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Evaluation of expiratory humidity with different heated humidifiers circuits

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INTRODUCTION

The optimisation of the inspiratory and expiratory circuits used with heated humidification is necessary to avoid condensation and related problems, such as auto-triggering, difficulties to trigger the ventilator, or increase in expiratory resistances¹.

OBJECTIVES

To compare humidity in several expiratory circuits of different heated wire humidifiers.

METHODS

On a bench model simulating humidified expired gas (absolute humidity of 35 mgH₂O/L), we measured hygrometry of expiratory gases at proximal and distal side of expiratory circuits (figure 1). The evaluated circuit were Inspired ref. 51005683 (Vincent medical), FP950 (ref.950A81J, Fisher&Paykel), MR850 (RT210, F&P) and Evaqua2 (RT380, F&P), at different room temperatures (22-24°C and 28-30°C).

Ventilator settings (Evita XL): TV 400ml; RR 25/min; PEEP 5 cmH₂O; FiO₂ 0.21; Flow 60 lpm. 3 hygrometric measurements were performed for each condition with the psychrometric method.

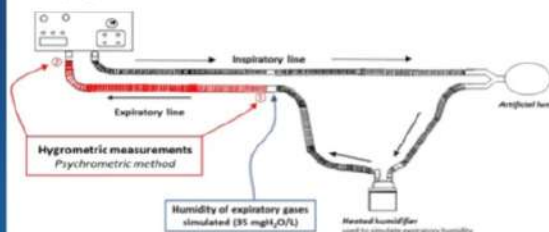


Figure 1: Bench model to simulate expiratory gases at 35 mgH₂O/L
Declaration of interest:

oxynov - Any other interest (financial or otherwise) : Co-funder, Co-inventor of FreeO2, ShareHolder, Board director

RESULTS

Main results are shown on the figure 2. The absolute humidity was reduced along the expiratory circuit with the FP950 and the Evaqua circuits (RT380). To avoid condensation in the expiratory limb, the VHB20 increases the temperature along the expiratory limb (leading to a reduction of relative humidity with stable water content). A similar functioning was observed with the MR850/RT210 circuit. No condensation was found along the expiratory limb for the different tested circuits in the bench study conditions. Results at different ambient temperatures were very closes.

With an HME (Hygrobac DAR) at the Y-piece and usual simple tubing: the humidity after the HME and at the expiratory port of the ventilator was low as expected. After Y-Piece = AH:7.7±0.4 mgH₂O/L (RH=27.2%). At expiratory port = AH:7.8±0.3 mgH₂O/L (RH=28.7%).

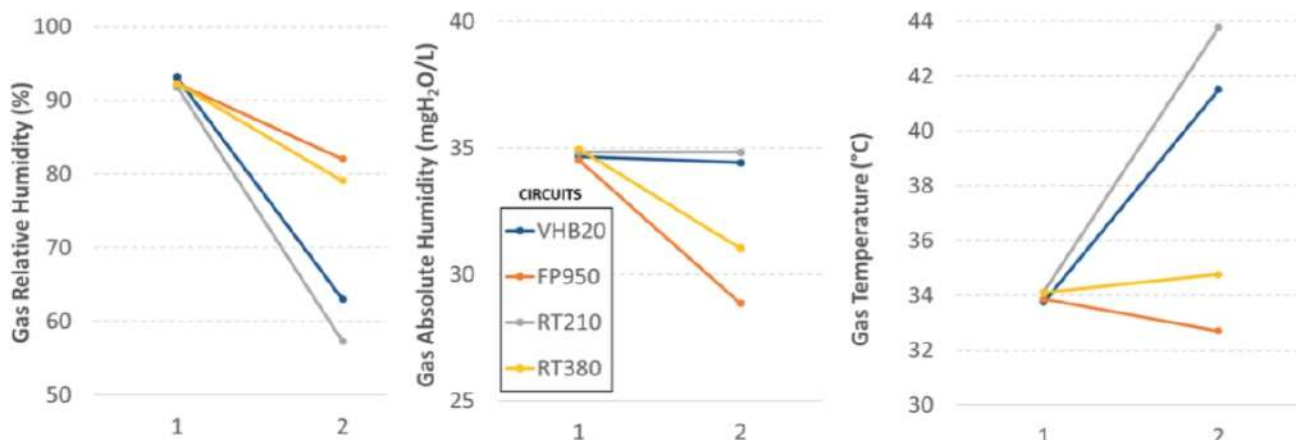


Figure 2: Mean Relative Humidity, Absolute Humidity and gas Temperature measured at the Y-piece ① and at ventilator inlet ② with different circuits used with VHB20, FP950 and MR850 (RT210 and RT380, Evaqua2) heated humidifiers. When a performing HME is at the Y-piece, RH is ① ②, AH is ① ② and temperature is ① ②.



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