

# Quantification of dissolved hydrogen in C<sub>3</sub> cuts

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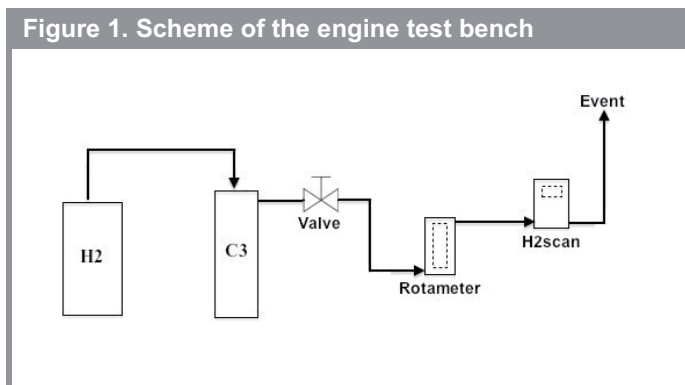
## Introduction

Currently the quantification of dissolved hydrogen in C<sub>3</sub> cuts is calculated by thermodynamic models. However these calculi have not been verified yet. The purpose of this project was then to quantify the amount of dissolved hydrogen in C<sub>3</sub> cuts for a certain temperature and pressure, and then to compare these values to three thermodynamic models. This study was carried out at IFPEN (Institut Français du Pétrole et des Énergies Nouvelles) on an engine test bench with the help of a hydrogen analyser: H<sub>2</sub>scan.

## Material and methods

First, the calibration curve of the analyser was built with the help of a calibrated gas dilutor for hydrogen concentration varying from 0.5 % to 3.0 % per volume at one atmosphere.

Figure 1 represents the engine test bench.



The bottle of hydrogen was connected to the C<sub>3</sub> bottle, which was also linked to a needle valve and then directly connected to the analyser by a rotameter. A firm based in California manufactures H<sub>2</sub>scan.

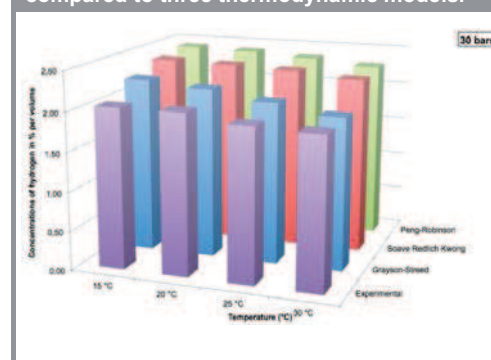
To realize measurements, a bit of C<sub>3</sub> was vented by a valve (from liquid phase to gas phase). The rotameter was here to adjust the flow rate. Measurements were made at various times of the day and then 24h later to make sure to be at saturation of hydrogen in the C<sub>3</sub> cuts (measurements have been made for different pressures and temperatures: from 20 bars to 30 bars by steps of 5 bars, and from 15 °C to 30 °C by steps of 5 °C).

## Results and discussion

The experimental results obtained were compared to three thermodynamic models: Grayson-Streed, Soave Redlich Kwong and Peng-Robinson.

Figure 2 represents the results obtained for different temperatures at 30 bars, compared to these three thermodynamic models.

Figure 2. Results obtained at 30 bars, for temperatures going from 15 °C to 30 °C, compared to three thermodynamic models.



As we can see on the bar graph, the experiment values correspond more or less to the thermodynamic model of Grayson-Streed. It could be interesting to make more measurements for extreme values of temperatures and pressures to confirm this hypothesis.

## Conclusion

Thanks to this project, it was possible to observe that concentrations of hydrogen in C<sub>3</sub> cuts at saturation match to a specific thermodynamic model. We can wonder if this model is also applicable for other C cuts like C<sub>4</sub> or C<sub>2</sub> cuts.



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