

Validation of drugs separation in a multiplexing infusion system

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Overview

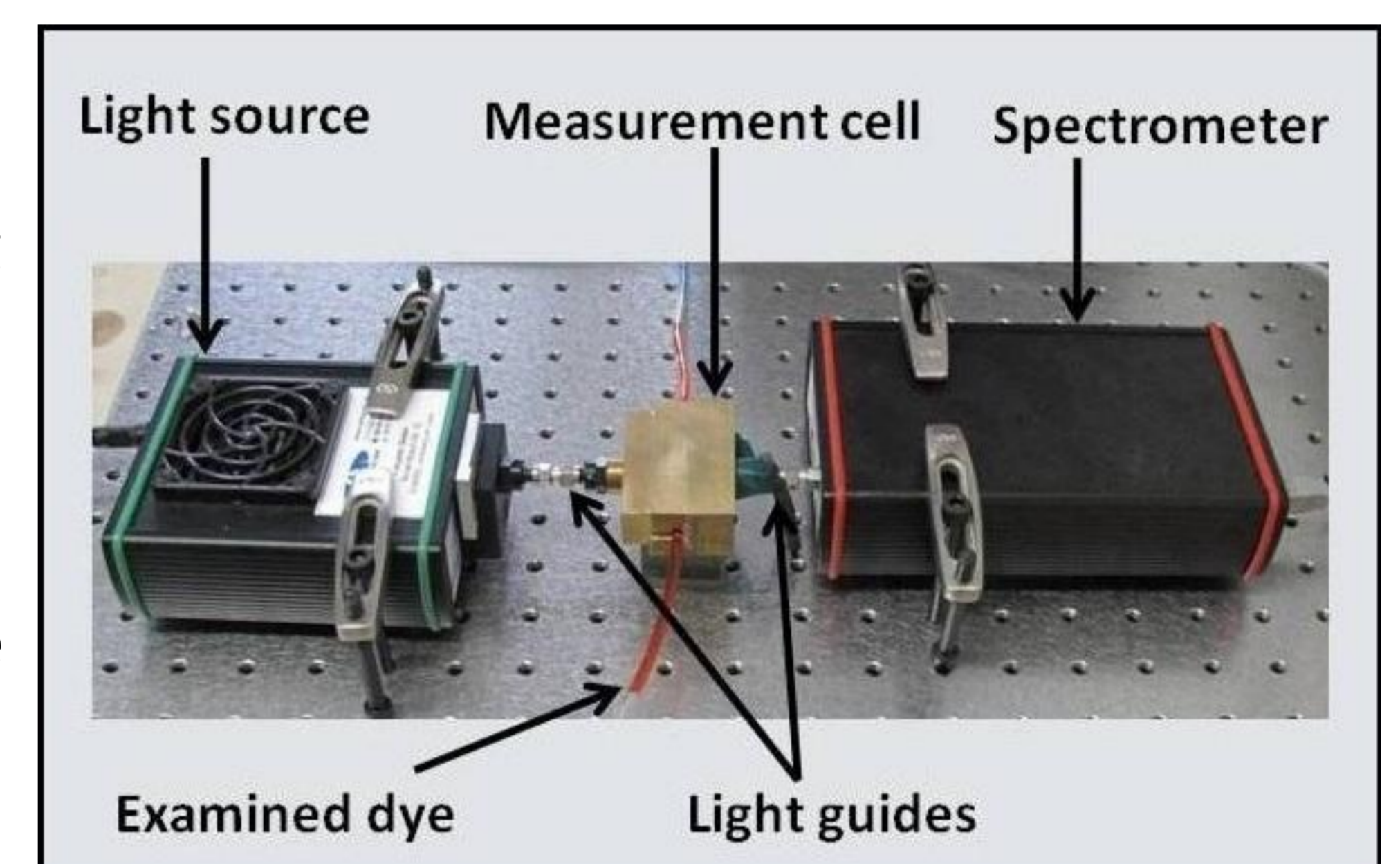
Preventable hospital errors related to infusion systems

- Intravenous (IV) infusion errors are a significant source of harm to patients.
- IV infusion setups seem uncontrolled due to flow rates and pressure differences between syringe pumps[1].
- Hygiene problems present when transporting patient (connected to infusion lines) between operating room and intensive care unit[2].
- Drug multiplexing means separating successively flowing drug portions by a gaseous medium.

Method

Measuring absorption for concentrations identification

- Dyes with different concentrations were prepared to mimic drugs.
- Dyes separated by CO₂ or air portions of μL volume were flowed through an optical measuring cell.
- UV-VIS absorbance measurements were done to explore dyes concentrations.
- Concentrations deviation from known original values means that the contaminants are present in the following portions of the flowing dyes.

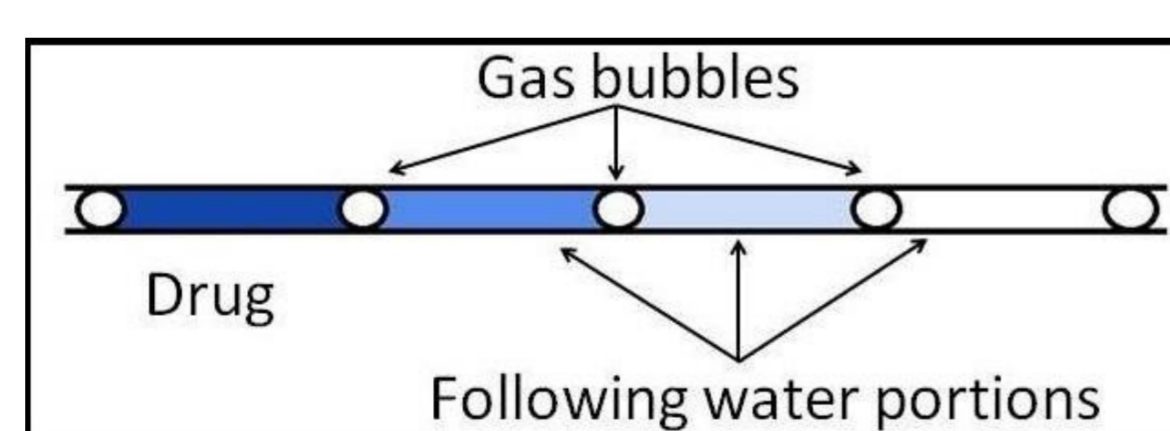


Optical setup for measurements of light absorption.

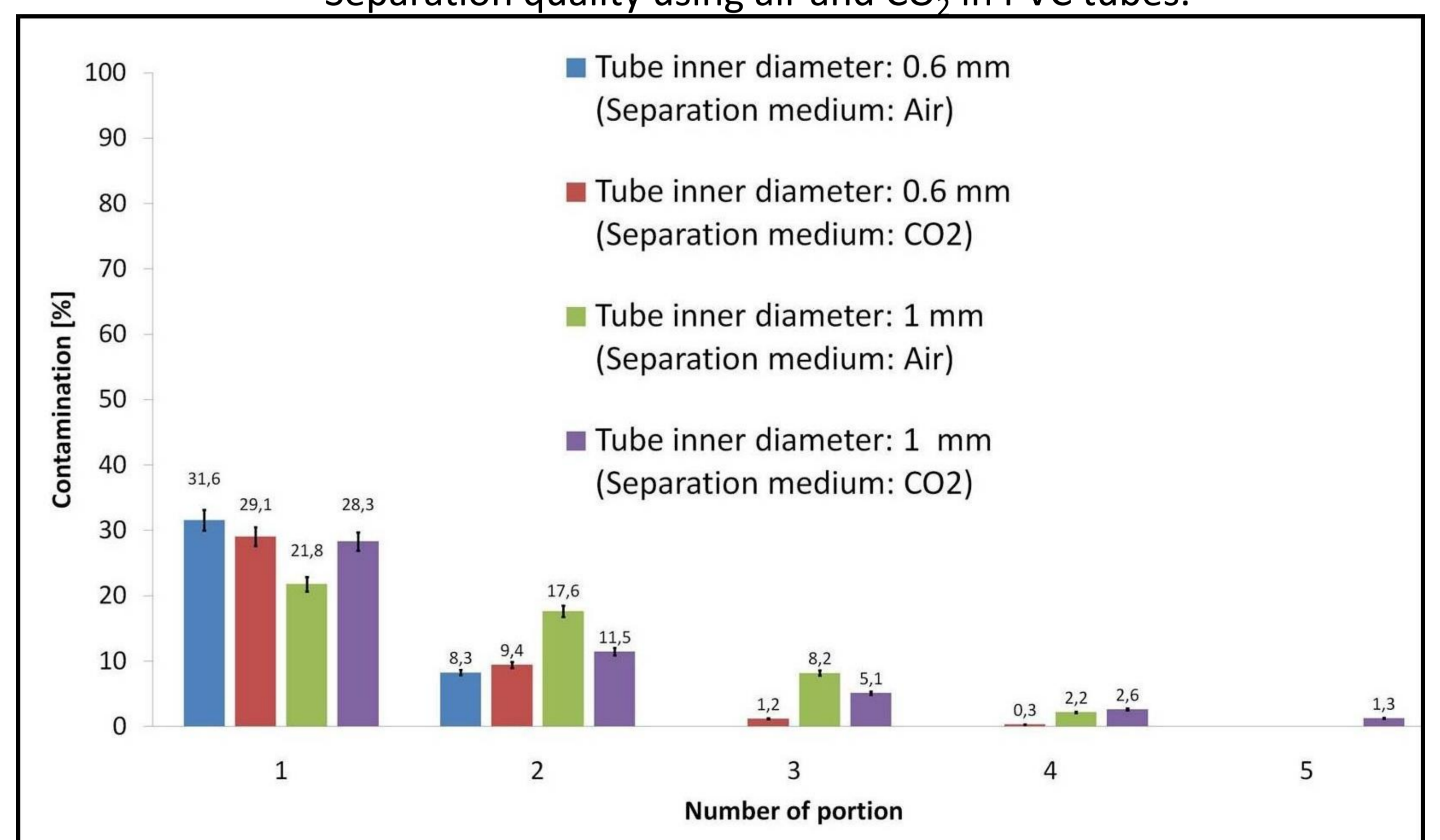
Results

Contamination measurement of multiplexed drugs

- Due to its high solubility in blood, CO₂ was used as separating medium in the experiments.
- Measurement were repeated 8 times with Polyvinyl chloride (PVC) tubes of 0.6 mm and 1 mm inner diameter.
- Volume of 4.26 μL CO₂ served as separating medium effectively.
- CO₂ flow rate < 0.1 mL/ min.
- The showed results represent the mean value of 4 measurements.



Separation quality using air and CO₂ in PVC tubes.



Conclusion

- Infusion line diameter plays a vital role in drug multiplexing.
- Better separation is achieved with smaller inner diameter of the tubes.
- The smaller the line diameter, the less volume of CO₂ needed to eliminate contamination of drugs.

References

- [1] A.M.D Timmerman, B. Riphagen, J.H.G.M Klaessens; R.M. Verdaasdonk, Development and validation of a new method for real-time measurement of fluid dynamics during simulated multi-infusion setups IFMBE Proceedings Vol. 25, 2009.
- [2] S. Abdul-Karim, Design and development of a test bench to separate drugs in a multi-infusion system using gas bubbles, Master Thesis, Lübeck University of Applied Sciences, 2013.

