醫療院所常見麻醉廢氣採樣分析技術初探

A Preliminary Study of Sampling and Analysis for Common Waste Anesthetic Gases in Medical Unit

中文摘要

醫療院所醫護人員在使用麻醉氣體爲病患進行手術時，常暴露於病患呼出或管線洩漏之麻醉廢氣，其中以笑氣最爲嚴重。研究指出，暴露笑氣可能會造成醫護人員生殖系統之危害，引發自發性流產、早產、新生兒低出生體重以及不孕等問題，並可能會減緩心智活動之能力，實有必要對醫療院所麻醉用笑氣定期進行環境監測。

我國尚未建立笑氣測定之採樣分析方法，而目前常見之笑氣測量技術主要以紅外線光儀直接分析空氣，或使用分子篩 5A 吸附管採樣，經脫附後以氣相層析儀搭配電子捕捉偵測器（GC-ECD）或紅外光儀分析。方法皆有其限制或不便。

本研究以採樣袋收集笑氣樣本，送回實驗室利用氣相層析質譜儀（GC- MS）進行笑氣濃度分析，驗證方法之準確性與精確性。實驗結果發現使用此方法確能同時偵測笑氣及 Desflurane、Sevoflurane 和 Isoflurane 三種揮發性麻醉劑，具良好之定性及定量能力。採樣後在冷藏之環境下可以儲存七天，而使用內標法則可增加分析的穩定性及準確度。本研究方法值得做爲笑氣分析方法選擇之參考。

英文摘要

Nitrous oxide is used as a surgical inhalation anesthetic. Health care professionals worked in operating rooms or recovery rooms are potentially exposed to nitrous oxide from various components of the anesthesia delivery system or the exhaled gases of patients. The possible effects of nitrous oxide exposure included spontaneous abortion, premature delivery, low birth weight, involuntary infertility, as well as the decrement in audiovisual performance. It is important to evaluate the potential risks of excess exposure to waste anesthetic gases and to implement the appropriate controls to minimize these risks.

We do not yet have a certified standard method for nitrous oxide sampling and analysis. Current best recommended method for nitrous oxide measurement is infrared spectrophotometer. The molecular sieve 5A sampling tube was also used to collect nitrous oxide. After sampling, molecular sieve 5A tube are desorbed and then analyzed by gas chromatography or infrared spectrophotometer. However, the uptake rate of nitrous oxide on molecular sieve 5A tube varied with the absorbed mass. The sampling rate was non-liner and the variance was too large to satisfy. Moreover, infrared spectrophotometer is easily interfered with carbon dioxide, and its minimum sampling volume is limited by the cell volume of spectrophotometer when using air

sampling bag instead of field direct reading.

In this study, we try to establish a new method of nitrous oxide measurement. Air will be sampled with sampling bag and then determine the concentration using gas chromatography with mass detector. The accuracy and precision of the new method will be verified. For the co-existing of nitrous oxide and volatile anesthetic gases in a field environment, we also attempt to analyze those co-existing anesthetic gases, Sevoflurane, Isoflurane and Desflurane. Finally, a suggested method for nitrous oxide air sampling and analysis will be drafted.