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RECENT DEVELOPMENTS IN GUM ARABIC DERIVATIVES: AN OVERVIEW

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ABSTRACT :
In recent years, natural polymers have been actively investigated in many industriesand environmental field.One of natural polymers is Gum Arabic that has gained enormous attention.This moleculehas been used widely due totheir readily available, non-toxic, biodegradableand cost effectiveness, therising sensitivity to environmental protection and sustainability. Gum Arabic can be modified to enhance its positive attributes and eliminate deficiencies in its native characteristics. Modified gumsusually show better the resistance to thermal degradation, resistance to shear stress and good electric properties. This review discussed thechemical composition and structure of Gum Arabic and the recent developments in the use of this compound and their derivatives.

KEYWORDS: *Polysaccharide; Protein; Gum Arabic;Modification; Applications.*

STRUCTURE OF GUM ARABIC

Gum Arabic is a water soluble, slightly acidic complex compound, comprised of polysaccharides, glycoproteins and their calcium, magnesium and potassium salts.The chemical composition, which also determines the quality of the gum vary depending on its geographical origin, weather conditions at the time of harvest, soil, age and genotype of tree and the processing conditions [1].

Three distinctsections have been recognized in structure of Arabic Gum: the first part, which has a spherical and strongly branched structure with a molecular weight of nearly 250,000, is the largest portion and there are no amino acids in this section. The second part has a wattle-blossomstructure and molecular weight of about1,500,000.This part contains about 10% protein and probably five sphericallobes of carbohydrate withmolecular weight eachof about 250,000 that are connected to anormal polypeptide chain. The main amino acids in this section are hydroxyproline and serine.The third part, with a molecular weight of about 200,000, is highly compressed. This section contains 20 to 50 percent protein. Since proteins in this region are not degraded by enzymes, appears is located deep in the center of the molecule.The outstanding amino acids in this part are aspartic, serine, leucine, and glycine[2].

APPLICATIONS OF GUM ARABICAND ITS DERIVATIVES

Gum Arabic and its derivatives are widely used in various industries such as food industry, building industry, textile industry, cosmetic and pharmaceutical industry, as a binder for watercolor painting in synthesis and stabilization of nanoparticles and green electrospinning, in adhesive formulations for postage stamps, labels, and envelopes, as binder in watercolor paints, in soil conditioning, as plantgrowthpromoters, as clouding and clarifying agent, as a bone graft substitute for bone regeneration, as functional hepatoprotective components, as dietary fiber with interesting nutritional properties [3-4] that we'll see some examples below.

In building industry, Gum Arabic biopolymer may be an effective plasticizer as well as a very good viscosity modifying agent to concrete mixes that provides better workability and higher compressive strength[5-6].

Protein-polysaccharide complexes such as fish gelatin (FG)-gum arabic (GA) collections are the originofnumerous commercial products that can be usedas anappropriate emulsifier in materials comprising concentrated emulsions [7].

In these times,request for food products made by natural origins is rising so fast. Lysozyme (Lyz) was mixed with Gum Arabic (GA) in order to be applied in mayonnaise, at which the attendance, of both preservative and emulsifier is necessary. The Lyz-GA mixturedisplaybetter functional characteristics and antibacterial activity [8].

Gum Arabic and their derivatives has a remarkable effect on the plant growthin terms of quantity of leaves and height as well as in waterlesssubstanceconstruction. Moreover, the commonformof the plant was improved [9].

Gum Arabichave been extensively used as reducing and stabilizing agentin synthesis of various metallic nanoparticles such as gold nanoparticles and silver nanoparticles. Use Colloidal metallic nanoparticlesare especially attractive owing to their specific physical, chemical and biological properties and diverseapplications for energy, water, food, biotechnology, the environment, medicine, targeted delivery, catalysis and agents with antimicrobial, antiviral and anticancer capabilities have immensely introduced [10]. Water pollutionowing totoxic heavy metals including Cr, Hg, Cu, Ni, Zn and Cd is a subject of great concern due to their harmful factors on both the environment and human health. Sources of heavy metals have risen dramatically to include mining, industrial, medical, agricultural, household chemicals, and others. Various processes have been developed for the removal of toxic metals, such asadsorption, chemical precipitation, ion exchange, coagulation, solvent extraction, reverse osmosis, biological methods. Among these techniques, adsorption is considered an easy,efficient, relatively low-costmethod for the elimination of variouscontaminant, from wastewater. In recent years, different natural polymers such as Gum Arabic and its derivatives (Gum Arabic-Fe_3O_4, Gum Arabic-mushroom, Gum Arabic-Hydroxyapatite) based eco-friendly adsorbents have proved to be effectivefor the removal of varioustoxic heavy metals from the wastewaters[11-15].

A corrosion inhibitor is a chemical additive which when added to a corrosive aqueous environment reduces the rate of metal wastage. It is widely accepted that inhibitors work by an adsorption mechanism. The main functional groups capable of forming chemisorbed bonds with metal surfaces are amino (-NH_2), carboxyl (- COOH) and phosphate (-PO_3H_2) although other functional groups or atoms can form coordinate bonds with metal surfaces. The term ‘‘green inhibitor’’ or ‘‘eco-friendly inhibitor’’ refers to the substances that have biocompatibility with the natural environment. Gum Arabic and derivatives(consisting of Gum Arabic and nanoparticles) have been seen to be effective in retarding metals corrosion in acidic and alkaline environment because they are cheap, ecological friendly, renewable materials, easily available, nonhazardous, potentially biodegradable and also biocompatible with the natural environment[16].

In recent years, the use of natural food pigments (also known as natural colorants) has enhanced in foods and beverages as substitutes for their synthetic counterparts. This is mostly owing to the increasingnotification of the environmental dangers and the possible side-effect impacts of the chemicals

used in the synthesis of food colorant. Anthocyanin is one of the most routinelyused natural ingredients because of their favorable color andpossible health advantages. Anthocyanins have been shown to have anti-oxidant, anti-diabetic, and anti-inflammatory effects. Anthocyanins also may be able to exhibit cancer, cardiovascular diseases, and obesity. One of the main challenges experienced when using anthocyanins as food ingredients is that they are highly sensitive to chemical changes throughoutprocessing and storage. These changes often lead to color disappearing and loss of bioactivity. Gum Arabic could be used to increasethe color stability of anthocyanins in beverages [17].

Gum Arabic has gained importance in the pharmaceutical industry as bothsoothing and thickening agents in toothpastes. It is used for curing wounds and has been exhibit antimicrobial,anti-inflammatory, bio fungicide, anticoagulant activities.In a research, Sesame, Gum Arabic and H_2O_2 havebeen used in toothpaste and medicine for the treatment of dental caries. This mixture haseffective antimicrobial activity against the most common bacteria that cause dental caries such as Streptococcus Mutans [18].

Chronic kidney disease (CKD), a global health subject, is a slowly advanced disorder that might lead to end-stage renal disease (ESRD). Hence, there is a great requestfortracking novelimproving agents. One of this agents Gum Arabic is that the addition of GA to the diet has a better effect in patients with CKD [19].

Hydrogels are considered as one of the most encouraging materials owing to their special features and broad scale of usages. They are polymer-based (Such as Gum Arabic) three dimension cross-linked network systems which can absorb amounts of water and biological fluids in their structure without dissolution. Hydrogels gain amany scope of applications in the fields of medicine, pharmacy, biotechnology, and controlled release of drugs. In last years, hydrogels have been used for the immobilization of enzymes, proteins, antibodies, and antigens [20,21].

CONCLUSION

Gum Arabic is one of the quicklydeveloped natural polymers andplay uniquerole in modern industry because of its abundance, biodegradability, processability, and structural variety. The development of new gum-derivatives and introducing additional functional groups will provide a new approach for the expansion of applicationand thereformodification of Gum Arabicbecomes the interesting research field.

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