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Fast Refinery Gas Analysis on the Agilent 8890 Gas Chromatograph with Large Valve Oven

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Introduction

Refinery gases are mixtures of various hydrocarbons, permanent gases, and sulfur compounds. This complex mixture can be difficult to separate accurately and reliably. The Agilent 8890 GC fast refinery gas analyzer (RGA) provides a complete solution for the separation of refinery gases. Using a combination of packed, micropacked, and capillary columns, the analysis is separated into three channels for the simultaneous detection of hydrocarbons, permanent gases, and hydrogen with one injection (Figure 1). This configuration also benefits from the inclusion of the Agilent 8890 large valve oven. The large valve oven allows columns to be run isothermally, outside of the GC oven. This configuration improves oxygen response stability, as oxygen trends downward over time on porous polymers subjected to temperature programming.
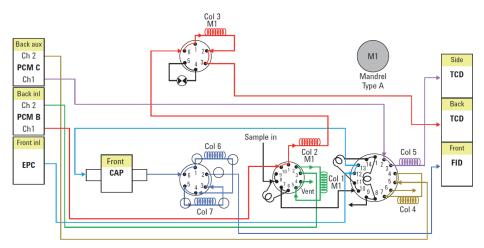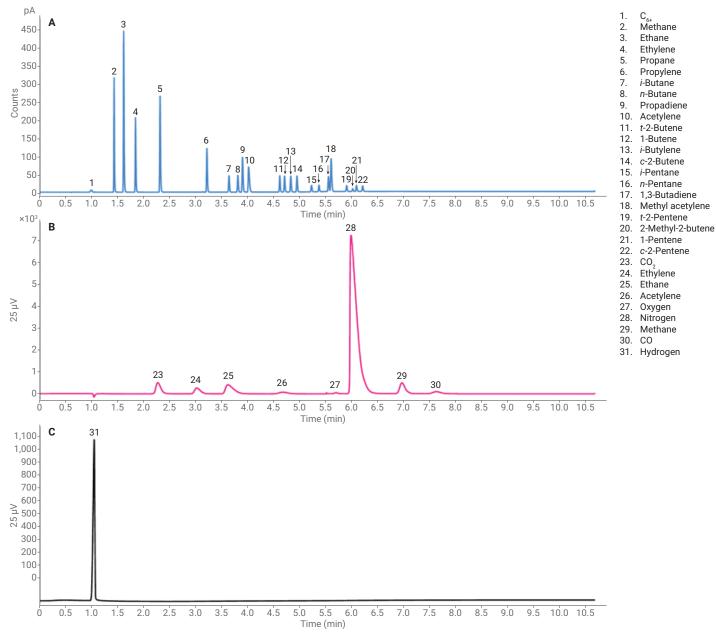

Figure 1. 8890 fast RGA valve diagram. Columns 1, 2, and 3 are situated in the large valve oven.

The separation of hydrocarbons is performed on the FID channel with an Alumina PLOT column. Isomers of 22 hydrocarbons from C_1 to C_5 are separated, while C_6/C_{6+} hydrocarbons are backflushed from a DB-1 precolumn, and elute as a group at the start of the chromatogram (Figure 2). Permanent gases are analyzed on the first TCD channel using a combination of HayeSep and MolSieve columns. These gases could include CO_2, CO, O_2, and N_2, with the option of also analyzing H_2S and COS by adjusting the backflush time. The second TCD is dedicated to the analysis of hydrogen, running with nitrogen carrier gas for improved detection of hydrogen.

1. C_{6+}
2. Methane
3. Ethane
4. Ethylene
5. Propane
6. Propylene
7. *i*-Butane
8. *n*-Butane
9. Propadiene
10. Acetylene
11. *t*-2-Butene
12. 1-Butene
13. *i*-Butylene
14. *c*-2-Butene
15. *i*-Pentane
16. *n*-Pentane
17. 1,3-Butadiene
18. Methyl acetylene
19. *t*-2-Pentene
20. 2-Methyl-2-butene
21. 1-Pentene
22. *c*-2-Pentene
23. CO_2
24. Ethylene
25. Ethane
26. Acetylene
27. Oxygen
28. Nitrogen
29. Methane
30. CO
31. Hydrogen

Figure 2. FID (A) and TCD (B,C) channels with compound identification.

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