E7 Biocompatible Polymer for Self-Humidification

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This research proposes biocompatible materials to recover moisture from human exhalation for humidifying inhaled air to alleviate the iatrogenic nasal dryness caused by Continuous Positive Airway Pressure (CPAP) therapy.

Humans diagnosed with Obstructive Sleep Apnoea (OSA) experience repeated breathing pauses during the night. CPAP therapy is recognised as the first-line non-invasive treatment for OSA, and this treatment can continuously keep the human upper airway open using pressurised airflow (Al-Jumaily et al., 2003). Despite the benefits of this treatment, the high pressure leads to nasal dryness due to moisture depletion and temperature damage to the respiratory tissues. Humidifying the CPAP airflow is the traditional way of resolving this problem, which is bulky, costly, and inconvenient for users. However, literature has proved that human exhaled airflow contains sufficient water to rehumidify the inhaled air (Grau-Bartual & Al-Jumaily, 2018).

The primary objective of this investigation is to address the issue of upper airway dryness by fabricating a smart polymer capable of capturing and releasing water vapour molecules. The ideal characteristics of this polymer would include facilitating optimal water vapour exchange (approximately 44 mg H_2O/L) and operating effectively within the typical human breath cycle, which lasts 4 to 6 seconds (Grau-Bartual & Al-Jumaily, 2020). A comparative analysis was conducted on various polymer compositions, different experimental configurations (shapes, sizes), and CPAP pressure conditions to identify the most promising polymer. Preliminary results indicate that certain polymer compositions achieved high moisture recovery under some configurations. However, limitations such as polymer durability remain for further investigations.

These findings highlight the potential of smart polymer materials as promising candidates for biomedical applications requiring rapid moisture recovery. This presentation outlines the nasal dryness issue associated with CPAP therapy and the innovative non-invasive solutions, emphasising smart polymer applications to humidify the respiratory airflow.

Keywords
Smart Polymer, Humidification, CPAP therapy

References

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