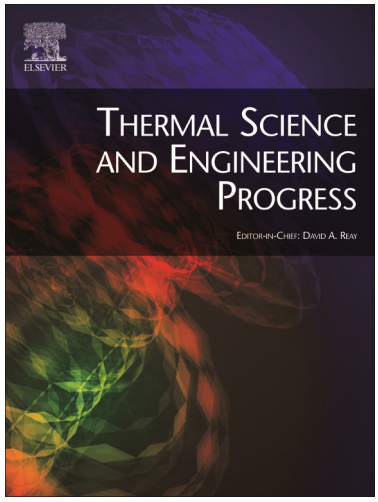

Flow Dynamic and Energetic Assessment of a Commercial Micro-Pump for a Portable / Wearable Artificial Kidney: Peristaltic vs. Diagphram pumps

Giovanni A. Longo, Simone Mancin, Giulia Righetti, Claudio Zilio

PII: S2451-9049(17)30013-6
DOI: http://dx.doi.org/10.1016/j.tsep.2017.03.006
Reference: TSEP 14

To appear in: *Thermal Science and Engineering Progress*

Received Date: 30 January 2017
Revised Date: 1 March 2017
Accepted Date: 16 March 2017

Please cite this article as: G.A. Longo, S. Mancin, G. Righetti, C. Zilio, Flow Dynamic and Energetic Assessment of a Commercial Micro-Pump for a Portable / Wearable Artificial Kidney: Peristaltic vs. Diagphram pumps, *Thermal Science and Engineering Progress* (2017), doi: http://dx.doi.org/10.1016/j.tsep.2017.03.006

FLOW DYNAMIC AND ENERGETIC ASSESSMENT OF A COMMERCIAL MICRO-PUMP FOR A PORTABLE / WEARABLE ARTIFICIAL KIDNEY: PERISTALTIC vs. DIAGPHRAM PUMPS

Giovanni A. LONGO*, Simone MANCIN, Giulia RIGHETTI, Claudio ZILIO

University of Padova, Department of Management and Engineering,

Str.lla S. Nicola 3, Vicenza, I-36100, ITALY

Abstract

This paper identifies different commercially available peristaltic and diaphragm micro-pumps suitable for the application in a portable / wearable artificial kidney and carries out their flow dynamic and energetic assessment in a specifically designed experimental rig. This analysis provides information on pressure and flow rate behaviours for developing control algorithms and data on energy consumption for increasing operation time of portable / wearing systems. Both the peristaltic and the diaphragm commercial units are able to cover the whole operative range of a portable / wearable artificial kidney. The peristaltic units allow a more regular flow and a reduced level of noise and vibration, particularly at low and medium flow rates, whereas the diaphragm units are more compact and lightweight and they exhibit a superior energetic efficiency. The overall efficiency of the diaphragm pumps is 2–4 times higher than that of the peristaltic pumps those exhibit very poor efficiency, particularly at low rotation speed. The final assessment of the more suitable commercial micro-pump for this specific application requires further investigation concerning biocompatibility, hemolysis, sterilisation, reliability, and economic costs.

* Corresponding Author (tony@gest.unipd.it)