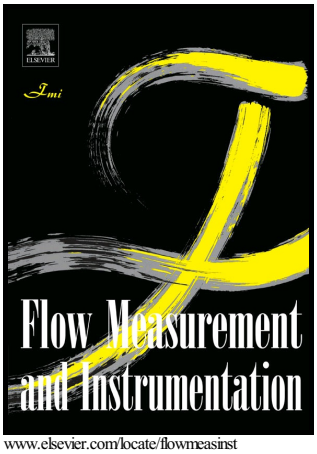


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PII: S0955-5986(17)30297-2
DOI: https://doi.org/10.1016/j.flowmeasinst.2018.03.009
Reference: JFMI1433

To appear in: *Flow Measurement and Instrumentation*

Received date: 14 July 2017
Revised date: 1 February 2018
Accepted date: 18 March 2018

Cite this article as: Seok Hwan Lee, Woong Kang and Sejong Chun, Dynamic behavior analysis of drug delivery devices using a dynamic gravimetric method, *Flow Measurement and Instrumentation,* https://doi.org/10.1016/j.flowmeasinst.2018.03.009

# Dynamic behavior analysis of drug delivery devices using a dynamic gravimetric method

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Abstract

The calibration of drug delivery devices is essential for accurate dose control. In this study, drug delivery devices, namely infusion and syringe pumps, were assessed using a dynamic gravimetric method. The flow rates caused by the syringe pump, infusion pump, and pressure-based pump were measured at various flow rates (0.5–60 mL/h) by simultaneously using a dynamic gravimetric method and flow meter. The measurement error uncertainty of the pumps were obtained using the dynamic gravimetric calibration method. The pulsation period and amplitude were obtained with respect to the flow rate to analyze the pulsating flow of the syringe pump and infusion pump. The pump error increased in the following order: the pressure-based pump, syringe pump, and infusion pump based on the flow rate. The measurement error uncertainty of the syringe pump increased slightly when the flow rate decreased, whereas the infusion pump exhibited significant increases in the error and uncertainty when the flow rate decreased. The flow stability of the pulsating flow from each pump was analyzed according to the flow rate. Thus, we discussed the characteristics of the pulsating flow from each drug delivery device. We confirmed that the pumps had different flow stability, error, and measurement uncertainty because of their different working principles.
Keywords: Drug delivery device; micro-flow; gravimetric method



## 1. Introduction

Drug delivery devices are widely used in clinical environments. The calibration of the micro-flow rate of a drug delivery device is a crucial process in drug delivery such as for pain treatment using Prialt (maximum daily dose 21.6 μg) and implanted infusion devices (70 nL/min) [1]. Precise control and measurement are also required in micro-reactors, catalysis [2], and micro-pumps used for medical applications such as implantable insulin pumps [3].