

Design and implementation of a test bed to separate different drugs in multi-infusion system using gas bubbles

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Motivation

Preventable hospital error

- Uncontrolled Intravenous (IV) setups due to flow rates and pressure differences between syringe pumps[1].
- Hygiene problems when transporting patient between operation room and Intensive Care Unit[2].
- Chemical incompatibility between drugs; means that the drug may be chemically degraded, due to oxidation, or decomposition[3].
- Chaos and complexity in infusion lines could be seen as a source of errors.



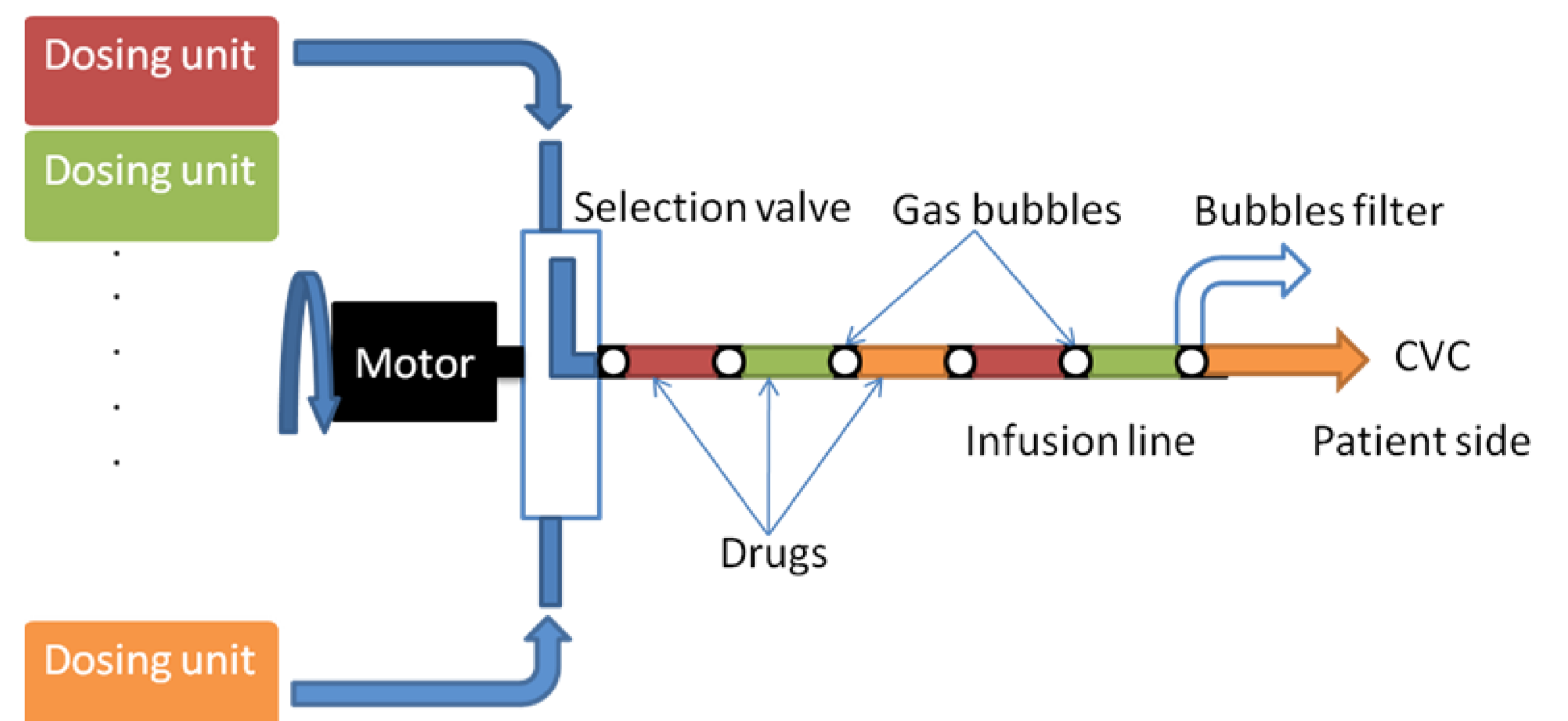
Complexity creates opportunity for errors[4].

Solution

One miniaturized IV delivery station

- By inserting only a single Catheter and applying a proper separation method between flowing drugs, the total volume of the delivery station will be miniaturized[5].

Concept

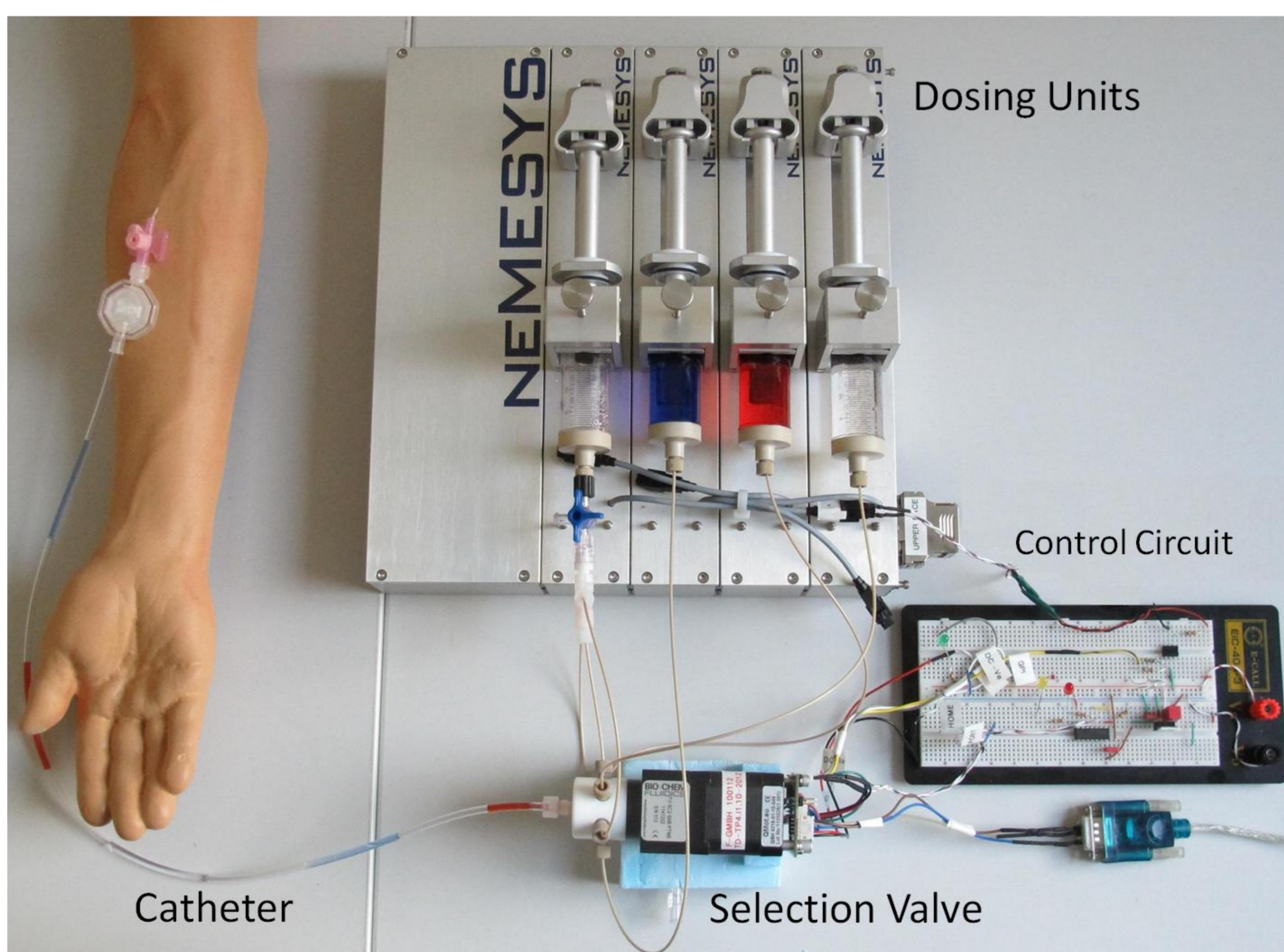


A concept for single Catheter infusion system[2].

Results

State-of-The Art Drug Multiplexing

Realization of Concept



Test bed as a functional prototype attached via Catheter to a phlebotomy arm.

Measurements

The quantitative results (for testing Catheters of different materials and diameters with different flow rates) are shown in the table.

Material of Catheter	Dosed volume 0.41 [mL]		Dosed volume 0.16 [mL]	
	Measured volumes		Measured volumes	
	Mobile phase	Cleaning medium	Mobile phase	Cleaning medium
PUR*	0.46 (+12.2 %)	0.48 (+17 %)	0.18 (+12.5 %)	0.17 (+ 6.25)
PVC**	0.43 (+4.878%)	0.40 (-2.439%)	0.17 (+6.250%)	0.17 (+6.250%)

*Polyurethane (Catheter radius: 1.25 mm)

**Polyvinyl chloride (Catheter radius: 1.5 mm)

The results present the mean of 8 values.

The measurements were done at 25 °C and 30% RH.

Conclusion

- The design of a test bed toward one module delivery station is accomplished.
- The principle of separating different fluidic media using gas bubbles is quantitatively approved.

Outlook

- Verifying the separation principle qualitatively and quantitatively.
- Developing a functional model.

References

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- [4] Image "Complexity creates opportunity for errors", Internet:<http://ehealthinnovation.org> (Accessed: 01 Mar. 2014.)
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