

Introduction

Flownamics has interfaced the YSI 2700 Select™ and YSI Multiparameter Biochemistry Analyzers with the Seg-Flow 4800 Automated Sampling and Feed Control System. The integration of these instruments provides on-line, real-time nutrient, metabolite and product monitoring of fermentation and cell culture processes as well as on-line biochemistry analyses for biofuel, food, beverage and other industrial chemical processes. In order to establish the reliability and analytical capabilities of these integrated systems, evaluations were accomplished to demonstrate analytical performance comparability between the Seg-Flow 4800/YSI analyzer system and its respective off-line YSI instrument. Furthermore, the study was conducted to rule out any cause for analytical drift or error that could be attributed to the type of vessel sampling probe used.

Performance Evaluation

The first evaluation was performed using a YSI 2700 Select biochemistry analyzer integrated with the Seg-Flow 4800 system. The second evaluation was conducted using a YSI 7100 Multiparameter biochemistry analyzer. Both Seg-Flow 4800/YSI analyzer systems performed simultaneous vessel sampling and analysis of chemically defined media every 15 minutes. On-line samples were drawn from the vessel using both a FISP *in-situ* sampling probe (0.2 um microfiltered) and a glass dip tube (non-filtered). Samples obtained through each of these probes were analyzed for comparability. Off-line analyses were conducted in manual mode using the same YSI analyzers that were interfaced with the Seg-Flow 4800 instrument. The concentrations of glucose, lactate, glutamate, glutamine were varied throughout the experiment to ensure a broad measurement range for the YSI analyzers.

Performance Data

The correlation coefficient (R^2) values of each analyte are summarized in Table 1. The data is segregated by the YSI instrument evaluated, and is further differentiated by the on-line sampling method used, i.e., FISP *in-situ* sampling probe vs. glass dip tube. Figure 1 shows the correlation curve, R^2 values and slope for the measured analytical range of each analyte obtained by the YSI 2700 and YSI 7100 analyzers.

Table 1. Correlation Coefficient Summary for On-line and Off-line YSI Analyzer Analyses

Analyte	Correlation Coefficient (R^2)			
	YSI 2700		YSI 7100	
	FISP Sampling Probe	Dip Tube	FISP Sampling Probe	Dip Tube
Glucose	1.00	1.00	0.99	1.00
Lactate	1.00	1.00	1.00	1.00
Glutamate	1.00	1.00	1.00	1.00
Glutamine	1.00	0.99	1.00	1.00

As shown by the correlation coefficient data displayed in Table 1 and Figure 1, a strong, positive correlation was observed between the off-line and on-line analytical methods for each of the analytes. This relationship was essentially the same for both the YSI 2700 and YSI 7100 analyzers, which affirmed the analytical integrity of the Seg-Flow on-line integrated system. Additionally, the on-line analytical performance was independent of the sampling probe used, which demonstrated the robustness and consistency of the FISP *in-situ* sampling probe as compared to the glass dip tube.

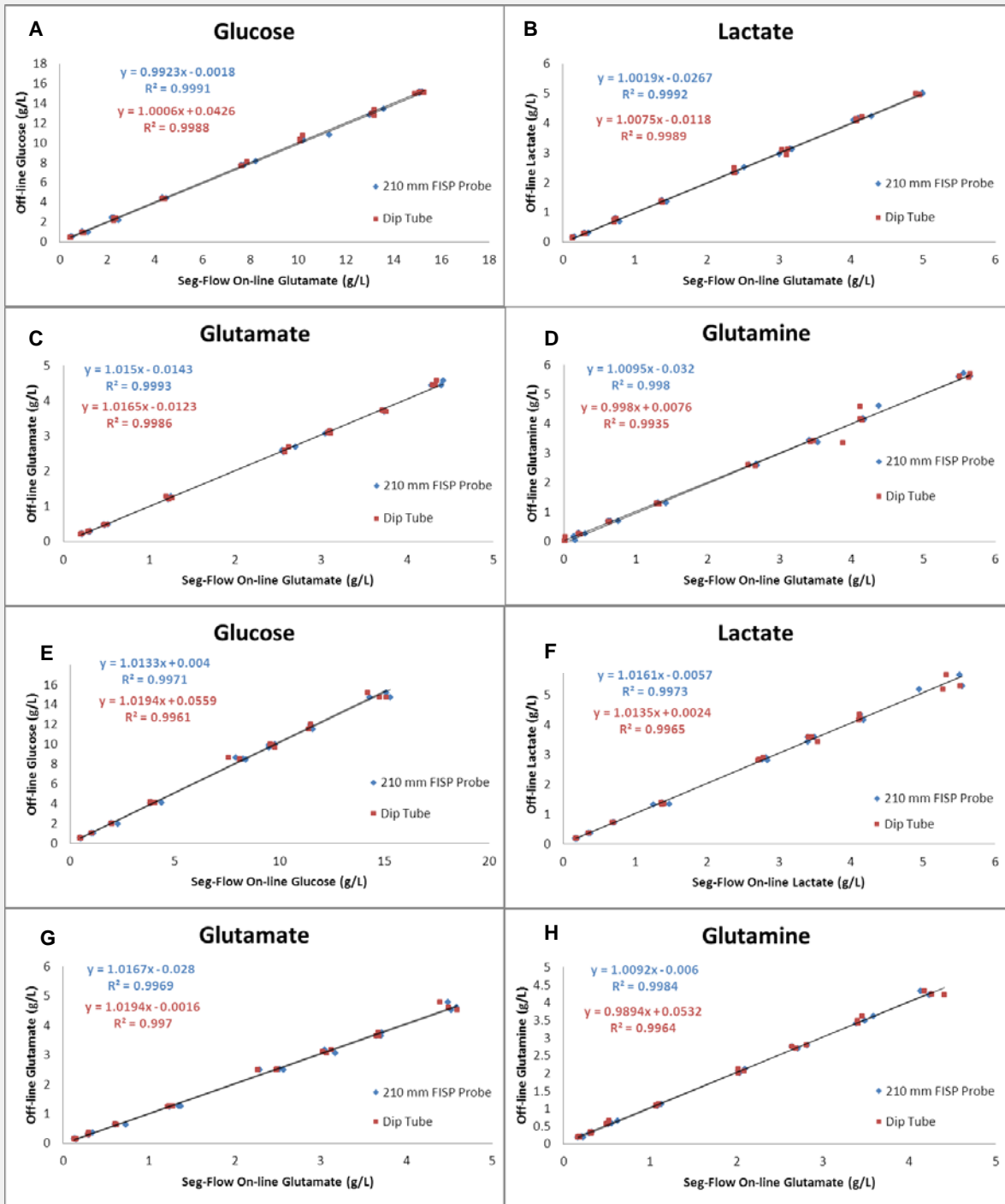


Figure 1. Scatter plots comparing the off-line and Seg-Flow on-line YSI 2700 analyses for (A) glucose, (B) lactate, (C) glutamate, (D) glutamine. Scatter plots comparing the off-line and Seg-Flow on-line YSI 7100 analyses for (E) glucose, (F) lactate, (G) glutamate, (H) glutamine. Linear regression (slope) and correlation coefficient (R^2) are shown for each analyte. Seg-Flow on-line data generated from samples drawn through the FISP *in-situ* sampling probe and dip tube are shown in blue and red, respectively.

Conclusion

In this study, both the Seg-Flow 4800/YSI 2700 Select and the Seg-Flow/YSI 7100 automated on-line systems demonstrated analytical robustness and consistency throughout the measured analytical range for each analyte. Furthermore, the Seg-Flow 4800 enhances the YSI biochemistry analyzer's analytical capabilities by providing fast, precise on-line analyses for real-time monitoring of fermentation, cell culture and other biochemical processes.