Compact Separation Technologies for Debottlenecking Mature Field Produced Water Treatment Facilities

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ASCOM OVERVIEW

Est. 2009 Based in Netherlands

ISO 9001:2008

Renogas Group:
• HQ in Arnhem, NL, with main support office in Kuala Lumpur, Malaysia
• A company by separation specialists
• Investing in R&D and new technology development for keeping a high innovation level; own proprietary technology and IP rights
• Conceptual studies to optimize total solutions
• CFD important tool as part of overall product and service portfolio
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ASCOM provides two distinct technologies and separation equipment:

- Vessel-based
- Pipe-based

These technologies are key solutions for:

- Debottlenecking facilities
- Water treatment
- Remote oilfields Produced
- Subsea processing
Mature Field PWT Challenges

- HP Production
- MP Production
- LP Production

Production / Field Life Time

Well Pressure vs. Water Cut
Case 1:

Application of ASCOM Mixedflow Hydrocyclones for Saudi Aramco – Safaniyah field produced water treatment
HYDROCYCLONES COMPARISON

TANGENTIAL
- Long presence on the upstream produced water market
- Tangential inflow
- Pressure energy is converted partly into undesirable turbulence
- Unstable flow
- Often incapable to meet new regulations

AXIAL
- Axial inflow
- Swirl generation through guiding vanes
- Better than tangential cyclone
- Not optimal pressure to velocity conversion

MIXEDFLOW
- Recently developed by ASCOM
- Swirl generation is based on the mixed flow principle
- Combination of radial and axial inflow
- All pressure energy is converted into a rotating motion
- Stable, undisturbed centrifugal flow
- Distinctly improved separation of oil from water
ASCOM MIXEDFLOW HYDROCYCLONE

Flow is guided through vanes
- Lower pressure drop
- Pre-separation in swirl

Multiple inlets
- Symmetric flow pattern
- Minimal reject core oscillation

Avoidance of preferential flow path
- No severe erosion

Removable swirl section
- Easy cleaning & inspection
CFD: STREAMLINES
SAFANIYAH FIELD

Tests were conducted in a heavy oil producing facility in winter (Nov. 2010)
LOCATION ANALYSIS

PRODUCED WATER STORAGE VESSELS
High res. Time →most of oil separation
OIW: UP TO 164 PPM

CENTRIFUGAL PUMP

TECHNOLOGY:
MixedFlow Hydrocyclones

DISPOSAL:
TARGET OIW ≤ 20 PPM
ASCOM PROPOSED DESIGN

Objective:

- OIW separation with min. dP
- 1-stage design: field trials for qualification on existing facilities upgrade

Design:

- Material of construction: Duplex
- 4 MixedFlow Hydrocyclone liners

MF hydrocyclone test skid before shipment to ARAMCO
SAUDI ARAMCO TEST SKID

Skid before shipment to ARAMCO

Skid connected on site
RECOMMENDATIONS

For full scale up of MFH:

- Place MFH upstream of a pump if pressure allows,
- Use a low shear pump, or
- Add pipe length in between pump and MFH

MFH: Mixed Flow Hydrocyclones
CONCLUSIONS

Lab testing

- Proves the benefits of the mixed-flow concept

Field test

- In the field test 12 to 16 ppm OIW levels have been reached; confirming lab test results and CFD predictions
- Showing the practical application

Summary for Mixed-Flow Hydrocyclones

- Tests were done successfully
- 20 - 30% lower pressure drop compared to conventional hydrocyclones
- Excellent turndown with respect to flow rate and reject rate
Case 2:

Application of ASCOM Bulk De-oiler liners to reduce a WHP energy demand for feed / heavy oil heating
Situation

- Existing well head platform (100,000 bpd liquid)
- Rapidly increasing water cut (60-95%)
- High viscosity oil
- Need significant energy for oil heating (all taken from fuel gas)
- Available energy soon lower than required
- Existing lay out does not give much flexibility with regards to conventional solutions
Existing PFD

Oil Export

Well stream

Water Treatment
Solution

• Keep existing equipment 100% unchanged

• Install a compact bulk water removal stage upstream oil heating units

• Preliminary energy consumption calculations indicate that 60-90% water removal is sufficient to keep WHP energy balance positive

• Add one low dP water polishing unit upstream of the existing hydrocyclones
Proposed PFD
Resulting energy and flow balance

- Total liquid production & Required Heat
- Available Heat
- New Required Heat
- Reject Flow
- Oil Production

Power & Flow vs. Year
CONCLUSIONS

The demand on produced water treatment systems is increasing

• Higher water cut and load in well streams from maturing fields
• Stricter regulatory limits and compliance expectations

Meeting these requirements demands smart application of available technologies

Compact separation technologies can play an important role in meeting these requirements