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# Blood Compatibility of PET Fabric Modified by Surface Grafting

Xiaochun Wang [a], Guoliang Zhao [a,*], Wanhong Teng [b]
Huijing Song [a], Hao He [a]

[a] *Beijing Institute of Fashion Technology, Chaoyang District, Beijing 100029, China*

[b] *Shenzhen Academy of Metrology Quality Inspection, Nanshan District, Shenzhen Guangdong 518055, China*

**Abstract**

In order to improve the blood compatibility of Poly (Ethylene Terephthalate) (PET) fabric purposed for an artificial heart valve sewing ring, the grafting of Acrylic Acid (AA) and Polyethylene Glycol (PEG) on PET fabric by Ultraviolet (UV) irradiation has been studied. The influences of UV irradiation time, UV irradiation intensity and the concentration of acrylic acid have been investigated. The results revealed that acrylic acid was successfully grafted onto the surface of PET fabric and the blood compatibility of PET fabric was effectively improved. The blood compatibility tests suggested that UV irradiation method can effectively induce PEG onto the surface of AA modified PET to further prolong the Activated Partial Thromboplastin Time (APTT), Prothrombin Time (PT) and Thrombin Time (TT).

*Keywords*: Poly (Ethylene Terephthalate) Fabric; Acrylic Acid; UV; Grafting; Polyethylene Glycol

## 1 Introduction

The use of Poly (Ethylene Terephthalate) (PET) as an artificial organ such as an artificial heart valve sewing rings has been increasing tremendously over the past 30 years because of its excellent mechanical properties and moderate biocompatibility [1]. However, there is a controversy on the long-term thrombosis nature of PET in vivo applications. Attmepts are made to improve its blood compatibility. Since most of the biological interactions with materials occur at the interface, a significant number of studies on improving the blood compatibility of PET have focused on surface modification.

Surface modification of PET has been carried out by many researchers using graft polymerization of various monomers, induced by UV, plasma, ozone and radiation [2-8]. UV induced grafting polymerization is an effective way for modifying the surface chemistry of polymeric materials. A

*Corresponding author.
*Email address:* clyzgl427@bift.edu.cn (Guoliang Zhao).


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desired monomer can be polymerized onto the UV-activated polymer surface resulting in the formation of a grafted layer of chains on the top surface of the PET fabric. The grafted surfaces may then provide active sites for the binding of biomolecules. This method is highly surface selective, where the modification is confined to a depth of a few nanometers without modification of the bulk properties. UV induced grafting polymerization has consequently proven highly successful as a means to develop functional interfaces for the immobilization of biomolecules [9].

Although many researches on PET film modified to improve its blood compatibility are reported, the real implanted polyester articles are usually in a form of fabric. Since there are significant differences between PET film and its fabrics in terms of surface appearance, biomechanics property and the interaction between matrix material and blood, the researches on film can not reflect the blood compatibility of the implanted PET in the form of fabrics in clinical application. In addition, the assessment of the blood compatibility of PET fabrics can also be complicated by the alteration of weaving factors and edge profiles and these could be the reason behind the unavailability of a commonly acceptable standard method so far.

In this study, the UV induced grafting polymerization was undertaken between acrylic acid and PET fabric which was in exactly the same form of fabrics used to make artificial heart valve sewing rings. A preliminary research was also carried out on the grafting of PEG on the AA-modified polyester. According to the structural characterization of the substrate fabrics after the graft polymerization, the experiment established a suitable method for the assessment of blood compatibility of fabrics for implantation purposes.

# 2 Experimental

## 2.1 Materials and Equipment

Knitted PET fabric used in this study was provided by Topnew Group of Beijing, China. This fabric was pretreated by washing in turn with acetone, dichloromethane, methanol and distilled water in an ultrasonic cleaner for 10 min followed by heat setting at 130℃ for 3 min. Blood plasma of goat was supplied by Fuwai Hospital of Beijing, China. Reagents used for TT, APTT, PT tests were supplied by Sysmex Corporation of Japan.

The blood compatibility of modified PET fabric was determined with CA-50 Sysmesx blood coagulation analyzer (Japan). The absorbency was tested on a 722 spectrophotometer (Shanghai, china). UV generator was made by Beijing Nomal University, China and SEM of Model JSM-6360L (Japan) was used to study the surface of the modified fabrics.

## 2.2 Experimental Methods

### 2.2.1 Grafting of Acrylic Acid on the PET Fabric

Acrylic acid solutions of different concentrations were prepared using the acrylic acid being purified by means of a low-pressure distillation, and 0.05% Benzophenone (BP) was put into acrylic acid solution before usage.