PHYSICAL PROPERTIES OF EDIBLE FILM MADE FROM AL-ASHAR/GELATIN

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ABSTRACT

Al-Eshar (Calotropis) is a natural Eco-friendly Packaging materials whereas they are safety and healthy. Physical properties of edible film made from Al-Eshar and Gelatin was investigated. Edible films were prepared using different ratios of Al-Eshar to Gelatin (1:1, 1:2, 1:3 and 1:4) whereas Al-Eshar concentration was constant and Gelatin concentration was changed. Physical properties of edible films (TGA, tensile strength, elongation, transparency) were investigated.

Keywords: Al-Eshar, Calotropis, Edible Films, Gelatin, (TGA), Transparency

I. INTRODUCTION

Calotropisprocera is a member of the plant family, Asclepiadaceae, a shrub widely distributed in West Africa, Asia and other parts of the tropics. The plant is erect, tall, large, branched and perennial with milky latex throughout .A large quantity of latex can be easily collected from its green parts. Local people use it successfully to combat some cutaneous fungal infections. The abundance of latex (containing alkaloids) in the green parts of the plant reinforces the idea that it produced and accumulated latex as a defense strategy against organisms such as virus, fungi and insects. (Abbas, et al., 1992 and Carlini & Grossi-de Sa, 2002).

It is known by various vernacular names like Swallow wort in English, madar in Hindi, and Alarka in Sanskrit. It is found in most parts of the world with a warm climate in dry, sandy and alkaline soils. Calotropis is primarily harvested because of its distinctive medicinal properties. It is commonly referred to as ark, swallow-wart or milkweed and it occurs frequently in Indonesia, Malaysia, China, and the Indian subcontinent as wasteland weed. Calotropisprocera Linn is an erect, tall, large, highly branched and perennial shrub or small tree that grows to a height of 5.4 m, with milky latex throughout. The bark is soft and corky, the branches are stout, terete with fine appressed cottony pubescence (especially on young). The leaves are sub-sessile, opposite, decussate, broadly ovateoblong, elliptic or obovate, acute, thick, glaucous, green, covered with fine cottony pubescent hair on young but glabrous later and base cordate. Flowers in umbellate-cymes and tomentose on young, Calyx glabrous, ovate and acute. The corolla is glabrous, the lobes erect, ovate, acute, with coronal scales 5-6, latterly compressed and equally of exceeding the staminal column. (Ajay, et al., 2011)

Fig. 1 Calotropisprocera Flowering Shoot

Edible film is defined as a thin, continuous layer of edible material, which can extend the shelf-life and improve the quality of almost any food system by serving as a barrier to mass transfer or

as a mechanical protection (Torres, 1997). The incorporation of antibiotics or antioxidants to edible films or coating has gained considerable interest owing to the increased potential to retard the deterioration by microorganism or oxidation at the food product surface (Guilbert, 1996)

Edible films can be prepared from polysaccharides, hydrocolloids, proteins, and their combinations. The advantage of an edible coating is that it can be applied to foods by dipping or spraying and may be used to inhibit the migration of ingredients in processed foods, minimally processed vegetables, raw meat, etc., and to improve the mechanical integrity or handling, (Were, et al., 1999)

Gelatin films have been used as a delivery system for applying antioxidants to poultry or applied directly to food surfaces or processed foods to prevent microbial growth, salt rust, grease bleeding, handling abuse, water transfer, moisture loss, and oil adsorption during frying. Despite these successes, gelatin lacks strength and requires a drying step to form more durable films (Cutter, 2006).

The objective of this work is the preparation of edible film made from Al-Eshar and Gelatin, Also investigating the physical properties for these edible films.

II. MATERIAL AND METHODS

2.1. Materials

Calotropis (Al-eshar) was collected from Ismailia desert road, Egypt. Gelatin and Glycerol was obtained from Acmeticcompany.

2.2. Methods

2.2.1. Preparation of edible film

Four samples of Al-Eshar/gelatin edible film forming solution was prepared by dissolving gelatin in distilled water with stirring at 60°C using a thermostatic water bath and adding 1% glycerol as plasticizer in order to obtain (2, 4, 6 and 8%). Fine cottony pubescent hair of Al-Eshar plant (2 gm) was cut to very small pieces and added to different concentrations of gelatin solution, the mixture was stirred at 100°C and 400 rpm for 15 min.

to obtain a homogenized solution. The prepared solution was poured into a petri dish and placed into a laboratory oven at 40°C for 24 hours to dry the samples, after drying the film was peeled off manually. Thickness of films was determined using a 0-25 mm manual micrometer with an accuracy of 0.01 mm. The reported values are the average of four readings taken randomly on each film sample.

2.2.2. Mechanical properties

The tensile properties (Tensile strength and elongation at break) were determined using a HANG TA as shown in figure (2). The samples were clamped between pneumatic grips and force (N) 10-50 KN. Four samples of edible films from Al-Eshar and Gelatin was measured as follows:

Table (1) Conditions of measuring Mechanical properties of Al-Eshar/gelatin edible films

Sample	Sample 1	Sample 2	Sample 3	Sample 4
	1:1	1:2	1:3	1:4
Extension force	70% - 75%	55% - 35%	there are no	there are no
Extend force MPa	2.65- 2.55	3.33 - 4.90	5.96 - 6.96	8.92- 8.43
Dispersion force of fiber pieces MPa	0.86 (-0.15)	1.08 - 0.35	(-1.37)(-0.29)	0-0.44

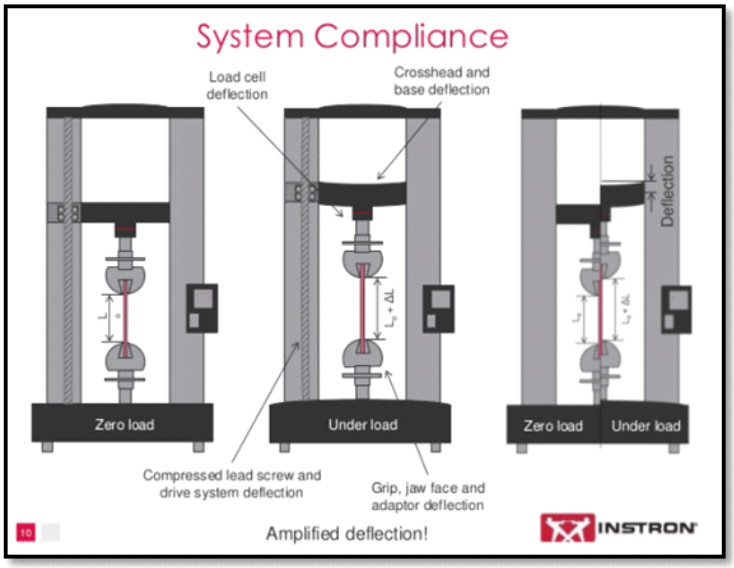

Fig2: Mechanical properties Device

2.2.3. Thermal-Gravimetric Analysis (TGA)

Thermo-gravimetric tests were performed using Schimadzu TGA-50H as shown in Figure (3). The tests were carried out at temperature range from 5 to 100 °C with a heating rate of 10 °C/min under nitrogen gas. Film sample of 1×1 cm was placed in the sample pan and heated. The weight loss as function of temperature was depicted as thermal-gravimetric analysis (TGA) curve.

Fig. 3 TGA Device

2.2.4. Measurements of Transparency

The light barrier properties of the films were measured by exposing the films to light absorption at wavelength 0-1000 nm (spectophotometer the 3,600 UV). Film transparency was measured according to the method of Bao et al., (2009) by placing rectangular film samples (2×2cm) into a spectrophotometer test cell directly according to (ASTM E903-JIS-R3106).

III. RESULTS AND DISCUSSION

3.1. Preparation of edible films

Figure (4) shows the edible films prepared by mixing 2 gm of Al-Esharwith different concentrations of Gelatin solution (2, 4, 6 and 8%).

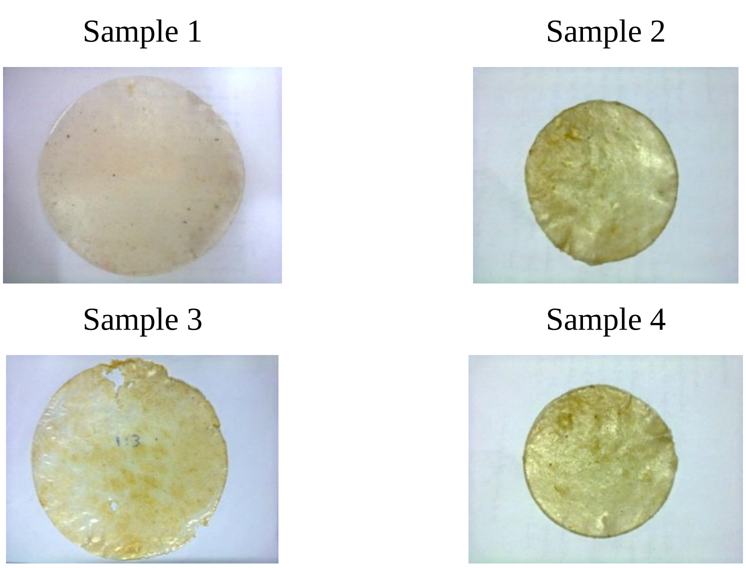

Fig. 4 Edible films made from Al-Eshar and Gelatin

3.2. Mechanical properties

Mechanical properties (tensile strength and elongation) of the Ashar/gelatin based films are presented in Figure (5). Figure (5) shows the tensile strength of edible film made from El-Ashar and gelatin solution with different concentrations. The results observed that tensile strength increased with increasing the gelatin concentration, this may be explained by the distribution of Al-Eshar particles in different concentrations of gelatin solution which increase the tensile strength.

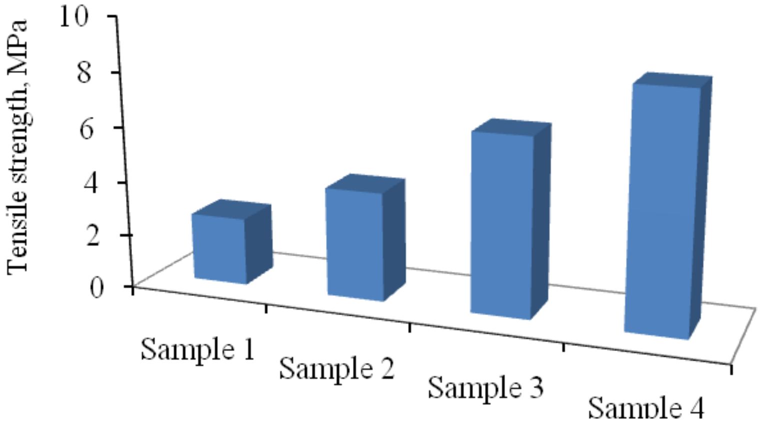

Fig5: Tensile Strength of edible film made from El-Ashar and Gelatin

Figure (6) shows the behavior elongation at break varying according to the El-Ashar dissolved in gelatin solution. Elongation is a measure of the film's capacity for stretching, elongation results (Figure 6) show that elongation at break decrease with increasing gelatin content in the blend for all films prepared.

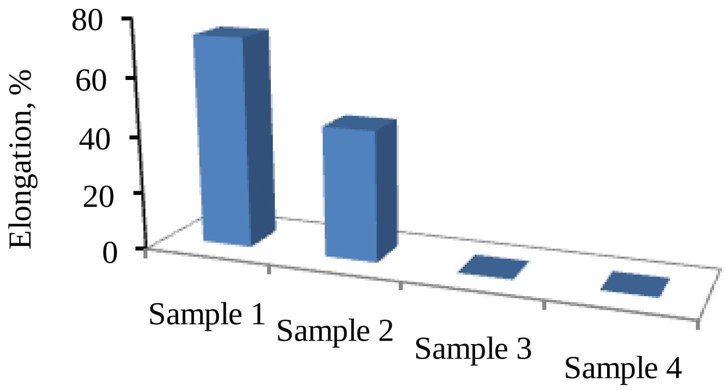

Fig6: Elongation of edible film made from El-Ashar and Gelatin

3.3. Thermal Gravimetric Analysis

Thermal-gravimetric analysis technique was utilized to determine the thermal decomposition and stability of Al-eshar and Gelatin edible film films (Dang and Yoksan, 2015). The results of the TGA curves were presented in Figures (7-10) in which the mass (mg) losses of film samples were plotted as a function of temperature (°C).The initial stage of thermal degradation of films occurred at temperature less than 100 °C. The mass loss at this stage can be associated with the evaporation or dehydration of loosely bound water and low molecular weight compounds in the films (Cyras et al., 2006; Wu, et al., 2013). Samples 2, 3, 4 showed higher mass loss than sample 1, this may be due to that by increasing gelatin concentration, the thermal degradation rate increased.

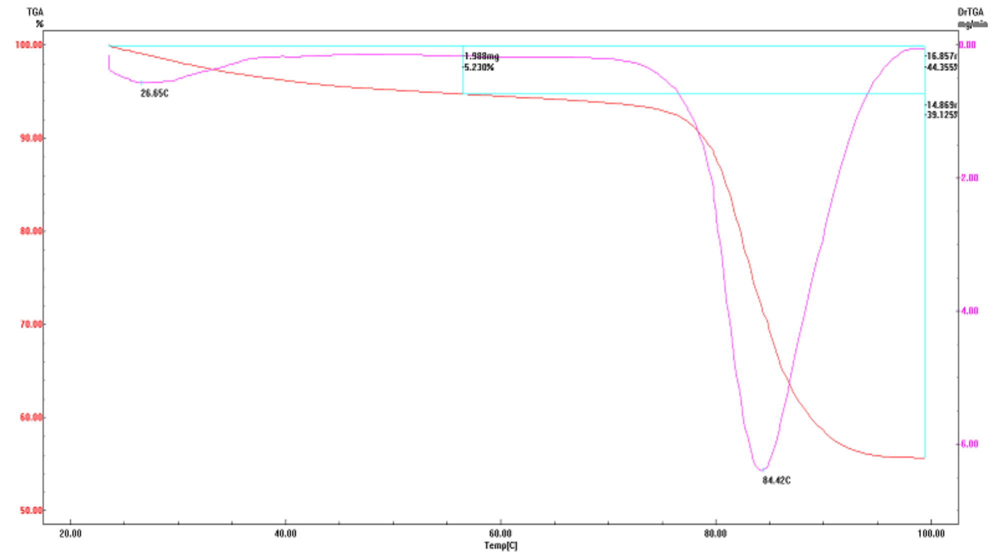

Fig. 7 TGA for edible film of Al-eshar/gelatin (sample 1)

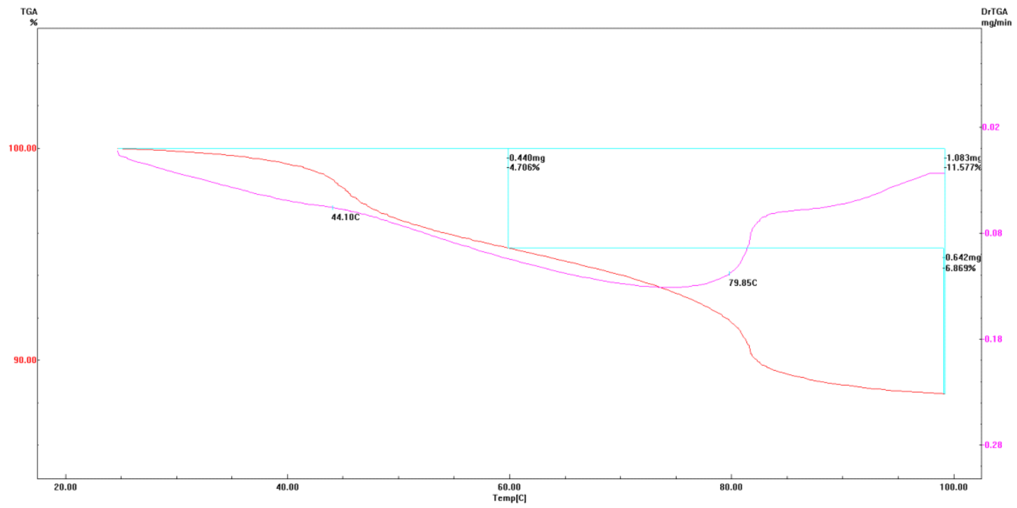

Fig. 8 TGA for edible film of Al-eshar/gelatin (sample 2)

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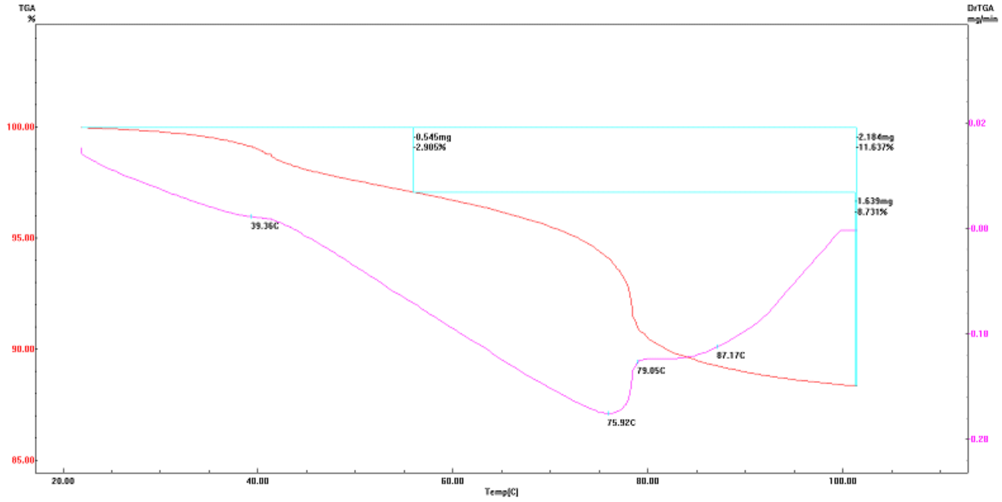

Fig. 9 TGA for edible film of Al-eshar/gelatin (sample 3)

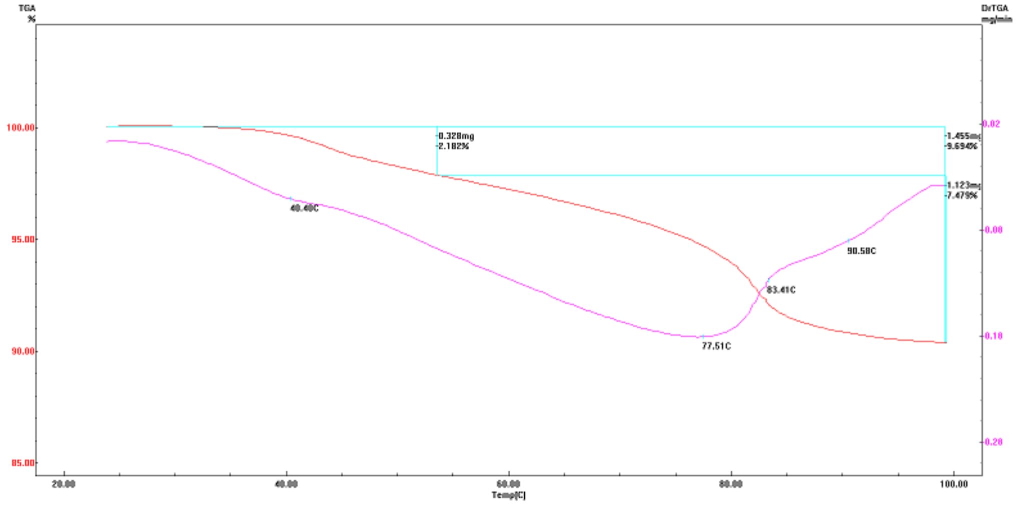

Fig. 10 TGA for edible film of Al-eshar/gelatin (sample 4)

3.4. Measurements of Transparency

Transparency is one of the common optical properties of light permeable materials. Spectrophotometer is used to measure the transparency of a material by light-transmittance or absorbance. Development of transparent packaging materials which allow product visibility is a general trend and requirement in packaging films. (Yusukeet al., 2004). The edible from Al-Eshar and gelatin (sample 1) has a transparency of 85.12% indicating that the film was more transparent than samples (2, 3 and 4).

Table (2) Transparency of Al-Eshar/Gelatin edible film

Sample	Transmittance %
1	85.12
2	78.94
3	59.78
4	55.24

IV. CONCLUSION

Edible films made from Al-Eshar and Gelatin with different ratios was prepared by heating and mixing at 400rpm to have a homogenized solution. Physical properties of edible film made from Al-Eshar and gelatin were investigated. Mechanical properties (tensile strength and elongation)

The results observed that tensile strength increased with increasing the gelatin concentration, while elongation at break decreased with increasing gelatin content. TGA was measured for edible films samples; the results observed that samples 2, 3, 4 showed higher mass loss than sample 1. Transparency of Sample 1 was 85.12% indicating that the film was more transparent than samples (2, 3 and 4).

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