

What is the quantity of Oxygen added to the perfusate in Hypothermic Machine Perfusion?

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Introduction

HMP is one of the strategies used to overcome the existing gap between the available organs and the suitable organs for transplantation, helping reducing the number of patients waiting for the intervention. HMP can be implemented operating on $T < 12^{\circ}\text{C}$ and using systems that allow active oxygenation to the perfusate with the direct administration of O_2 to the perfusate or with the transfer of O_2 by an oxygenator connected to the gas supply. The low T corresponds to low metabolic rates and, consequently, lower oxygen demand than in "in-body" conditions. In HMP, the oxygen reaching the organ is dissolved in an acellular, aqueous perfusate. In this report, we characterize the amount of oxygen available in the perfusion solution during HMP, focusing on the standard perfusate solution used: Belzer UW MPS solutions.

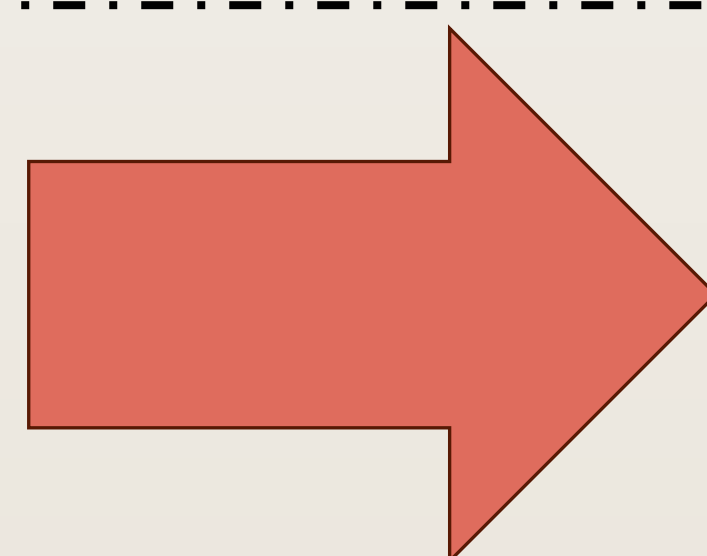
Methods

We characterized the oxygen solubility (solO_2) in BUW focusing on the main influencing factors: salinity of the solution associated with BUW composition, T range $4\text{--}12^{\circ}\text{C}$, different quantity of oxygen administered, expressed as pO_2 and the $\text{p}_{\text{Atm}} = 1 \text{ atm}$. We used these factors to determine the amount of O_2 (mg/L, ml/L) corresponding to many different conditions, by applying a validated online calculator to iteratively solve the Debye–Hückel theory limiting laws for unideal solutions, expressing the existing relationship between the solO_2 and all the considered parameters.

Factors influencing O_2 quantity

- Perfusate Salinity (composition)
- Perfusate T
- O_2 active administration (pO_2)
- Atmospheric pressure

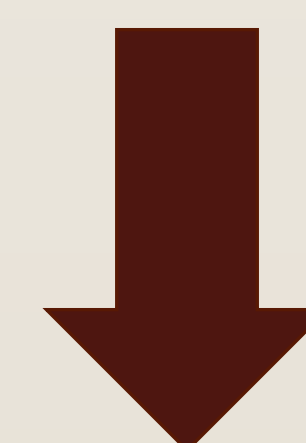
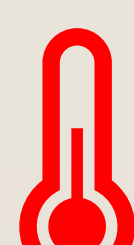
Debye–Hückel theory
limiting laws for unideal
solutions



- 34.590 ppm salinity
- T range: $4\text{--}12^{\circ}\text{C}$
- O_2 different pO_2
- $\text{pAtm} = 1$

HMP protocols

HMP treatments
34.590 ppm
 $50 < \text{pO}_2 < 800 \text{ mmHg}$



Dissolved O_2

Conclusions

The amount of O_2 administered to the organ is associated with the perfusate flow towards the organ and $[\text{O}_2]$ in the perfusate. As the perfusate is carrier-free, the O_2 reaching the organ corresponds to the dissolved O_2 in the perfusate. The relationship among O_2 content in perfusate, pO_2 and T shows higher T associated to lower O_2 at constant pO_2 .