Bio-plastics and edible films for food packaging

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Currently, more than 300 million tons of oil-derived plastics are produced each year, 50% of which is for single use purpose. By 2050, there could be more plastic in the ocean than fish by the weight. In Palestine about 11 million tons will be consumed at the end 2020. Most of the food packaging available in the market is developed from synthetic traditional polymers such as polyethylene, polypropylene, or polystyrene causing health hazards due to migration of toxic additives into the consumables. Plastic degradation is very long process it required more than 50 years to fully degrade. Now a days, worldwide working to find out an alternative product to plastic that cannot pollute our environment it called "Bio-plastics" that could be bio-based, biodegradable or both. Moreover, edible film is defined as a thin film obtained from hydrocolloid substances, which allow the film to be ingested without causing any adverse health problem to human. This films can be deposited on the food surfaces or between the food components.

Edible films can be synthesized from different carbohydrates and/or protein such as pectin, chitosan, plant and animal proteins. In this work the attention was in the industrial by-product like the wastes that derived from the oily seed after the oil extraction it called defatted cake. Our attention was to find out the cheap protein or polysaccharide sources to use it to prepare the edible films. We intended to use the *Nigella sativa* defatted seed cake to extract the protein, which used to prepare the *Nigella stevia* protein films. Glycerol (30% w/w protein) as plasticizer was used to obtain good film properties because without plasticizer cannot form films. Recently, we find out that using only 2 % (v/v) grape juice is enough to obtained handleable films without glycerol. Moreover, microbial transglutaminase enzymes (20 U/g protein) that used as crosslinker showed an important strategies to improve the *Nigella stevia* protein films with promising properties. Pectin films with glycerol and nanoparticles were used to extend the strawberry shelf-life up to 8 days at refrigerated temperature. Moreover, chitosan and protein films under vacuum were used to extend the Nabulsi cheese shelf-life without salt up to 12 days under refrigerated temperature.

In conclusion, using bio-plastic and edible films is a promising strategies to reduce the plastic food packaging that will help to reduce the environment pollutions. *Nigella stevia* protein, pectin and chitosan showed a positive effect to enhance food shelf-life. Nanoparticles, cross-linker, plasticizer, essential oil and

may other materials have a potential effect on the functionally properties of the obtained materials.