Rock core extraction
Core cleaning and fluid extraction techniques

Abstract

The BUCHI SpeedExtractor E-914/916 is a pressurized solvent extraction instrument that dramatically decreases the time necessary for whole and crushed rock core cleaning and extraction. In comparison to traditional extraction techniques such as Soxhlet, the SpeedExtractor can perform these tasks in several hours instead of several days. Up to six samples (E-916) are processed in parallel at elevated temperatures and pressures.

Introduction

Rock cores provide essential data for the exploration, evaluation, and production of oil and gas reservoirs. Through measurement and analysis of porosity, permeability and fluid saturation from core samples, operators are better able to characterize pore systems in the rock and accurately model reservoir behavior to optimize production. In addition to rock matrix, core samples contain formation fluids. These formation fluids will typically contain a mixture of hydrocarbons and brine which must be completely removed from the pore spaces of the rock for analysis. [1]

Rock core cleaning

Whole core samples (typical size: 1.5" x 3") are extracted with toluene to extract all petroleum components while leaving the core intact. The remaining intact core is then analyzed for characteristics such as porosity and permeability. This extraction can be accomplished in several hours as compared to several days using Soxhlet extraction.

In whole core analysis the extracted petroleum is not of interest. In this case the extract from each cell can be collected in one waste container for minimal solvent handling. Instead of discarding the solvent and extract, the mixture is pooled from several extractions and recovered using a 20 L BUCHI R-220 industrial rotary evaporator.

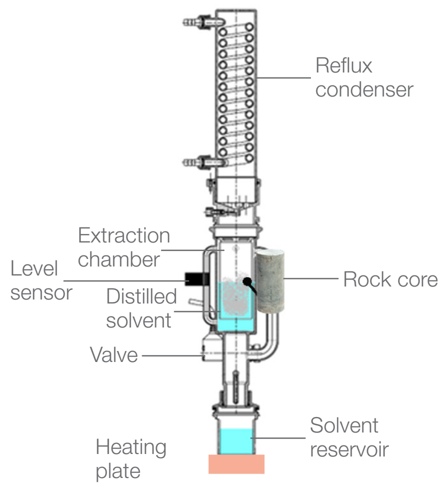


Figure 1: Soxhlet extraction is a traditional distillation process used to clean the core. While effective, this traditional extraction technique is performed over the period of several days. One or more solvents are gently boiled, and the distilled solvent is collected in the extractor, in which one or more core samples soak. The heated solvent is continually distilled, condensed and refluxed until the extraction is complete. [1]

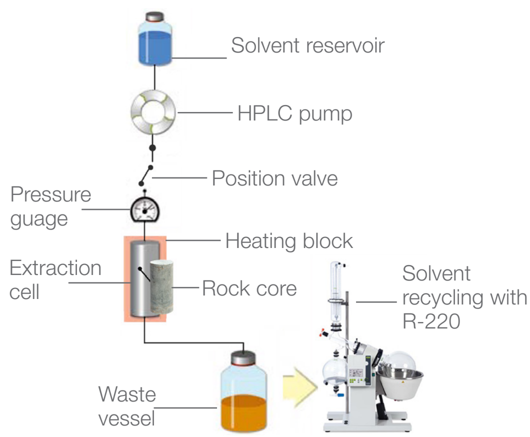


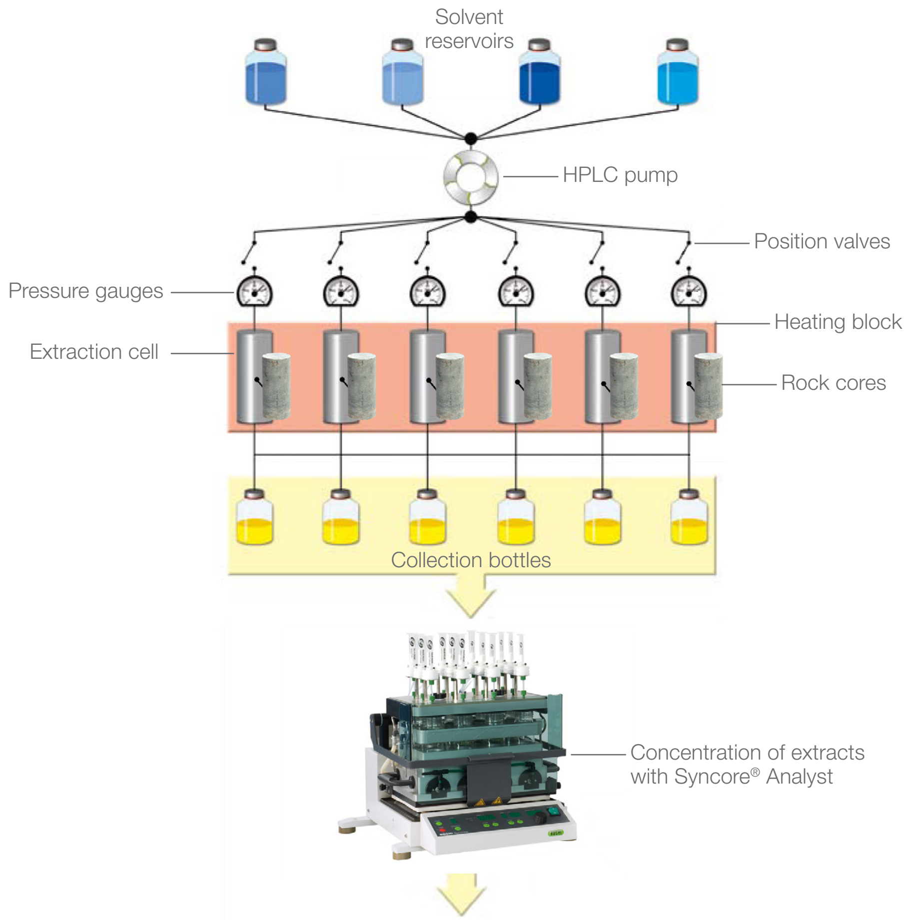
Figure 2: The SpeedExtractor is a pressurized solvent extraction instrument capable of performing up to six parallel extractions at elevated temperatures and pressures. The SpeedExtractor operates at pressures up to 150 bar for increased solvent penetration and up to 200 °C for increased analyte solubility. Up to four solvents can be mixed for each extraction step for ultimate versatility. Extraction cells are made up of only five parts and are automatically sealed by the instrument to reduce complexity and variability.

Fluid analysis

In contrast to the core cleaning procedure, compositional analysis performs testing on the materials extracted from the core. Certain markers such as hydrocarbons, water, brine and organic matter provide information to the customer about their well site. The rock matrix is not important in these tests so the samples are crushed to provide more surface area resulting in increased extraction efficiency. The E-916 SpeedExtractor is used with six 40 mL extraction cells and is equipped with two solvent ports for 100% DCM followed by 9:1 DCM/MeOH extractions. The extracted analytes are analyzed after the solvent is concentrated to a residual volume using BUCHI's parallel evaporation instrument the Syncore® Analyst.

Conclusion

In comparison with traditional extraction techniques the BUCHI SpeedExtractor has many valuable advantages. Core cleaning as well as analyte extractions can be accomplished in hours instead of days. Up to six samples can be processed simultaneously using mixtures of up to four solvents. Streamlined extraction cell preparation and automated sealing increases the safety and reproducibility. The final extracts can be collected into vessels so that parallel evaporation to residual volume can be performed with no solvent transfer step.



Reference

[1] Background information and Soxhlet text from the following publication:
Mark A. Andersen, Brent Duncan, Ryan McLin, Schlumberger Houston, Texas, Oilfield Review Summer 2013: 25, no. 2.

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