CHAPTER II
LITERATURE SURVEY

Medical gloves produced from natural rubber latex are widely used to protect the skin of healthcare workers from harmful antiseptic. However tack property in vulcanized glove is not desirable. Over the years, a variety of powders have been used to coat the inner and outer surfaces of the gloves to aid in manufacture and prevent the rubber glove surfaces sticking together. Unfortunately, these powders, especially modified cornstarch powder, can cause allergy. Various methods of making powder free gloves have been proposed to provide tack reduction, avoid the allergy, and facilitate the manufacturing procedure.

Homsy *et al.* (1976) treated a surface of glove with a fluorinating gas. As stretched in a chamber without extraneous oxidizing agents, glove was treated with a fluorinating gas including a mixture of fluorine with nitrogen. Nitrogen was admitted into the chamber in order to purge the space surrounding the exterior of the glove, thus excluding oxygen or any other competing oxidizing agents. This treated glove was neutralized with 0.1 N NaOH to remove hydrofluoric acid. Glove was easily donned without powder. In addition, its better properties included non-curling cuffs, and increased tactile transmission.

Esemplare and Beeferman (1976) constructed surgeon's glove coated with two synthetic resin copolymers which is selected from vinyl chloride-alkyl acrylate copolmer and vinyl chloride-vinyl ester copolymer, and vinylidene chloride vinyl ester copolymer. This coating imparted excellent characteristic of slipperiness.

To avoid the use of powder, glove was also treated by chlorine or bromine that was preferably to fluorine. This treatment gave tack reduction and slippery surface. Joung (1981) proposed a covalently bonded room-temperature vulcanizing (RTV) silicone coating to the interior of a rubber surgeon's glove. This was established to reduce but not eliminate the need for powder. To avoid the utilization of powder, Joung halogenated the inner surface of the glove while the outer surface was covalently bonded with silicone or urethane. Furthermore Joung (1982) suggested another way to reduce tack by deposition of a lipo compound, which is lipid or lipophilic substance in combination with a surfactant in a coagulant solution, onto rubber glove.

Halogenated glove was also constructed by Momose (1986). Glove had a halogeanated outside surface to a first degree and a halogenated inside surface to a second degree by controlling the halogenation process. So it provided different slippery coefficient surface on the outside and the inside of the glove.

Liou (1996) described a powder-free natural or synthetic rubber glove on both sides of which was covered with the laminate layer. The inside layer was covered with polyurethane and silicone emulsion while the outside layer was covered with polyurethane. The said glove was slippery to easily put on or take out of the hand. In addition, polyurethane rendered abrasion resistance and waterproof. The said waterproof polyurethane isolated the contents of water-soluble chemicals and protein so that the glove was hypoallergenic.

Grazeley (1997) made gloves having an adherent anti-tack coating such as surgeons' gloves and gloves used by doctors and veterinary surgeons for examination purposes. The coating comprised a mixture of a carboxylated synthetic rubber latex having a minimum film forming temperature (MFFI) of 10^0C or above, or a synthetic latex or natural polymer having MFFI of 10^0C or below and/or a partly water or wholly water-soluble organic polymeric hydroxy material. The carboxylated synthetic latex polymers including acrylic copolymers, vinyl copolymers, and particularly carboxylated styrene-butadiene polymers (CSBR) had low friction characteristics and provided anti-tack properties. The natural rubber latex or styrene butadiene copolymer having MFFI of 10^0C or below conferred high friction, giving good grip on the outside surface of a glove. The water-soluble organic polymeric material including polyvinyl alcohols, polyethylene oxides, polyhydroxyethyl acrylate, improved the adhesion of the anti-tack coating to the rubber surface without significantly spoiling the low-friction characteristics of the coating and reduced the friction of the rubber substrate against wet surface.

Lee (1997) provided non-tacky, acrylic based copolymer adhering to the surface of rubber glove. The copolymers deposited on an outside of glove were copolymerizable silicone oligomers, butyl acrylate, methyl acrylate, methacrylic acid, acrylic acid and styrene. They induced the properties of mold stripping to the formed rubber glove. On the other hand, either dry or wet donning surface to be on the inside of the gloves consisted of copolymers comprising a silicone oligomer, styrene, butyl acrylate, methyl acrylate, acrylic acid, trimethylpropanetriacrylate and n-isobutoxy methyl acrylamide without the need for further chemical treatment. In addition, this acrylic based copolymer rendered coating that was stretched or elongated with rubber with minimal cracking, flaking or debonding.

Walker (1998) made multi-layer barrier glove having improved tactility and dexterity characteristics which included three components, an outer layer or shell, a protective intermediate barrier insert, and an inner layer or insert. Outer shell was preferably knitted from aramid fibers for providing durability, cut resistance, and fire resistance identified by non-melt and non-flammable properties. A protective intermediate barrier insert, disposed underneath the shell, was fabricated from porous polytetrafluoroethylene (PTFE) which was a gas permeable, liquid impermeable material and suitable for use as glove for protecting a wearer from noxious liquids and gases. The inner layer was a knit liner constructed from a softer fiber such as a cotton or a cotton-polyester blend to enhance the comfortability and wearability of the glove. There were various methods to attach the three layers to each other such as by using tabs, adhesives, and remetable tapes to prevent any tendency for the lining of the glove to invert when the glove is doffed.

Chen (1998) made a flexible surgical glove displaying slip properties with respect to damp and dry mammalian tissue without utilization of powder lubricants. The glove comprised a substrate layer having an elastomeric material, the layer having a wearer-contacting surface, and a damp slip-conferring amount of a lubricant compositon applied to the wearer-contacting surface. The elastomer might be natural rubber, a polyurethane, a homopolymer of conjugated diene such as neoprene, isoprene, a copolymer of at least two conjugated dienes and at least one vinyl monomer such as nitrile rubber, styrene-isoprene-styrene block copolymer and styrene-butadiene-styrene block copolymer and combinations thereof. To impart damp slip properties, rubber surface was treated by cleaning, chlorinating, neutralizing, and treating with a lubricant composition. The lubricant composed of first and second composition. The first composition contained an acetylenic diol and at least one compound selected from the group consisting of an organo-modified silicone, an amino-modified silicone and a cationic, preferably 1-hexa decylpyridinium chloride monohydrate. The second composition contained a cationic surfactant, preferably 1-hexadecylpyridinium chloride monohydrate and at least one compound selected from the group consisting of an organo-modified silicone, an amino-modified silicone and an acetylenic diol. The acetylenic diols were acetylenic tertiary glycols and ethylene oxide adducts of acetylenic tertiary glycols, and preferably have a 10 carbon chains as a backbone with a carbon-carbon triple bond in the middle with a hydroxyl group on the carbon atoms on either side of the triple bond. Overall the molecule had a hydrophobic-hydropholic-hydrophoblic structure due to the combination of acid groups yielding a region of high electron density, thus making the molecular polar, and a symmetrical, highly branched group on each side of this region supplying the molecule with two hydrophobic areas. These make it a good wetting agent or surface tension reducer.

Merovitz *et al.* (1999) constructed surgeon's glove having improved properties from copolymer latex of neoprene and 2,3-dichloro,-1,3-butadiene, which were basically non-allergenic and were free of proteins. They contained preferably 40% of chlorine (DuPont under code number 750). The gloves were often made by utilizing coagulant dipping process, which comprised the Anode process or the Teague process. This synthetic glove had equal or better softness than the common surgeon's glove constructed of natural latex.

Horwege *et al.* (1999) described a flexible glove that was substantially deniable without the need for donning powders. Twice dipping process performed a two-layer glove including a first layer of polyvinyl chloride (PVC) and a second layer of polyester polyurethane. Serving as a binder, the latter also consisted of a slip agent facilitating the glove stripping and a texturing agent. Be stripped from the mold, the glove had the PVC layer as the outside contacting surface and the polyester polyurethane with the slip agent and the texturing agent as the inner user contacting surface.