CHAPTER II
LITERATURE REVIEW

The abundance of carboxylic groups existing in alginates makes this biopolymer a potential modifier of textile fiber surfaces which combined with its exceptional metal sorbing capacity may provide additional sites for metal binding. Nikolaos et.al, 2013 was reported that copper (II) incorporated with alginate has been used as a wool textile modifier, in order to improve absorption of metals capacity antibacterial activity. The resulting alginate/copper fabric showed excellent antibacterial properties, evident upon contact with *E.coli.*

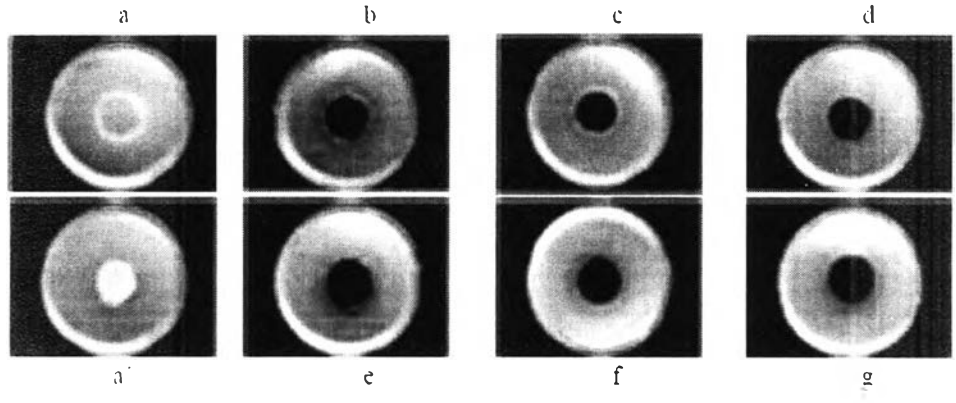

Figure 2.1. Antibacterial effect of WCF and WACF treated fabrics according to the ISO20645:2004 test method. (a) raw wool fabric, (a′) wool alginate fabric (WAF), (b) wool fabric with Cu (WCF), (c) WCF after dry cleaning, (d) WCF after liqCO_2 treatment, (e) wool fabric with alginate-Cu (WACF), (f) WACF after dry cleaning, (g) WACF after liqCO_2 treatment.

In 2012, Bagchi and coworkers synthesized antimicrobial ceramic composite has been developed by simple adsorption of copper nanoparticle suspension. The physico-chemical properties of samples were characterized by different instruments which showed that the composite is well crystalline with homogeneous distribution of copper nanoparticles on the surface. Antimicrobial study was performed by plate count technique which showed >99% mortality for all the bacterial species studied after 24 h of incubation.

Minimum inhibitory concentration (MIC) value determined by batch culture process showed considerably low values (in terms of copper content) indicating that mullite matrix plays a role in enhancing the antimicrobial efficacy of the composite. Biocompatibility studies on human cancer cell lines indicated that the composite had negligible toxicity below 100 μg/mL of Cu content.

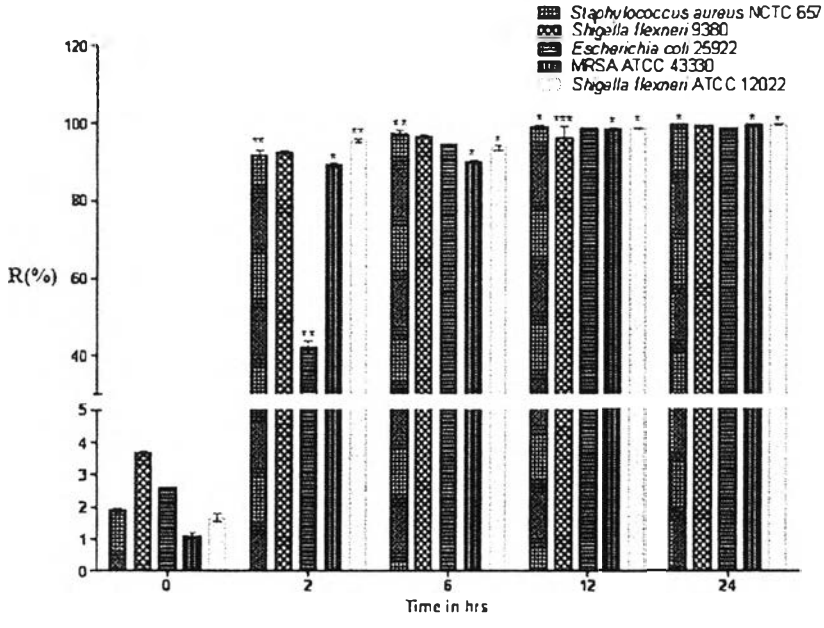

Figure 2.2. Antibacterial effect (R%) on bacteria after treatment with CuM2 for 2, 4, 6, 12 and 24 h. Values are means± SEM of 5 separate experiments done in triplicate *p<0.05, **p<0.005, ***p<0.0005, one way ANOVA.

Linghui and coworkers (2010) prepared water-stable PAA nanofibrous tubes that exhibit reversible phase transitions induced by divalent-monovalent cation exchange in aqueous solution. Polyelectrolyte poly (acrylic acid) (PAA) nanofibers were generated by means of electrospinning, and the influence of the preparation parameters during the electrospinning process such as PAA concentration and feeding rate on the formation of PAA nanofibers was systematically investigated. The PAA nanofibers contained ethylene glycol (EG) and were rendered water-stable by cross-linking via thermally-induced esterification. Since an axon in nerve fibers possesses elongated conduit morphology, non-woven PAA fibrous tubes were fabricated and their reversible swelling behavior was studied in $CaCl_2$ solution.

In summary, PAA nanofibers electrospun under various processing parameters were systematically investigated. The results showed that uniform fine fibers with an average diameter of 890±90nm were obtained at a polymer concentration of 4wt% with a flow rate of 0.8mL/h. The samples were rendered water-insoluble by heat-induced esterification and the fiber structure was preserved in water. For the axon-mimic applications, PAA nanofibrous tubes were fabricated and neutralized in a base solution. Neutralized PAA tubes consisted of a swollen and porous polymer network in water. Sodium analysis of neutralized PAA tubes indicated a crosslink content of approximately 20% after the thermal esterification, and about 80% of carboxylate groups in PAA were available for phase transition experiments.

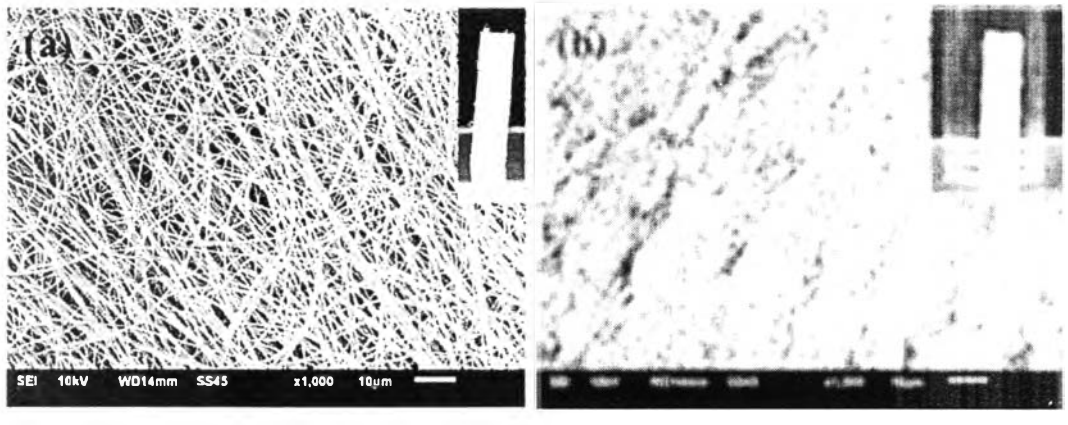

Figure 2.3. SEM images and snap shots (inserted) of crosslinked PAA nanofiber tubes before (a) and after (b) immersing in water.

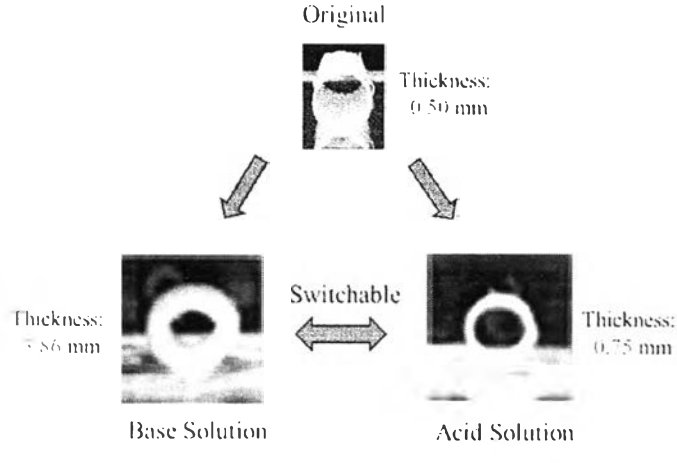

Figure 2.4. pH responsive of crosslinked PAA fiber tubes

In 2011, Ligia and coworkers produced chitosan and collagen-chitosan porous scaffolds by the freeze drying method and characterized as potential skin substitutes.

Their beneficial effects on soft tissues justify the choice of both collagen and chitosan. Samples were characterized using scanning electron microscope, Fourier Transform InfraRed Spectroscopy (FTIR) and thermogravimetry (TG). The in vitro cytocompatibility of chitosan and collagen-chitosan scaffolds was evaluated with three different assays. Phenol and titanium powder were used as positive and negative controls, respectively. Scanning electron microscopy revealed the highly interconnected porous structure of the scaffolds. The addition of collagen to chitosan increased both pore diameter and porosity of the scaffolds. Results of FTIR and TG analysis indicate that the two polymers interact yielding a miscible blend with intermediate thermal degradation properties. The reduction of XTT (2,3-bis[2-methyloxy-4-nitro-5-sulfophenyl]-2H-tetrazolium-5-carboxanilide) and the uptake of Neutral Red (NR) were not affected by the blend or by the chitosan scaffold extracts, but the blend and the titanium powder presented greater incorporation of Crystal Violet (CV) than phenol and chitosan alone.

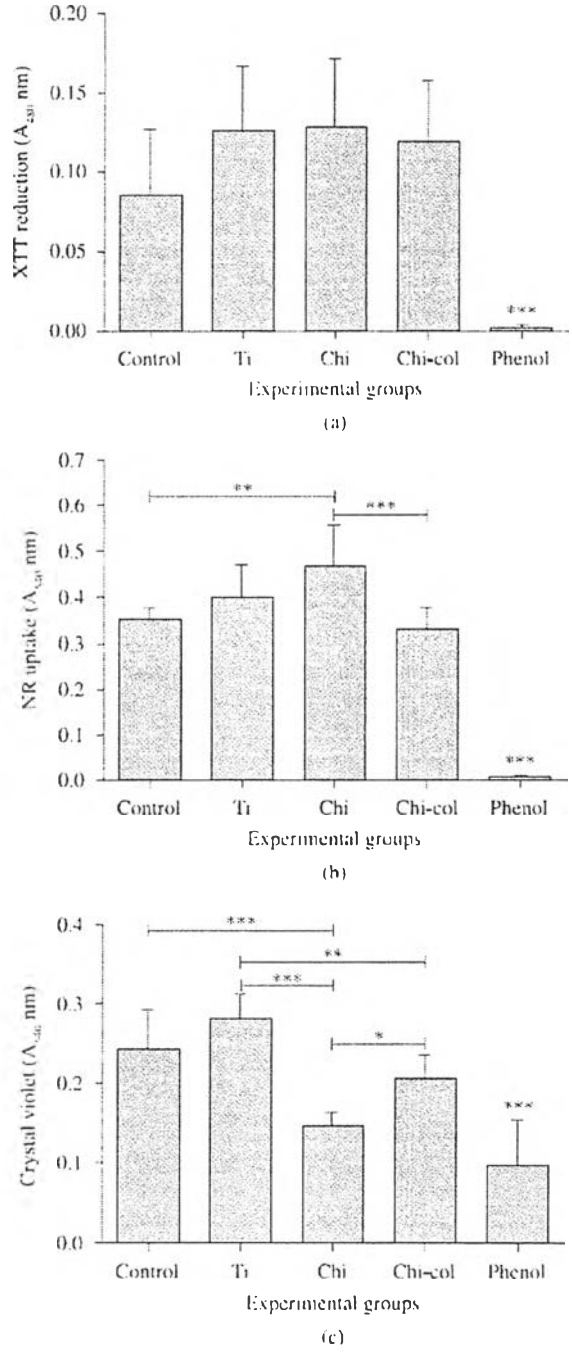

Figure 2.5. Cytotoxicity assay. Cytotoxic effects of collagen-chitosan (chi-col) and chitosan (chi) scaffolds on mouse osteoblasts. a) XTT reduction; b) Neutral Red uptake; and c) Crystal Violet Dye Elution. ***Statistically significant differences between groups ($p < 0.001$). ** Statistically significant differences between groups ($p < 0.01$). * Statistically significant differences between groups ($p < 0.05$).