PORTABLE GAS CHROMATOGRAPH

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Summary
An improved inexpensive portable gas chromatograph for the acetylene reduction assay of nitrogenase is described. The instrument is more convenient to use than a previously described model. Modifications permit the detection of hydrogen or methane.

Introduction

The reduction of acetylene to ethylene by nitrogenase is the basis of a common assay for that enzyme. The separation and measurement of ethylene are usually accomplished by gas chromatography using a flame ionization detector. Such equipment is expensive, and its use generally restricted to the laboratory. Convenient and inexpensive means of estimating nitrogen fixation in the field are required to evaluate legume rhizobial combinations, and the effect of the environment or agronomic practice on symbiotic fixation.

We have described an inexpensive, portable gas chromatograph (1). The detector was a Taguchi Gas Sensor®, consisting of a tin oxide semi-conductor. In the presence of oxygen and a combustible gas, the sensor’s resistance decreased. The change in sensor conductivity was visualized by the deflection of a meter needle. Carrier gas (air) was provided from a tank pressurized by a hand operated pump.

Our experience has demonstrated the need for some improvements. The air supply was inconvenient to use. The operator was obliged to watch the moving needle carefully to observe its maximum deflection ('peak height'). The detector response was not linear except at low ethylene concentration.

The modifications described here overcome these deficiencies. The use of different columns or detectors also permits estimation of hydrogen and methane – two gases of interest to some soil microbiologists.

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Apparatus

The injector port, column and detector block are as described previously (1). The measurement of hydrogen or methane requires a 3 mm O.D. (1/2 inch) stainless steel column, 1.9 m long, packed with Molecular Sieve 5A, 40–60 mesh (Matheson, Coleman

![Diagram of the electronic circuit of the power supply and meter of the portable gas chromatograph.](image)

Fig. 1. Electronic circuit for the power supply (top) and meter of the portable gas chromatograph. Major components include two 7805 5 volt regulators IC, a Taguchi Gas Sensor (TGS), a digital panel meter with analog/digital conversion (DPM (AD)), a 25 turn potentiometer and two dual operational amplifiers 1458.