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NO_x光解测量装置的设计与测试

Design and application of the NO_x photolytic convertor system

关键词：二氧化氮 氮氧化物 光解 测量技术

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摘要：根据二氧化氮的光解反应原理,自主设计、装配了一套氮氧化物光解反应装置,并将其与Thermo 42系列氮氧化物分析仪的化学发光检测室联用,进行了不同条件下(分别为标气流量、臭氧流量、光源温度、功率、样品湿度)NO_2光解转化效率的测试.结果表明:进样流量为100~200 mL·min^{-1}、光源温度为20℃、光源功率约为60 W(光密度约26 W·mL^{-1})的条件下,可得到较高的光解转化效率(约80%);臭氧流量及样品相对湿度对转化效率影响不大.在上述最佳转化效率的条件下,将其与PLC860-CLD88p(ECO PHYSICIS)进行了为期8 d的比对实验.结果显示:二者的NO_2实际测量结果趋势基本一致:$[NO_2]_{ECO}$=0.908×$[NO_2]_{PKU}$ +1.913(R^2=0.955),初步证实了该套自主设计光解装置应用于实际观测的可靠程度.

Abstract：A set of photolytic convertor was designed according to the principle of nitrogen dioxide photolysis reaction. The convertor was combined with the NO-NO_2-NO_x analyzer's chemiluminescence detector(Model 42i-TL,Thermo Fisher Scientific Inc.) in order to test NO_2 conversion efficiency under various conditions of the sample flow, the dry air flow, the light source temperature, the source power and the relative humidity of the sample. Two Preliminary conclusions are drawn from this study: ① when the sample flow was between 100 and 200 mL·min^{-1}, the light source temperature was 20 ℃ and the source power was about 60 W, a relatively high conversion efficiency was obtained (about 80%);② Both the dry air flow and the relative humidity of the sample had little influence on the conversion efficiency of NO_2 in the present system. Furthermore, an 8-day intercomparison experiment was conducted between the photolytic convertor system designed in this study and commercial instrument of PLC860\\CLD88p (ECO PHYSICIS). Both NO and NO_2 results showed good correlation between the two instruments, which indicated the reliability of the new photolytic convertor for field measurement.

Key words：NO_2 NO_x photolytic monitoring technique