

烟度自动监测仪*

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摘要 烟度自动监测仪是一种能昼夜连续自动监测锅炉排放烟气黑度的现代化仪器。它具有自动采样、显示、存贮、运算等功能。整机采用单片机控制, 对实测和运算值进行数字显示, 及时监测烟气排放是否超标。机内还设计了断电保护装置, 即使连续断电半年, 数据仍不丢失, 断电恢复后, 仪器能自动启动并连续运行。机内可存贮连续半年的监测有效数据。该机也同样适用于水泥、陶瓷、化工等行业的粉尘及烟尘监测, 只需改变软件程序, 仍可达到同样的监测效果。

关键词 烟度, 监测仪, 环境监测。

1 主要技术性能

测定方法: 光度测定法。

测量范围: 0—5 级林格曼黑度 (0—5000mg/m³)。

测量精度: $\pm 5\%$ 。

显示形式: 八段 LED 显示器。

显示方式: 有 6 种状态可选择显示:

- (1) 显示当日最大烟气黑度;
- (2) 显示当日超标累计时间;
- (3) 显示累计开机后超标时间;
- (4) 显示累计开机后有效工作时间;
- (5) 显示实时钟时间;
- (6) 显示修正时间。

采样频率: 1 次/min。

2 结构与原理

2.1 结构

本仪器由检测传感器、恒流电源、微控制器、存储器、放大电路、F/U 转换、运算控制、数据显示、断电保护、电源稳压电路等组成。其结构见图 1。

2.2 工作原理

2.2.1 检测部分

(1) 采样检测接受装置由标准光源和信号检测器组成。当它受光射时在受光面和背光面之间

产生相应的电位差, 而光电检测器在特定的范围 (线性段) 内和特定条件 (外电阻不大于 400 Ω) 下所产生光电流的大小与受光强度成正比, 光强越大, 产生的光电流也越大。

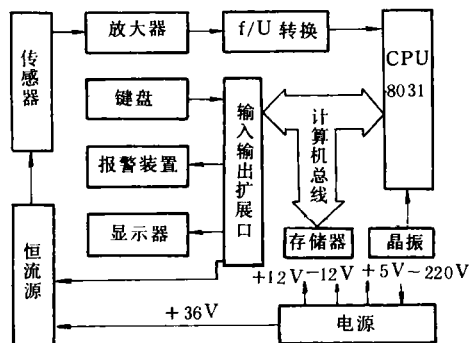


图 1 结构框图

(2) 采样接受装置工作过程 光源发出一束恒定强度的标准平行光, 通过被测烟气后, 照射在光电检测器上, 检测器便产生与照度成线性关系的电流, 此电流通过馈线输入主机。烟气黑度等级的划分, 是采用林格曼光度定标法进行确定的。采样为每分钟的第 58 秒光源开启, 第 59 秒的光照电流值作为计算机的采样信号。第 60 秒光源关闭。

2.2.2 主机部分

采样信号为 0—50 μ A 的微弱电流。此电流

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经过 I/U 转换和前置放大后为一定幅度的交流电压信号。这个电压信号通过 F/U 转换及整形便成为计算机可接受的频率信号;经光电耦合器耦合至计算机 8031 的计数器输入端口。

频率信号为 800Hz—1500HZ。由于采用的元件全为线性元件,所以这个频率与光电池的电流变化均为直线性,不需使用其它措施进行补偿。计算机内部的计数器对采样信号进行计数,并对计数值用软件进行运算后,送至八段 LED 显示器进行林格曼黑度值的显示。

该机采用 8031 单片微型计算机作为控制装置,在外围电路上扩充 2KRAM,用了 2KEPROM 程序区并扩充了 8255 口引向各个功能键。8031 单片机接受秒脉冲信号发生器的秒脉冲进入中断处理,将所采集到的数据进行寄存、处理、运算。然后分别把所运算后的数据存入相应的 RAM 单元中。

本系统软件约占 2K 字节,由 1 片 EPROM2764 组成,固化的 EPROM 插在单片机地址为 0000H 开始的 ROM 插座上。本机一接通电源,能自动从用户程序 0050H 启动工作。程序设计为每分钟采一个数,每天共采集 1440 个数据,然后按规定计算出日平均值、日最大值等,存入计算 RAM 区中。

整套程序具有较强的功能,整个设计,采取了模块化的程序结构,利用了分级模块的结构原理,使模块之间调用单一、单向化。这样提高了软件本身的结构化及容错能力。整套程序结构基本上分为 3 大块。见图 2。

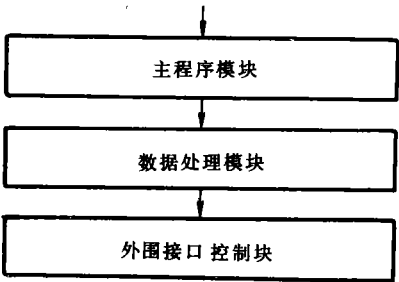


图 2 程序模块框图

主程序模块可分别对各个子程序进行调用,图 2 中下 2 个模块也能调用其它较低的模块如:

延时、乘除法等,但它们之间只是上下调用关系,而不能相互调用。

(1)主程序模块 程序、系统状态的初始化,并接受从面板上功能键打来的命令,在命令执行过程中,每个命令的执行都是独立的一个程序分支,通过对子程序的调用来完成,待命令执行完后返回主程序。见图 3。

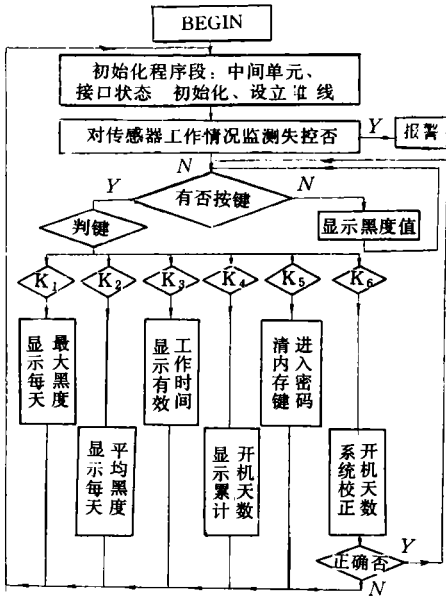


图 3 主程序框图

(2)数据处理模块 接受从 F/U 转换器发出的频率值、转换成相应的黑度值并进行所规定的运算。

(3)外围接口控制块 即外围接口电路。主要包括状况显示及显示程序部分。根据主程序及数据模块上处理后的数值情况,显示出当时系统的工作舜时状况,并显示所要求的数值如:黑度、时间等。

3 应用情况

该仪器从 1991 年开始投入了实践连续运行,获得了连续的有效数据。经过对该仪器的运行考核,各项指标均达到原设计的技术要求,这对烟气黑度的连续烟度自动监测提供了一套先进的技术手段。

Abstracts

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ions were also studied and it was found that most of them exhibited an additive, antagonistic or synergistic action. Aromatic compounds were found to have a close relationship between their structures and toxicities, and those with different numbers and types of substituent had different toxicities. It was also found that in the process of treating the wastewater containing nitro- compounds, the toxicities of wastewater reduced with reducing concentrations of nitrobenzenes and COD.

Key words: toxicity assessment, structure and toxicity, toxicants interaction, head- space gas chromatography, ecological toxicology.

Automatic Smokescope for Environmental Monitoring. Xing Ding' yao, Zhu Chang' yuan et al. (Luoyang Environmental Monitoring Station, Luoyang 471000); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 75—76

An automatic monitoring smokescope has been developed, which is a modernized instrument that can make an automatic monitoring on a day-and-night continuous basis for the blackness of smoke emitted from boilers, having the functions of automatic sampling, and data storage, processing and display. The whole machine is controlled by a monoboard computer so that it can digitally display the monitored and computed data and timely monitor whether the smoke being emitted has complied. The instrument contains a failsafe system which can preserve the data even if a power cut has lasted for as long as 6 months and allows the instrument to be automatically resumed and continuously operated with the original intact data as soon as the power supply is restored. In the machine, the available data monitored during a 6 consecutive month period can be stored. With a properly modified software, the instrument can also be used to monitor the dust and smoke emissions from cement, ceramic, chemical and other industries, with the same effectiveness.

Key words: smoke density, smokescope, monitor, environmental monitoring.

Catalytic Potentiometry Using Malachite Green Ion Selective Electrode for the Determination of Nitrite in Water. Li Guirong and Wang Yongsheng (Teaching and Research Section of Basic Chemistry, Heng' yang Medical College, Heng' yang 421001); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 77—79

A new catalytically potentiometric method for the determination of trace nitrite in water was developed, based on the ability of nitrite to catalyze the redox reaction of malachite green with potassium bromate in a phosphoric acid (H_3PO_4) solution. A malachite green ion selective electrode was used to

indicate the change in the concentration of malachite green that determined the reaction rate which was in turn proportional to the concentration of nitrite. This method showed a high sensitivity and selectivity, and had a linear relation in the range of $0-6\mu g/50\text{ ml}$ of NO_2^- and a detection limit of $1.9 \times 10^{-9} g/ml$ of NO_2^- . It can be operated conveniently at an ambient temperature. This method has been used to determine trace nitrite in environmental water samples with satisfactory results, relative standard deviation (RSD) of less than 4.3%, and average recovery of 99.7%.

Key words: nitrite, catalytic potentiometry, malachite green ion selective electrode.

Advance in Research on the Photocatalytic Organics Oxidation over Semiconductor Materials. He Beiping, Wang Zhansheng et al. (Dept. of Environmental Engineering, Tsinghua University, Beijing 100084); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 80—83

A review was made on the photocatalytic oxidation of organic compounds over semiconductor materials as a catalyst, based on the findings reported in the literatures, including the mechanisms of photocatalytic oxidation and degradation of organic compounds, the methods for improving photoactivity of semiconductor, and the development of fixed-phase photocatalytic oxidation process. The trend of future studies on photocatalytic oxidation was suggested and it was predicted that the process of photocatalytic oxidation may become a new, effective method for water and wastewater treatment.

Key words: semiconductor, catalyst, photocatalytic oxidation, organic compounds.

Progress in Research on the Biological Treatment of Wastewater Containing Chlorinated Aliphatics. Fu Xuqing, Wang Shuxiong and Lu Dewei (UNILAB, Branch in the Zhejiang University, Research Center for Chemical Reaction Engineering, Hangzhou 310027); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 84—87

In order to address the issue of general concern posed by chlorinated aliphatics which are toxic or even carcinogenic and have caused underground water pollution in some locations, a review based on references was made on the biodegradation of chlorinated aliphatics, including the strains and enzyme systems involved in such a degradation, the mechanisms of degradation processes, the kinetics of degradation, and the reactors used for such a purpose. The review also relates to the conditions under which some of acclimated strains can degrade chlorinated aliphatics, the features of a strain having