In-situ Plasmonic Monitoring of Dissolved CO and Metabolites for Biological Gas Conversion

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Monitoring the concentrations of CO and metabolites in biological gas conversion is essential for optimization of conversion process and prevention of process failure. In general, chromatography-based detection methods are used for measuring the concentrations. However, off-line sampling process is necessary for the detection, which exposes the reactor to the risk of contamination. Furthermore, the concentration of dissolved CO is predicted by calculating from the measured concentration of gaseous CO assuming that CO in gas and liquid phase are in equilibrium. Since CO is not in equilibrium in biological conversion due to continuous consumption by microorganisms, this prediction is inaccurate. Here, we demonstrate the in-situ plasmonic monitoring of dissolved CO and metabolites via surface-enhanced Raman spectroscopy. The sensitivity, selectivity, and reproducibility are systematically investigated by measuring Raman signals. The simultaneous monitoring of dissolved CO and metabolites in conversion reaction media are also demonstrated.