Protocol300i: Application as a Solvent for Asphaltene-Resin-Paraffin Deposits (ARPD)

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ARPD Problem Overview

Asphaltenes, resins, and paraffins precipitate from crude oil due to changes in pressure, temperature, and flow rate. Over time, they form dense deposits inside tubing, pumps, and surface equipment, creating serious operational challenges

Pipe Narrowing

Increased hydraulic resistance and pressure losses

Reduced Flow Rates

Lower well efficiency and productivity

Equipment Failures

Plugging and sticking of downhole equipment

Rising Costs

Higher failure frequency and maintenance expenses

Example: ARPD deposits on sucker-rod pump components

Methods for Combating ARPD

Asphaltene–resin–paraffin wax deposits (ARPD) represent one of the most common and costly problems in oil production. To ensure stable well operation, various methods of removal and prevention are applied.

01

Mechanical Methods

Scrapers, scraper assemblies, and cleaning devices. Require well shutdown and provide only short-term effect

02

Thermal Methods

Flushing with hot oil, water, or steam; heating of tubing. Characterized by high energy consumption

03

Chemical Methods

Injection of solvents, inhibitors, and pour-point depressant additives. Extend cleaning intervals and help control ARPD formation

04

Combined Technologies

Integration of chemistry, thermal, and mechanical methods. Include nanostructured compositions and advanced surfactants

The most promising approach is the application of **chemical methods (surfactants, inhibitors, solvents),** since they allow not only the removal but also the prevention of ARPD formation

Preparation of Laboratory Tests

Preparation of solutions

Protocol300i in produced water from an oil well

ARPD Sample

Real deposits from an oil well

Weighing ARPD samples

Preparation of ARPD test samples

Protocol300i Concentration	Solution Volume	ARPD Sample Weight
0,1%	20 ml	2,5233 g
1%	20 ml	2,5077 g
5%	20 ml	2,5094 g
10%	20 ml	2,5076 g

Thermal Treatment of Samples

Sample Heating

Thermal treatment was applied to dissolve ARPD deposits and to investigate the effect of temperature on their structural integrity.

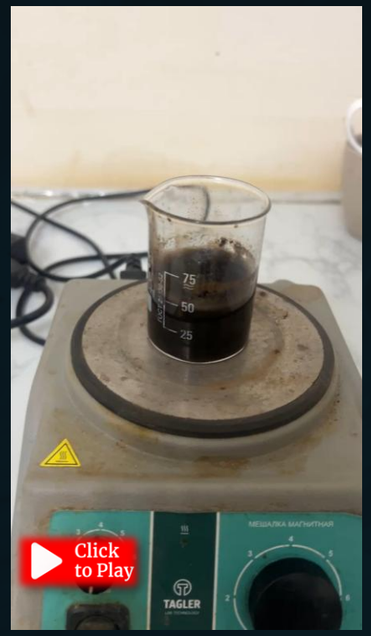
Critical Melting Temperature

82°C – identified as the critical threshold for complete phase transition and dissolution of ARPD samples

Test with 100% Protocol300i Solution

To evaluate the maximum efficiency of the reagent in dissolving ARPD at full concentration, without dilution in formation water

A control experiment with undiluted Protocol300i was conducted to assess its maximum dissolution capacity for asphaltene–resin–paraffin deposits (ARPD)



Preparation of ARPD Sample

in 100% Protocol300i solution

ARPD Sample After Treatment

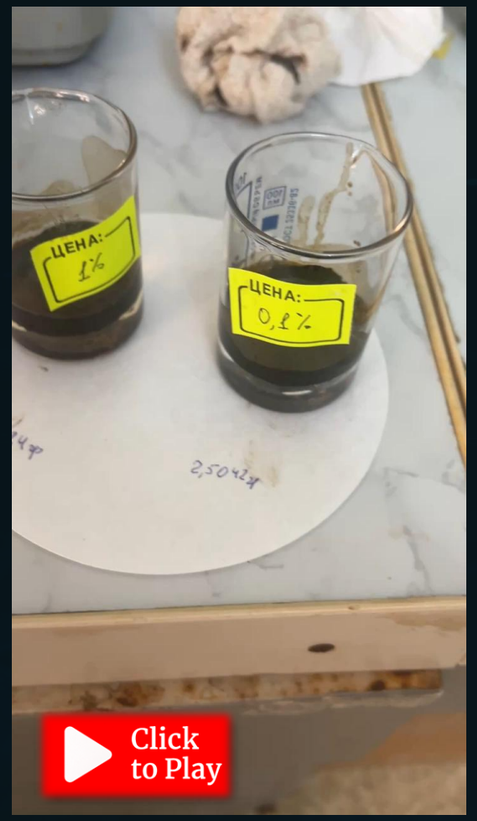
In 100% Protocol300i solution: after cooling, ARPD remained in liquid form with no recrystallization

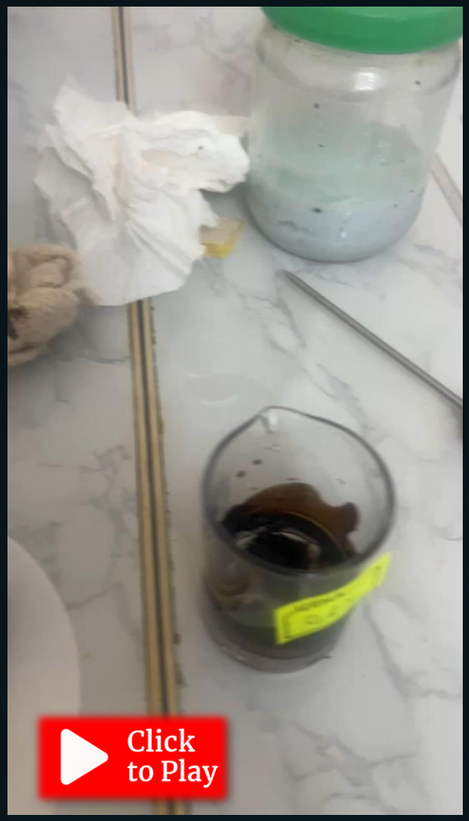
In the control sample (formation water without surfactant), ARPD did not dissolve and reappeared as solid deposits after cooling

Results of Tests at Different Concentrations

Prepared Samples

Different concentrations of Protocol300i



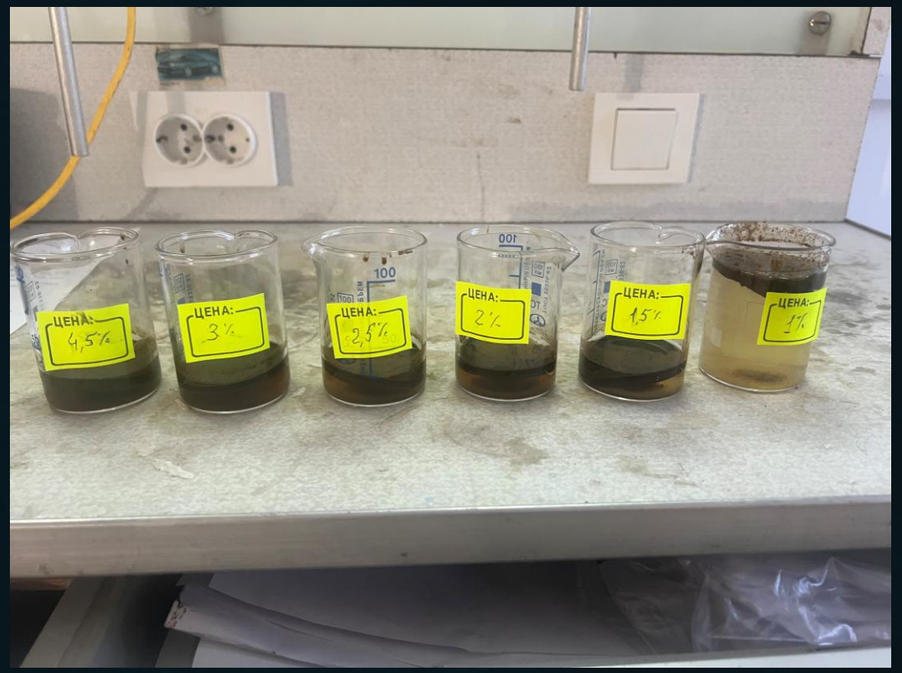


Samples After Treatment

Visual assessment of results

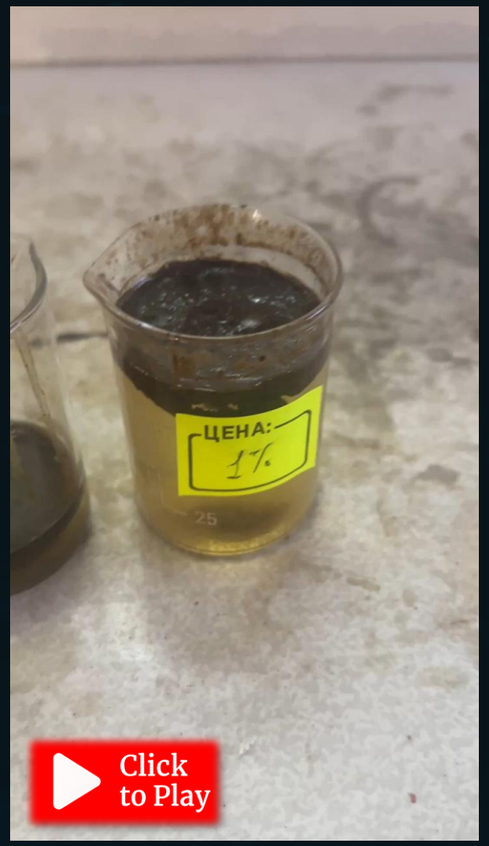
A systematic study of the effect of different Protocol300i concentrations on the structure and integrity of asphaltene–resin–paraffin deposits under standard laboratory conditions.

Results of Tests at Different Concentrations



Prepared Samples

Different concentrations of Protocol300i



1% Protocol300i Solution in 100 ml Formation Water

Visual assessment of results

An increase in the surfactant volume enhances ARPD dissolution, with visible disintegration observed even at lower Protocol300i concentrations

Effect of Solvent Volume

Experiment Scaling

A 1% Protocol300i solution in 100 ml of formation water showed significantly better dissolution results compared to smaller volumes

Key Observation

With increasing surfactant volume, more pronounced ARPD dissolution was observed even at lower reagent concentrations

Protocol300i: Key Findings from ARPD Dissolution Tests

Effective Dissolution

Protocol300i proved its ability to dissolve ARPD without re-crystallization

Concentration Dependence

Higher surfactant volumes allow effective results to be achieved at lower concentrations

Working Concentrations

20 ml: effect at 5%

100 ml: effect at 1%

1

Method Potential

Protocol300i confirmed as a promising chemical solution for ARPD control

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Further Research

Additional studies are required under diverse field conditions