Bioprocesses require automated process control to make quality products consistently and efficiently. Process analytical technology (PAT) to monitor bioreactor parameters is the first step toward automated bioprocess control and QbD (bottom). Raman spectroscopy is well suited as a bioprocess PAT. This poster presents Raman PAT solutions that enable process control with demonstrated cross-scale and cross-platform transferability.

**INTRODUCTION**

As a PAT in bioprocessing, Raman spectroscopy provides in-line measurements of multiple components in real time using a single probe. [1] A Kaiser RamanRxnSystems analyzer was used to collect Raman spectra during cell culture or fermentation in a laboratory/process development (top left), in suite placement (top center) and manufacturing (top right) environment. In situ real-time bioprocess monitoring achieved in single-use, glass or stainless steel bioreactors using Kaiser probes for lab-scale/PD (bIO-LAB, bottom left) or manufacturing scale (bIO-PRO, bottom center) or single-use (single-use systems, bottom right).
RESULTS AND DISCUSSION

Principles of Raman-based closed-loop feedback control (left). Raman-predicted glucose values enable in-process feeding corrections. A control model can be quickly developed in laboratory and concurrent bioreactor runs. Raman’s specificity is harnessed for qualitative (top right) and quantitative (top right) analysis. Bottom right: Raman-based closed-loop feedback control of glucose in CHO cell culture increased culture duration and VCD (bottom left) and improved product quality (bottom right). [3-5]

CONCLUSIONS

Raman spectroscopy has proven benefits for monitoring and control in upstream bioprocessing applications in miniature bioreactor, benchtop, pilot, and cGMP manufacturing-scale applications, leading to increased yield and improved product quality. [6-8] Kaiser’s award-winning Raman technology has also been demonstrated in downstream applications such as purification, aggregation, higher order structure, and post-translational modifications. Thus, Kaiser Raman is a valuable PAT throughout a bioproduct’s lifecycle.

REFERENCES