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Maire, M.; Ajji, A.; Bureau, M. N.; Robitaille, L.; Merhi, Y.; Yahia, L'H.

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HEMOCOMPATIBILITY OF NEW FIBROUS PET STRUCTURES WITH AND WITHOUT SURFACE MODIFICATION

M. Maire[1], A. Ajji[2], M.N. Bureau[2], L. Robitaille[2], Y. Merhi[3], L'H. Yahia[1]

[1] *Laboratory for Innovation and Analysis of Bioperformance, École Polytechnique de Montréal, QC, Canada*
[2] *Industrial Materials Institute, National Research Council Canada, Boucherville, QC, Canada*
[3] *Montreal Heart Institute, University of Montreal, QC, Canada*

Introduction

It is well known that commercial ePTFE porous vascular grafts show a very good hemocompatibility. However, they are used mainly for large diameter grafts and there is a need for medium to small diameter vascular grafts [(1)]. Woven structures of polyethylene terephthalate (PET) are also used as vascular grafts (Dacron), but for large diameter arteries only since PET does not show very good blood compatibility and poses some mechanical compatibility problems due to its low compliance [(2)]. The objective of this work is to develop a biomaterial, based on fibrous structures of PET with enhanced blood and mechanical compatibility from which arterial prostheses of medium and small diameter can be manufactured. Our strategy to increase blood compatibility is based on the functionalization of the fibrous PET structures. Various chemical groups can be grafted on the PET fibres. For example, polyethylene glycol (PEG) immobilization on the material surface, to increase compatibility with blood and decrease platelet adhesion, has been well documented in recent years, but this choice is not restrictive.

Experimental

Platelets were obtained from whole blood of human donors.

The blood compatibility was assessed through a quantification of the platelets adhesion reduction.

Functionalization

PET fibers were hydroxylated with formaldehyde during 4 or 8 hours. Then NH_2 groups were grafted on PET-OH. Finally, PEG was added on PET-OH-NH_2. Each step of the functionalization was tested to blood compatibility.

Platelet adhesion

Blood compatibility of fibrous PET structures was studied using adhesion tests of ^{51}Cr labelled platelets. Results from pristine PET structures, PET structures modified with NH_2, OH and PEG and commercial ePTFE and woven PET structures are compared.

Platelet morphology

After adhesion, samples were fixed with a glutaraldehyde solution and dehydrated in different ethanol solutions. Then, platelet morphology was assessed using scanning electron microscopy (SEM).

Results and Discussion

Preliminary results show that commercial ePTFE structures show the highest blood compatibility among the materials tested. They also show that NH_2 and OH modification improved platelet compatibility with respect to commercial PET structures. PEG modification with low NH_2 content improved blood compatibility with respect to fibrous PET structures with or without NH_2 and OH modifications.

Conclusions

All fibrous PET structures showed higher hemocompatibility than Dacron. Functionalized PET fibers showed equal or lower compatibility than non-functionalized PET fibers, with the exception of the sample containing the smallest NH_2 content (0.1%). We hypothesize that the increase in platelet adhesion with at 10% NH_2 is caused by surface peeling off of the functionalized layer due to the expected high thickness of the grafted groups on the PET fibers.

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