Optimization of the Determination of Carbon Monoxide in Postmortem Blood by using an IL 682 CO-Oximeter

R. Dayaljee*, C. M. Kinnear, H. J. Jansen van Rensburg, and A. A. Grové
Department of Health: Forensic Chemistry Laboratory, Private Bag X282, Pretoria 0001, South Africa

AIMS: Carbon monoxide (CO) poisoning is a significant cause of fire-related deaths in South Africa. The rapid increase in population in recent years has resulted in many people having to live in informal houses constructed of wood, corrugated iron or cardboard. The families utilize paraffin lamps and candles, which often result in fires, many of which are fatal. As urbanization has increased, the Forensic Chemistry Laboratory in Pretoria, South Africa has received a steady increase in the number of samples submitted for postmortem analysis of CO. Until 2006 the laboratory utilized a GC-TCD method for analysis of CO, with a separate spectrophotometric method for determination of total hemoglobin concentration. This method was found to be labour intensive and with an increasing number of blood samples, an alternative method needed to be investigated. CO-oximetry, using an IL 682 CO-oximeter with some sample pre-treatment, was the method of choice. The method is low cost, highly automated and produces a valid result within minutes.

METHODS: The IL 682 CO-oximeter has a thallium/neon hollow cathode lamp, and monitors wavelengths of 553.0 nm, 585.2 nm, 594.5 nm, 626.6 nm, 638.3 nm and 667.8 nm. Samples received for carbon monoxide determination, as well as MULTI-4™ CO-oximeter controls were used in this experiment. Sample pre-treatment involves the addition of sodium dithionite for to reduce methemoglobin to hemoglobin before aspiration into the CO-oximeter. Initially, the procedure was to add a spatula of sodium dithionite to a small amount of postmortem blood; however, this method was replaced by the more quantitative procedure of dilution with a saturated solution of sodium dithionite.

RESULTS: The procedure of just adding a spatula of dry sodium dithionite to a small amount of blood resulted in various instrument errors including “Check Cuvette”, “High MetHb” and “High Turbidity” messages. Satisfactory results were obtained by using a saturated solution of sodium dithionite to dilute post-mortem blood at a 1:1 ratio and vortex-mixing to ensure complete reduction of methemoglobin. The performance of this method on international proficiency testing specimens has been excellent.

CONCLUSIONS: This study demonstrated that, with the correct pre-treatment of postmortem blood, the CO-oximeter could be used for routine carbon monoxide determination in postmortem blood successfully, replacing the time-consuming, demanding and complicated GC-TCD and spectrophotometric method previously used.

Keywords: Carbon monoxide poisoning, Postmortem blood, CO-oximetry