

## Experimental Solubility of CO<sub>2</sub> in Vegetable and Reference Oils for Two Stroke Engines

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The last decades have seen a slow but steady move toward the use of “environmentally friendly” or more readily biodegradable lubricant fluids. Biodegradability has become one of the most important design parameters both in the selection of the base fluid and in the overall formulation of the finished lubricant. Lubricants based on vegetable oils are growing in popularity in various applications such as, two stroke engines, hydraulic and gear units for wind-turbines, greases and hydraulic and gear oils for agricultural applications.<sup>1</sup> The knowledge of the solubility of different gases such as O<sub>2</sub>, N<sub>2</sub>, and CO<sub>2</sub> in lubricants used for two stroke engines is important because these gases are involved in the combustion process together with the lubricant and the gasoline in the combustion chamber, and the developed vegetable oil should have a similar behaviour than the reference synthetic oil. In this study, the solubility of carbon dioxide, CO<sub>2</sub>, in a reference synthetic oil and in a developed vegetable-sunflower-based oil for two stroke engines has been performed from 283 to 348 K and pressures up to 8.8 MPa in a high pressure gas solubility apparatus developed to measure solubility in isochoric conditions. The experimental technique consists of determining the amount of gas absorbed in a known quantity of liquid solvent from the pressure change in a gas system of known volume, observed during the absorption of the gas.<sup>2</sup> It was found that the solubility of CO<sub>2</sub> in the vegetable oil is higher than in the reference synthetic oil, which shows that the molecular affinity between the lubricant and CO<sub>2</sub> is higher for the vegetable lubricant.

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[1] L.R. Rudnick, S.Z. Erhan; Natural Oils as Lubricants; *Synthetic Mineral Oils and Bio-Based Lubricants: Chemistry and Technology*; Taylor and Francis Ed.: Boca Raton, 2006.

[2] O. Fandiño, E.R. López, L. Lugo, M. Teodorescu, A.M. Mainar, J. Fernández; Solubility of carbon dioxide in two pentaerythritol ester oils between 283 and 333 K. *J. Chem. Eng. Data* 2008, 53,1854–1861.