Forecasting H₂S production risk in thermal EOR projects

Heavy oils produced by steam injection EOR projects can be associated to H₂S production due to aquathermolysis.

IFPEN solution: a tailor-made workflow to estimate H₂S concentration at the well-head and mitigate the associated HSE risks

- Characterization with unique lab equipment (Rock-Eval-Sulfur) and geomodel building – adapted to any reservoir specifications
  - Areas of H₂S production risk
  - Selection of the most relevant core samples for the laboratory study

- Calibration of the kinetic model based on H₂S and oil data from aquathermolysis experiments on reservoir rock sample - at different times and temperatures
  - H₂S yield (time, T, sulfur)
  - Oil composition (time, T, sulfur)

- Advanced EOR process simulation - for steam injection, fluid flows, aquathermolysis, PVT
  - In the reservoir:
    - H₂S concentration
    - Oil composition

- All the well-head:
  - H₂S concentration
  - Oil composition and API

Flexible to customer’s needs and adaptable to any reservoir specifications

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*IFP Energies nouvelles (IFPEN) is a public research and training player. It has an international scope, covering the fields of energy, transport and the environment. From research to industry, technological innovation is central to all its activities.*
IFPEN background

R&I since 2004: 4 patents and 13 publications

Among others:
- Sulfur-based kinetic model of H₂S generation
- SARA-based kinetic model of H₂S generation, compatible with reservoirs simulators

Proprietary reservoir simulator

Including compositional kinetic model for H₂S generation and oil conversion; entirely calibrated from aquathermolysis experiments
Calibration of the kinetic model and reservoir simulation performed on a unique simulator for a high accuracy

Key benefits

- Identifying the possible H₂S sources
- Quantifying H₂S yield upon aquathermolysis conditions
- Prediction of H₂S production
- Avoiding costly remediation solution
- Limitation of HSE risks for selection of appropriate surface facilities

IFPEN lab capabilities

Representative and accurate dedicated aquathermolysis experiments on reservoir rocks in gold bags:
- Followed by mass balances on atomic carbon and atomic sulfur
- Realized under inert atmosphere, with a wide range of test conditions (pressure: 4-12 MPa, temperature: 240-340°C, time: 1-52 weeks, oil/water ratio: 3/1-0.1/1)

On-going research on mineral effect

On-going research on compositional thermal reservoir simulation

Success stories

- Hangingstone heavy oil field: prediction of H₂S production in the context of steam injection
- Foster Creek asset: comprehension on the phenomena controlling the generation of H₂S in the reservoir during SAGD; successful prediction of H₂S production via reservoir simulation

On-going research on sulfur thermal reactivity and reservoir characterization

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