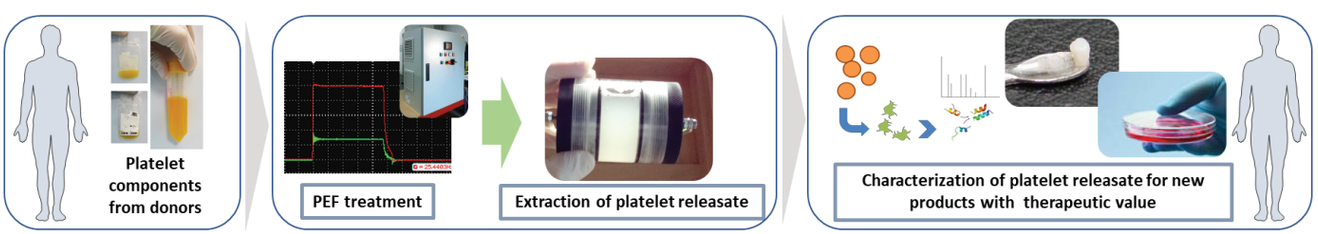
World Scientific

PRESS RELEASE

Application of pulsed electric fields for the valorization of platelets with no therapeutic value for transfusion medicine

April 25, 2019 — Proof-of-concept experiment aimed to produce a new blood-derived product by application of pulsed electric fields (PEF) to platelet concentrates (PC) with no therapeutic value for transfusion medicine.



Proposed processing for releasate production and application: from donor to application. A. Collection of blood and separation of blood components, platelet concentrate formation; B. Application of Pulsed Electric Fields treatment, releasate formation; C. Releasate application for biomedical applications.

Blood centers are diversifying their offerings by converting products with no therapeutic use into useful biomedical solutions, eliminating waste and applying their expertise in good manufacturing practice. The work presented is part of a larger project with the objective of propose a new methodology for producing a new blood-derived component for non-transfusion use, taking advantage of biological material (*e.g.* platelets) with no therapeutic value for transfusional medicine, that otherwise would be discarded.

The use of discarded platelet-derivatives is one possibility for blood banks diversification in terms of Cellular Therapies and Regenerative Medicine. Platelets function *in vivo* is focused on maintaining the integrity of the vascular system, preventing and treating bleeding. In addition, the ability of platelets to aid tissue healing has supported their use in other biomedical applications. Platelets store large concentrations of bioactive molecules, which are released by activation with an agonist at the platelet membrane receptor. This platelet releasate is enriched in growth factors, cytokines, integrins, and proinflammatory molecules known to be involved in tissue regeneration, stem cell proliferation and differentiation.

The release of proteins from platelets upon their activation is usually stimulated by either thrombin, calcium solutions or cycles of freeze and thawing, which inevitably lead to an uncontrolled lysis of the platelets and delivery of proteins to the supernatant, leading to an ill-defined protein concentrate. The consortium of this project proposes an alternative technology, pulsed electric fields, PEF, for controlled activation of platelets, which offers the possibility of selective release of endogenous proteins for production differentiate protein concentrates with more defined compositions and concentrations.

The application of PEF in biological systems (*e.g.* food and medical industry) is a technique known to allow transient or permanent permeabilization of the cell membrane, where pore size is controlled by PEF parameters (*e.g.* field amplitude, energy, and time of application), allowing a control over the available intracellular content.

This work shows promising results of this approach. After PEF treatment it was possible to create a releasate biologically functional. Furthermore, human mesenchymal stem cells (hMSC) were cultured with addition of this releasate, showing a behavior similar to hMSC cultured in optimized synthetic medium.

The consortium is now focusing on how variations on the electric pulse parameters induce changes in the activation process of platelets, platelet releasate and platelet properties. Furthermore, they will also use the obtained platelet releasate with different protein content to prepare novel human-derived supplements for stem cell expansion and differentiation and to generate new biomaterial formulations for application in regenerative medicine approaches. It is expected that this strategy would contribute for the development of new platelet-derived biological products.

A multi-disciplinary consortium is working together to combine knowledge from different fields. The consortium consists of 3 institution: Instituto Português do Sangue e Transplantação (Lisbon, Portugal), for blood and platelets concentrates supplying and support and diagnosis; Institute of Experimental Biology and Technology (Oeiras, Portugal), for diagnosis and cell culture; and Instituto Superior de Engenharia de Lisboa (Lisbon, Portugal), for pulsed power technology development. Another partner of the consortium is EnergyPulse Systems (Lisbon, Portugal) responsible for developing and building of PEF generators for biomedical applications.

This work was supported by Foundation for Science and Technology, FCT, under project PEFPlateletValue, PTDC/BTM-ORG/32187/2017.

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