Supplementary Information

To detect the concentration of the VOCs genenrated by the bubbler according to Henry’s law, we measured the different concentrations of isopropanol, ethanol, and acetone with different concentrations from 5 ppm to 500 ppb by a total VOC analyzer from Greywolf. For methanol, the analyzer is not able to do the calibration so we did not make the measurement. When the concentration is 250 ppb, the analyzer cannot make the measurement. The results measured by the analyzer are listed in Table 1. The concentrations measured by the gas analyzer is close to the concentrations we calculated by Henry’s law.

Table 1. Concentrations of different VOCs calculated from Henry’s law and measured by VOCs analyzer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 5 ppm | 2.5 ppm | 1 ppm | 500 ppb |
| Isopropanol | 5.07 ppm | 2.58 ppm | 0.94 ppm | 468 ppb |
| Ethanol | 5.32 ppm | 2.34 ppm | 1.03 ppm | 430 ppb |
| Acetone | 5.41 ppm | 2.73 ppm | 0.966 ppm | 413.2 ppb |

At the same time, we also changed the gas flow from 1000 sccm to 200 sccm and measured the concentration of isopropanol generated by different flow rates. The results are listed in Table 2. When the flow rate is higher than 400 sccm, the gas concentration is relatively stable and close to the calculated value, but when it is low to 20 sccm, the gas concentration is significantly decreased.

Table 2. Concentration of isopropanol generated with different flow rates compared with the calculated value

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Flow rate (sccm) | 1000  | 800 | 600 | 400 | 200 | Calculate |
| Concentration (ppm) | 5.38 | 5.25 | 5.03 | 4.60 | 3.59 | 5 |