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Extractive Industries and Sustainable Job Creation

Processing of High Tan Crude Oil in Khartoum Refinery: A Unique Experience

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Processing of High Tan Crude Oil in Khartoum Refinery: A Unique Experience

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Outlines

- Introduction – Refineries in Sudan
- Khartoum Refinery
- Refining acidic crude
- Potential challenges caused by Total acid Number
- Challenge crude processing Issues- High TAN
- Delayed Coking Unit DCU
- KRC challenge of processing Fula Crude
- Conclusion

Introduction – Refineries in Sudan

➢Port Sudan Refinery

Established: 1964
Capacity: 25,000 bbl/day
Crude: Middle East.

➢Abu Gabra Refinery

Established: 1992
Capacity: 2,000 bbl/day
Crude: Abu Gabra.

➢Elobeid Refinery

Established: 1996
Capacity: 15,000 bbl/day
Crude: Nile Blend.

Khartoum Refinery

Phase 1

Established: 2000

Capacity: 50,000 bbl/day

Crude: Nile Blend.

Phase 2

Expansion Project : Jan 2006

Expansion Capacity : 40000 bbl /day

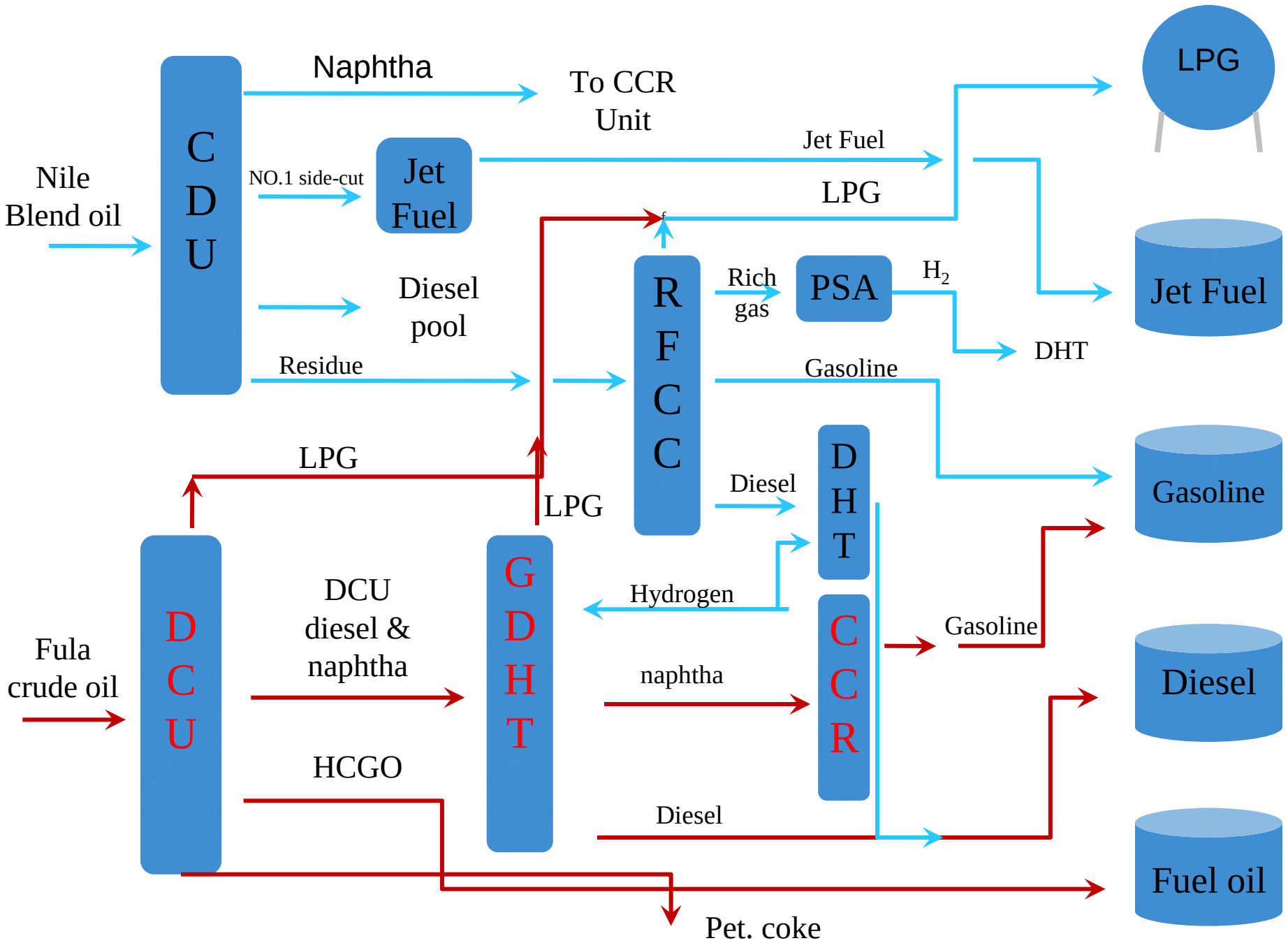
Crude : Heavy Fula.

Khartoum Refinery Over View

- **Khartoum Refinery Company is a joint venture between the Sudan Ministry of Petroleum & Gas [MoPG] and Chinese National Petroleum Company [CNPC] , China. Number of employees in KRC is 1045 Sudanese and 190 Chinese.**

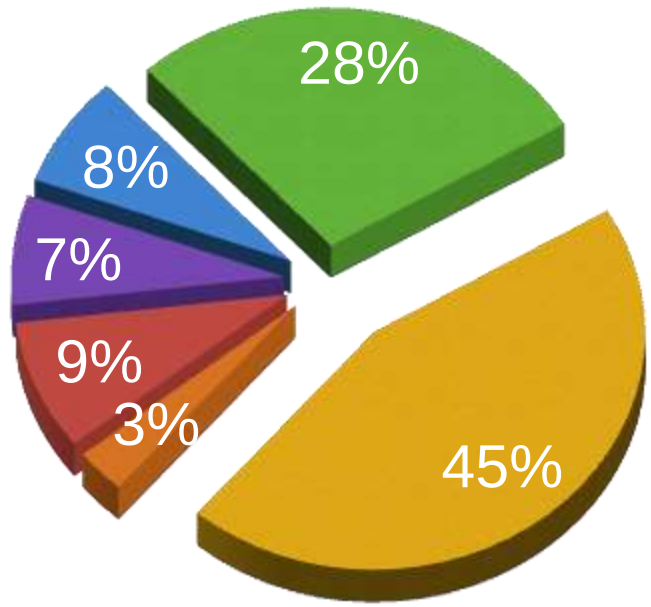
The Main Production Units

KRC Configuration



KRC Main Products

- LPG
- Gasoline
- Diesel
- Jet-A1
- Heavy Coker diesel
- Petroleum Coke



Production	Amounts kt/a
LPG	315
Gasoline*	1,159
Diesel*	1,837
Jet-A1	123
Heavy Coker diesel	364
Petroleum Coke	306

***Gasoline : RON 92; S : 50ppm**
***Diesel : Euro IV**

Refining acidic crude

- **What IS TAN ? Total Acid Number (TAN) is a measurement of acidity that is determined by the amount of potassium hydroxide in milligrams that is needed to neutralize the acids in one gram of oil .**
- **The TAN value indicates to the crude oil refinery the potential of corrosion challenges.**

- **Refining acidic crude oils is of increasing interest due to their increased production and usually discounted value.**
- **Acidic crudes are produced in every oil producing region. China will dominate production. Other locations historically noted for high TAN crudes include Venezuela, India, Russia and some fields in California. Newer regions include the North Sea, West Africa, Mexico and offshore Brazil.**

Potential challenges caused by High TAN crude oil

- **Crude Storage Tanks**
- **Minimal water removal in crude oil tanks**
- **Oily tank drain water**
- **Crude unit**
- **Desalter operations(Frequent upsets, Poor dehydration/salt removal , Scaling on desalter internals).**
- **Atmospheric column overhead systems ,Increased neutralizer consumption.**
- **Naphthenic acid corrosion attack.**

Challenge crude processing Issues- High TAN

- **Increased potential for naphthenic acid corrosion crude oil distillation units.**
- **High equipment costs lower unit reliability and availability.**
- **Increased severity of downstream unit fouling .**
- **Impact on quality of crude unit distillates.**
- **Uniqueness in process conditions , materials of construction and the frequent variation in crude .**
- **Despite the economic incentive, many refiners may avoid high TAN crudes because of these risks.**

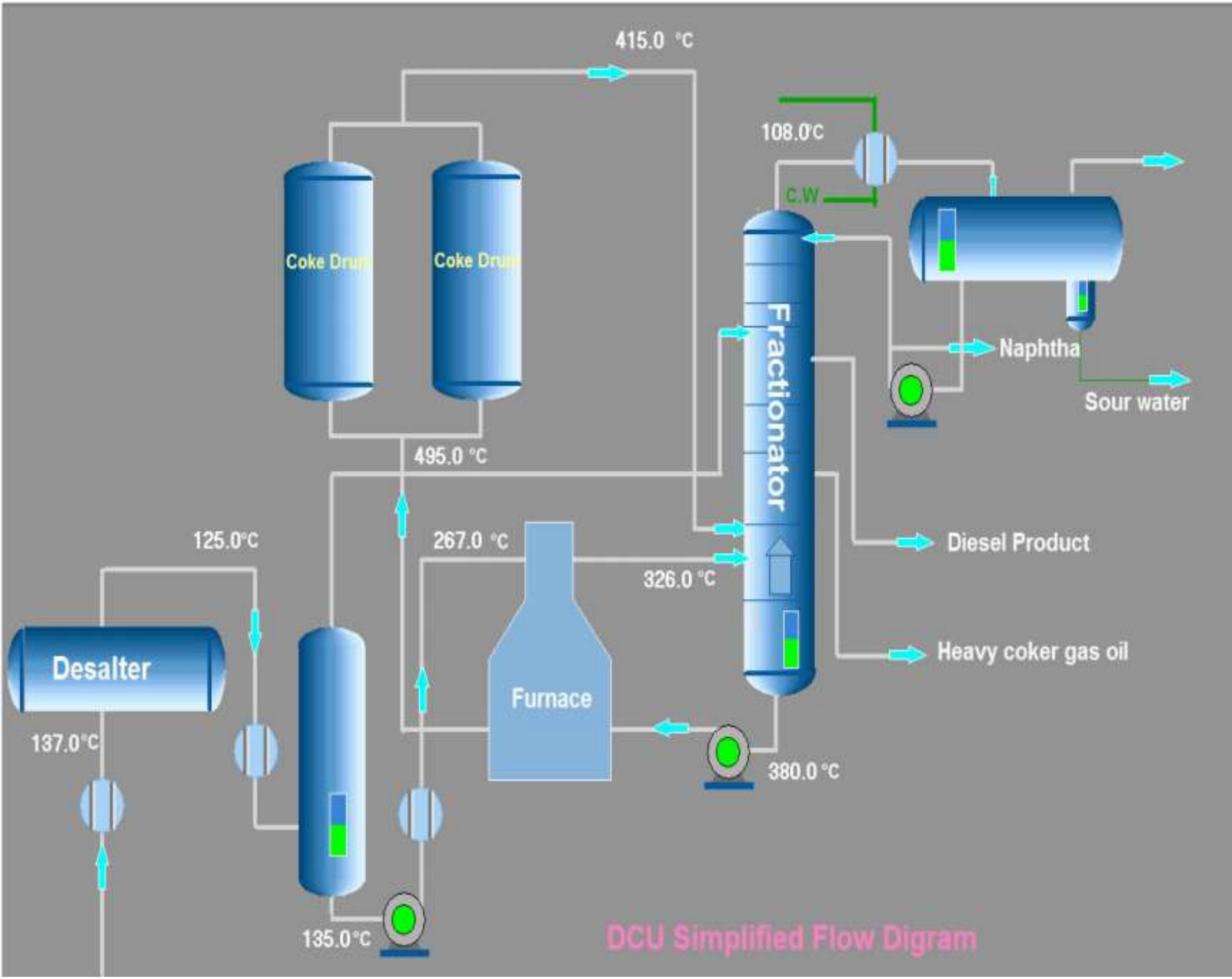
Processing Heavy Fula Crude (High TAN) in KRC

Delayed Coking Unit
DCU

Main characteristics of Fula crude

- **KRC process 40.000 bbl/day of High TAN, high Ca Fula crude oil .**

- **API°** **21**
- **TAN** **7.8 mgkOH/g**
- **Density @15 °C** **0.9353 kg/l**
- **Ca content** **1300 ppm**
- **Pour Point °C** **12**
- **Flash Point °C** **48**
- **viscosity@100 °C** **40 mm2 /s**
- **sulfur** **0.135 ppm**


415.0 °C
108.0°C
C.W
Coke Drum
Coke Drum
Fractionator
Naphtha
Sour water
495.0 °C
125.0°C
267.0 °C
326.0 °C
Diesel Product
Desalter
Furnace
Heavy coker gas oil
137.0°C
380.0 °C
135.0 °C
DCU Simplified Flow Digram

KRC Preventive Measures

Design Measures

1- Crude fed directly to DCU to minimize negative impacts.

2- Adopted four stages desalting to improve desalter efficiency .

3- Use corrosion resistant materials for DCU equipment.

4- Furnace designed to facilitate on-line decoking.

Operational Measure

1- Special emulsion breaker was selected and applied.

2- Application of proper type of anti coke agent injection .

3-Increase guard catalyst layer in GDHT reactor.

4- Good corrosion management system.

Material of construction

No	Equipment	Material
1	Coker drums	15Cr MOR+OCR 13 (Top) 15Cr MOR (Bottom)
2	Fractionator (cladding)	316L
3	Heat exch. bundles	316L
4	Corresponding valves	316L
5	Furnace tube	316L

KRC challenge of processing Fula crude

1- The best technique for processing High TAN , high calcium crude without blending or metal removing ; through delayed Coking unit (DCU) .

KRC challenge of processing Fula crude

2- Good corrosion management done by selecting high corrosion resistance material metallurgy. In addition to high quality corrosion inhibitors and corrosion monitoring program.

Conclusion

- **KRC successfully processed High TAN Fula crude without blending.**
- **DCU added value to Fula crude**
  - ➢ **No fouling.**
  - ➢ **Insignificant corrosion.**
  - ➢ **Minimal impacts on downstream units.**

Thank You!