functionalized nano-sensors, such as nanofibers with high surface areas and light weight, are attractive candidates for use in these applications by embedding in package headspace. This can lead to enhancement in detection efficiency of the devices. In this work, nanofibers of blends of biodegradable and biocompatible polylactide (PLLA) and hydrophilic polyglutamic acid (γ-PGA) are prepared by electrospinning. This leads to a combination of carboxylic acid functional groups on supporting PLLA matrix nanofibers. The nanofibers are prepared at 4 PLLA/γ-PGA ratios (100/0, 95/5, 85/15 and 75/25). To restrain the presence of γ-PGA, the blended fibers are cross-linked by employing reaction of their carboxylic acid and hydroxyl groups of glycerol (G) and ethylene glycol (EG). FTIR and SEM results suggest that the γ-PGA component is released from the original (untreated) PLLA/γ-PGA fibers when submerged in water, while those cured by EG and G can retain high amount of γ-PGA on the fibers. Comparing the efficiency of cross-linkers, EG exhibits high value of retaining γ-PGA due to its higher the reactivity. The ammonia absorption activity of the materials are examined. The results clearly depict that the fibers can absorb ammonia molecules by using the reaction of carboxylic acid groups on γ-PGA. The materials have high potential for use as test kits for monitoring meat freshness or in extending shelf life of the products.

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Session Classification: Falcon 1

Track Classification: Nanomaterials & nanostructures