NOTES

VLIEGASVERWYDERING DEUR MIDDEL VAN GRUISBEDFILTRASIE

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Die gruisbedfilter-navorsingsopstelling in die Departement Chemiese Ingenieurswese aan die Universiteit van Pretoria is gedurende die afgelope jaar opgestel en eerste navorsingsresultate is verkry.

Gruisbedfilters is veral geskik vir gasreiniging onder hoë temperatuur en druk of vir die verwydering van "moeilike" stof, byvoorbeeld stof wat moeilik deur middel van elektrostatiese presipiteerders verwyder sou word. Die navorsingsopstelling is bedoel om die invloed van verskillende parameters op verwyderingsdoeltreffendheid vir partikels kleiner as 10 mikrometer te ondersoek.

Die eenheid bestaan uit die gruisbed self (verskillende beddiktes is beskikbaar) met fasiliteite om 'n elektriese veld van maks 30 kV aan te wend, 'n seksie waarin lug gemeet en eweredig oor die bed versprei word, 'n seksie vir toevoer en dispersie van stof en 'n partikelteller waarin stofkonsentrasie in die toe- en afvoer gemeet kan word.

Om die bevredigende werking van die verskillende onderdele te verseker en vaardigheid met die bedryf op te bou is die verwydering van 'n standaardvliegas (gemiddelde grootte ongeveer 7 mikrometer) deur middel van 'n bed van 4 mm sferiese glasballetjies met verskillende veldsterktes ondersoek en vergelyk met teoretiese waardes.

Die voorlopige resultate toon dat die beddoeltreffendheid sterk afhanklik is van die lading op die vliegas voordat dit die gelaaide bed opgegaar het. Doeltreffendhede met 'n skoon bed is in die orde van 50% vir partikelgrootte van 1,5 mikrometer sonder die aanwending van 'n elektriese veld en 90% vir dieselfde partikelgrootte met die aanwending van 'n veld van 5 kV/cm oor 'n bed van 4 cm dik. Eksperimentele waardes vir die skoon bed kan binne 'n redelike foutgrens voorspel word mits sekere aannames oor die lading van die partikels gemaak word, maar daar bestaan tans nog geen metode om die invloed van akkumulasie in die bed op beddoeltreffendheid te voorspel nie.

Daar word beoog om die navorsing gedurende 1986 voort te sit en om spesifiek die volgende faktore te ondersoek:

- die meting van partikellading en die invloed daarvan op doeltreffendheid
- die gebruik van meer praktiese filtermedia (bv silika of dolomiet gruis
- die bepaling van die invloed van beddiepte op doeltreffendheid.

THE CAPE POINT TRACE GAS MONITORING PROGRAMME

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Over the last few decades, anthropogenic activities have been identified as significant sources of tropospheric gases such as CO_2, SO_2, CH_4, CO, N_2O and halocarbons. These gases are produced by processes such as the burning of fossil fuels, combustion processes and the use of agricultural fertilisers. Although trace gases make up less than 1% of the total composition of the atmosphere their environmental influence is far-reaching. Trace gases complete the great bio-geochemical cycles for essential life-giving elements such as sulphur and carbon and initiate three important processes in the atmosphere.

- Some of them contribute to the longwave opacity of the atmosphere (greenhouse effect) by absorbing infra-red radiation.
- Some of them can be photolysed in the stratosphere, thereby releasing atoms such as chlorine which can partake in catalytic chain reactions leading to the destruction of the stratospheric ozone layer which forms a protective ultra-violet shield around the globe.
- Some of them react with and destroy the tropospheric OH radical, the dominant cleansing agent of the atmosphere, which reacts with nearly all trace gases.

World-wide concern about such possible environmental influences gave rise to the International Stockholm Conference in 1976, where a call went out to nations to partake in a Global Environmental Monitoring System. A year later, Dr E C Halliday took the initiative on behalf of the CSIR and established a small baseline station at Cape Point.

The Cape Point station (34^oS 19^oE) is situated on a 230 m high cliff at the southern tip of a nature reserve away from direct urban/industrial influences. During most of the time, measurements are made in air masses derived from the South Atlantic. What we have learnt so far, confirms the original argument that Cape Point meets the requirements for a baseline station.

The analytical instruments are housed in a little building kindly rented to the CSIR by the Department of Transport, whose lighthouse generator also supplies the electricity for the analysing equipment. After a very modest beginning the work which was in progress attracted the interest of Dr W Seiler of the Max Planck Institute for Atmospheric Chemistry in Mainz, West Germany. This resulted in the development of a collaborative project with the Max Planck Institute supplying a large portion of the equipment. The project has now been running for seven years and the research team comprises two scientists, one technician and a data handler. The headquarters of the team, with laboratory, office and computer facilities are at the CSIR's National Accelerator Centre at Faure, near Cape Town.

At present CO and O_3 are being monitored continuously, while F-11, CCl_4, CH_4, and N_2O are being measured on a semi-continuous basis. Recently, work was also started on the measurement of atmospheric HCHO and Kr^{85}. It is also planned to add CH_3CCl_3 to the list of parameters in due course. The importance of CH_4, N_2O and F-11 is that they are infra-red absorbers, while CO and CH_4 are strong OH removers. Freon-11, CCl_4, CH_3CCl_3 and N_2O are potential destroyers of stratospheric O_3. It is hoped that the Kr^{85} results will throw light on air-exchange processes between the northern and southern hemispheres.

The trace gas measurements are supplemented by meteorological data. An automatic anemometer records wind velocities and directions on magnetic tape. Air temperatures and pressures are obtained from the lighthouse staff, who collect this information for the Weather Bureau. The hourly averages of all the parameters being measured comprise about 78 000 data points per year, and are being handled by computer.

The actual instrumental monitoring work is not without challenges and difficulties, especially since the equipment is very specialised. The concentrations of some trace gases are being measured down to the pptV range (1 pptV = 10^{-12}), where contamination is always a potential problem. Spare parts for some of the more sophisticated instruments are often not available in South Africa and have to be obtained from overseas. Every instrumental breakdown, even a power-failure of two minutes, may mean data loss of a few days. The question of reliable and stable calibration gases is vital to all meaningful long-term monitoring work. In order to achieve this aim, inter-laboratory calibrations, particularly with the Max Planck Institute in Mainz, are carried out on a regular basis.

The Cape Point programme is a long-term project, whose primary aim is to collect reliable trace-gas data over many years. Such continuous monitoring forms the foundation on which all other air-chemical research is based. This includes the quantification of the sources and sinks of a trace gas and the estimation of its atmospheric residence time.

There are only a few baseline stations in the Southern Hemisphere (for example: American Samoa, Tasmania and Antarctica), so Cape Point forms a vital link in the chain of global stations. The growing international interest in Cape Point is manifested by the co-operative ventures, which other research institutes world-wide have launched there. In this respect it is worthwhile to mention the Global Precipitation Project (Prof. Keene, Virginia, USA), which is a study of acid rain in the 'clean' troposphere, the Krypton Project (Dr Weiss, Freiburg, W-Germany) and the exchange of air samples between Cape Point and Oregon, USA (Prof Rasmussen) for the comparison of halocarbon analyses.

Some of our interesting results on the seasonality of CO and the growth rates of F-11 and CCl have already appeared in international journals and more are to follow.

THE MEASUREMENT OF NITROGEN DIOXIDE BY SIMPLE DIFFUSION TUBES

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Nitrogen dioxide is a major component of atmospheric pollution. It and associated oxides are the precursors of photochemically produced pollutants (ozone and -oxyacetyl-nitrate). Recently the European Community has examined the problem in depth, and it is anticipated that an EC Directive will shortly be approved.

Nitrogen dioxide has mainly been monitored by means of chemiluminescent NO_x analysers. This method is both expensive and requires technical expertise, thus large scale surveys are impractical. Researchers at the United Kingdom Atomic Energy Authority at Harwell have recently started measurements of NO_2 by use of simple diffusion tubes, based on the design by Palmes et al. (1976). Originally deployed for investigations of indoor pollution (gas cooking, domestic heaters) the technique is now finding widespread use in the UK for environmental monitoring (Atkins et al., 1978, Atkins, et al., 1980, Brice et al., 1985).

The tubes are constructed from perspex, 71 mm long and with a 12 mm internal diameter. They are sealed at one end by a coloured cap containing two or three triethanolamine coated stainless steel mesh discs. The other end is