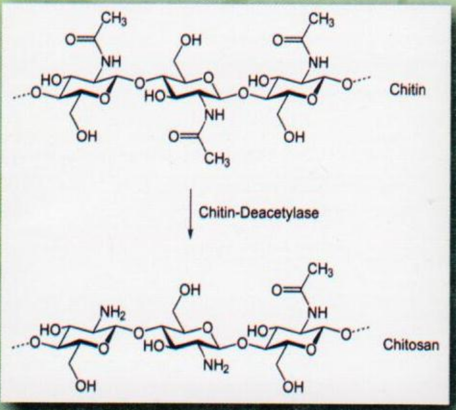
CHITOSAN : AN ATTRACTIVE BIOPOLYMER FOR DIFFERENT APPLICATIONS

Chitin, a polysaccharide similar to cellulose, is the earth's second most abundant polysaccharide after cellulose. It composed of N-acetyl-D glucosamine and generally discarded as industrial waste in the form of leftover seafood crustacean, mainly shrimps, prawns, crabs, and lobsters.

Chitosan is the N-deacetylated derivate of chitin, although the N-deacetylation process almost never complete depending on the degree of deacetylation (DAC). Chitosan and chitin are polysaccharide polymers containing more than 5,000 glucosamine and acetylglcosamine units, respetively. They inherently have specific properties of being environmentally friendly, and nontoxic and are low-cost polymers.

Chitosan has many physicochemical (reactive OH and NH2 groups) and biological (biocompatible, biodegradable) properties that make it an attractive material for use in various applications, ranging from pharmaceutical and cosmetic products to biosensor and water treatment. However, application of biopolymers such as chitosan as an electrical or optical material has rarely been reported. Applications of biopolymers in electrical devices are not only interesting but also important for environmental safety. (Yamada and Holma, 2005, Abdi et al, 2010). It has been reported (Abdi et al, 2010) that chitosan can enhance electrical conductivity and shielding effectiveness (SE) of polypyrrole. During the past decade, Chitosan as an attractive natural biopolymer has been used as immobilization matrix of protein to prepare biosensors. This biopolymer is one of the most promising immobilization matrix due to its excellent membrane-forming ability, good adhesion, nontoxicity, high mechanical strength, and hydrophilicity (Lin et al, 2004).



Molecular structure of chitin and chitosan

One of the significant developments in the new range of applications is the study of the ability of chitosan, as a potentially major environmental treatment material, to remove metal ions from waste waters. The amino group of chitosan has the ability of adsorbing metal ions from industrial waste waters through chelation. Chitosan and UV/TiO2 was used to degrade textile waste water by Chenl et al (2010). This biopolymer was also mixed with surfactants, to finish fabrics in textiles with the aim enhancing the color fastness and fixing dyeing (Najafi et al., 2009).Chitosan can stimulate growth and increase yield of plants as well as induce the immune system of plants to improve their disease and insect resistant ability. This macromulecule acts as the carbon source for microbes in the soil, speed up the transformation process of organic matter into inorganic matter and assists the root system of plants to absorb more nutrients from the soil. It was shown that chitosan has a considerable effect on rice production. Boonlertnirun et al (2008) showed that application of chitosan by seed soaking and soil application four times throughout cropping season significantly increased rice yield over the other treatments.

Chitosan and other hydroxymethyl derivatives are also useful in paper making and biodegradable packaging material for food wrap and other product. The paper produced with chitosan has a smoother surface and is more resistance to moisture. The effect of chitosan as sizing agents to enhance surface properties of kenaf paper was studied by Ashori et al (2005).

They clearly showed that the addition of chitosan to a sheet formed from beaten fibres had excellent improvement in surface properties for printing papers and surface smoothness. Some attempts were made to modify and strengthen the chitosan properties. Kenaf dust was used as a reinforcing agent in chitosan matrix. However, it was shown that incorporation of kenaf dust into chitosan has reduced the thermal stability of the chitosan film (Julkapli et al 2010).

Chitosan is thought to mix with fat and then trap fat droplets in the stomach, preventing it from being broken down by pancreatic lipase (Gades et al, 2005). But these results were mainly are based on animal studies where very large doses of chitosan were administred, does not normally given to humans. In fact, some researchers have observed chitosan intake in short-term studies not significant by affecting body weight or fat binding capabilities. Other studies have reported the fat binding effects of chitosan on men, but there were no effects on women (Gades et al, 2003). Although some fat binding and weight loss effect by administered can be achieved, results are only evident over long-termconsumption.

Unlike most of other hydrocolloids which are polyanions, chitosan is the only natural cationic gum that becomes viscous on being neutralized with acid. It facilitates its interaction with common integuments (skin covers) and hair. Composition based on chitosan or other derivatives are used in creams, pack material, lotions, nail lacquers, foundation, eye shadow, lipstick, shampoo, cleansing materials, and toothpaste. Chitin and chitosan are fungicidal and fungistatic in nature and it is believed that they may be used to inhibit fibroplasias in wound healing and to promote tissue growth and differentiation in tissue culture. Fibers made of chitin and chitosan are useful as absorbable structures and wound-dressing materials. It was shown that wound dressing made of chitin and chitosan accelerates the healing of wounds by about 75% (Pardip et al, 2004).

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