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Antimicrobial Activity of Grape Seed and Skin Extracts Coated on Corona Treated LDPE and PET Films

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Abstract

Consumer demand for ready-to-eat 'fresh' and safe food products with less synthetic preservatives together with well documented food-borne microbial outbreaks drive both research and food industry toward new innovative methods for microbial growth inhibition while keeping food freshness, quality, and safety. Incorporation of natural bioactive agents in the packaging material to increase the shelf life of meat products is a promising technology. LDPE and PET films coated with GSE showed inhibition zones of *E. coli* growth in the variety of 16 mm-25 mm, while *S. aureus* growing inhibition zones were in the range of 15 mm-20mm. For LDPE corona movies coated with grape seed extract, the Minimum Inhibitory Concentration (MIC) was 0.002g/1cm^2 for E. coli and 0.003 g/1cm^2 for *S. aureus*. The coated films; LDPE/GSE or GSKE, were used to wrap fresh chicken bones, TVC, Pesudmonads, Brochothrix thermosphacta, Lactic acid bacteria, and Enterobacteriaceae totals were strong-minded during the storage period; 10 days for test samples and 8 days for controls. Microbiological study for tested examples was done on day 0, 2, 4, 6, 8 and 10 while for switch till day 8. There was a reduction in the populations of the examined bacteria in the range of 0.2-1.4 log cfu/g in the case of GSE, while with GSKE the reduction of bacterial populations range was 0.3-1.95 log cfu/g.

Introduction

1 option is to use packing to offer an increased margin of safety and quality. The food package may include materials with antimicrobial and /or antioxidant properties. Such packaging technologies may play a key role in extending shelf –life of foods and reducing the risk of pathogens. A promising technology of 'active' packaging consists of the incorporation of functional additives in the packaging material.

A contemporary approach to the above problem known as bioactive packaging is based on the rationale that the bioactive agent added to a packaging material will a) prevent lipid oxidation/ microbial growth in packaged food and b) will exert a beneficial health effect to the host (consumer) through its migration into the packaged food.

Grapes have a long rich history, in ancient Greek and Roman civilizations being used both as table grapes and in winemaking. Today, French hybrids, European grapes (*Vitis vinifera*), and North American grapes (*Vitis labrusca* and *Vitis rotundifolia*) are the three major grape cultivated species. Because of their biological activity and health-promoting benefits, polyphenols are the most significant phytochemicals in grapes.

Spoilage of poultry and meat products

Regarding spoilage and prediction of minimum shelf life, meat is one of the most sensitive food products. Meat microflora is mainly influenced by meat type, processing hygiene, distribution, and storage conditions. Concerning storage, temperature variations, and packaging atmosphere are the main factors that influence the growth dynamics and the composition of microbiota?

Meat products are differentiated based on their pH and water activity, into "easily perishable", "perishable" and "shelf-stable". Meat products that have a pH>5.2 and aw >0.95 are the "easily perishable" and should be stored at or below +5°C. The ''perishable'' meat products have either a pH of 5.2-5.0 (inclusive) or an aw of 0.95–0.91(inclusive) and must be stored at or below +10°C. Meat products that have a pH <5.2 and an aw<0.95 or only pH<5.0 or aw<0.91; these products are "shelf-stable" and need no refrigeration; the shelf-life of these meat products is not limited by bacteria but by chemical or physical spoilage, specifically rancidity, and discoloration.

Intrinsic and Extrinsic Parameters of Foods That Affect Microbial Growth

There are many factors affecting the development of microbial

associations in different food products. Intrinsic parameters (e.g. pH, water activity, nutrients, redox potential, antimicrobial compounds, etc.), extrinsic factors (e.g. humidity, temperature, atmosphere, etc.), as well as on methods of processing and preservation, and implicit parameters (e.g. direct and indirect interactions of microorganisms).

Nutrient Content

Microorganism's inability of utilizing certain food material limits its growth and allows the opportunity for its competitors to flourish on this food material. The principle needs for microorganism growth are water, energy, nitrogen sources, minerals, vitamins, and other growth factors.

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Water Activity

Living organisms totally depend on water in its liquid state. In the cytoplasm, reactions occur in an aqueous environment, the membrane which surrounds the cytoplasm is water permeable, and so, there is a dynamic two-way flow of water molecules in and out of the living cell. There is an equilibrium state that prevents plasmolysis (more water flow out the cell), or membrane rupture if there is more water flow into the cell, which is prevented by cell wall in fungi and bacteria. For a given food substrate, water activity is the ratio of water partial pressure in the atmosphere in equilibrium with the substrate, P, compared to the atmosphere partial pressure in equilibrium with pure water at the same temperature, P◦ gives the minimum aw requirements for microorganism growth.

The temperature of Storage

It has been confirmed that the lowest temperature for microorganism growth is -34°C, while the highest is over 100°C. According to temperature growth ranges, microorganisms can be classified into psychrophiles; they grow at as low as -5°C and their optimum is 12°C-15°C, psychrotrophic; they grow at or below 7°C and their optimum 20°C to 30°C, mesophiles; grow between 20° and 45°C with an optimum between 30◦C and 40°C, and thermophiles; grow at and above 40°C and their optimum growth temperature is between 55°C and 65°C. Species and strains of psychrotrophic are among the following genera: Alcaligenes, Shewanella, Brochothrix, Corynebacterium, Flavobacterium, Lactobacillus, Micrococcus, Pectobacterium, Pseudomonas, Psychrobacter, Enterococcus, and others. Microorganisms generally grow over a broad range of temperatures as individual microorganisms or a group.

The mechanism of lipid auto-oxidation involves three steps: initiation, propagation, and termination. Rate of and susceptibility to oxidation depending on the number of fatty acid double bonds; as the number of double bonds increases, susceptibility to and rate of oxidation increases. The initiation of oil oxidation may occur by photosensitizers or lipoxygenase. Lipid autoxidation and free radical production lead to oxidative meat deterioration and off-flavor production.

Note: This work is partly presented at the 3rd International Conference on Food Chemistry & Nutrition May 16-18, 2018 Montreal, Canada.