Introduction of Environmental Technology
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01 Company Profile

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Anton Oil (Technology) Group Co., Ltd. is a leading oilfield technology service company in the global oil and gas development emerging market. With international advanced technology. We have a full range of products and services. And also, we have comprehensive supporting service capabilities such as R&D and design center, raw material production base, service equipment and on-site construction organization. We have formed a strong combination of high-tech and low-cost services. Competitive advantage. The service base is located in China, the Middle East, Central Asia, Africa, South America, North America and other regions, forming a global service support system that can respond quickly.

Company Profile

Drilling service  Completion tool  Downhole operation  Oil production service  Inspection and repair service  Oilfield environmental protection
In 2011, Anton began to engage in oilfield environmental protection services, and spent 100 million yuan ($15 million) in 2014, registered and established a specialized company in Chengdu, Sichuan, China, and successively obtained the qualifications and access to the relevant national environmental protection business. Now it has a relatively complete oilfield environmental protection technology and product system, which is available at home and abroad that shows the ability of oil and gas fields to solve environmental problems.
Company Profile

➢ Research Center

- Environmental protection equipment maintenance base in Wushenqi, Suining
- Water treatment center station and equipment base in Baicheng
- Oil-based drilling cuttings processing center in Fulin
- Daqing, Tianjin and other bases
Base support

- Buzueragan Base
- Ha fa ya Base
- West Qurna
- Oasis Base
- Atelao Base
- Columbia Base
- Lun nan Base
- Wushebqi Base
- Suining Base
- Tianjin Base
- Karachi Base
- Dubai Base
Cooperative partner

CHINA KUNLUN ENGINEERING CO., LTD.

LIAONING HUAFU ENVIRONMENTAL ENGINEERING CO., LTD.
Focus on areas: oil and gas fields and environmental protection.

SCHLUMBERGER
A world-class oilfield technology service company.

SWACO
A subsidiary of Schlumberger, specializing in solid control and related technical services.

SICHUAN AGRICULTURAL UNIVERSITY

SOUTHWEST PETROLEUM UNIVERSITY

YANGTZE UNIVERSITY

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Anton can provide a full set of equipment and technical services required for oilfield environmental protection, and can systematically solve environmental protection problems in oil, gas field drilling, mining and other links.
Company Profile

Technical requirements and indicators

- Realizing the collection, treatment and resource utilization of drilling fluid, drilling cuttings and sewage;
- Developing integrated solutions to ensure the normal implementation of drilling operations, cost reduction and efficiency increase.

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>treatment process</th>
<th>Processing Standard</th>
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| Drilling Sewage        | Physical, Chemical and Biochemical             | - Standard for mud reuse (pH, density, solid content, viscosity, etc.)
|                        |                                               | - National level I emission standards                     |
| Drilling cuttings      | Physical, Chemical and Biochemical             | - Making bricks and paving roads                          |
|                        |                                               | - Safe landfill                                           |
| Oil-base drilling cuttings | Physical drying/extraction/thermal desorption | - Reuse oil-based mud                                    |
|                        |                                               | - Making bricks and paving roads                          |
|                        |                                               | - Safe landfill                                           |
| Waste water of Oil field | Physical, Chemical and Biochemical             | - Reuse slurry and fracturing fluid                       |
|                        |                                               | - Cleaning equipment                                     |
|                        |                                               | - reinjection                                             |
|                        |                                               | - National level I emission standards                     |
Certifications
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Core Technology
Oilfield wastewater treatment technology

➢ Oilfield sewage

- Sewage source: The main treatment targets are cuttings, drilling waste slurry, production wastewater, completion waste liquid, workover waste liquid (including acid liquid), oily wastewater, mechanical sewage, flushing sewage, cementing sewage, acidification of sewage, on-site oil scattered, natural rainfall intrusion.
- Composition: clay, weighting materials, various chemical treatment agents, sewage, sewage oil.
- Characteristics: The water pollution is complex, containing a large amount of chemical materials such as inorganic salts, organic matter, synthetic polymers, surfactants, and oil. The pollution source is scattered and the hazard is large. Due to the characteristics of high salt and high COD, such wastewater has natural degradation, and the pollution has persistence, stability, and self-cleaning characteristics.

Oiltfield sewage
Core Technology
Oilfield wastewater treatment technology

Process: pretreatment + evaporation crystallization + biochemical treatment + RO process

Pretreatment
Reducing the hardness of water by double alkali method. After the hardness reaching the requirement, the oil separation process would be used to remove most of the oil from the sewage. It is mainly used for degreasing the first and second grades of oil production sewage, removing free oil from water, synchronously removing perceptible particles, and assisting degreasing agent to remove emulsified oil if necessary. Usually, the separation precision is 20~50μm, and the effluent oil content is 10~20mg/L. The oil-removal technology is mainly based on natural settlement, inclined plate settlement and coalescence and degreasing, dissolved air flotation and so on. Gravity flow or pressure flow can be used depending on the overall process design. Support the necessary auxiliary heating and rinsing device without clogging.
Evaporation crystallization process

The electric energy or heat energy is used to evaporate the softened and degreased sewage, and the original unsaturated solution would gradually becomes a saturated solution. After heat recovery of the solvent, sewage treated as a unit enters next biochemical treatment.
Core Technology
Oilfield wastewater treatment technology

➢ Biochemical process

A large number of microorganisms are cultured in this system by simulating the self-cleaning process of natural sewage. A process for removing organic contaminants from sewage by utilizing the metabolism of microorganisms.
Reverse osmosis (RO process)

It is a water filtration method that uses a semi-permeable membrane to separate and purify impurities such as salt and heavy metals under the action of a pressure difference. It is opposite to the natural infiltration direction, also known as reverse osmosis.

The reverse osmosis membrane is a semi-permeable membrane made of a special polymer material through a special process. It only allows water molecules and less small molecular salts to pass through, and does not allow impurities to pass.
Core Technology
Oilfield wastewater treatment technology

• Fine filter material filter
use the most fine water treatment filter material to improve the processing precision of the media filter

• Treatment effect
SS (suspended solids) of water is less than 2mg/L, and the median diameter is less than 1.5 microns. Suitable for the original A2 water quality requirements.

• Technical features
Ultra-fine filter material with a specific gravity of 4.7 and a diameter of 0.1mm, has high precision of suspension separation. Special water and air screen, easy to wash back
As Pre-treatment security filtration for ultra filtration membranes
Ultra-high pressure reverse osmosis (RO)

The traditional desalination method mainly adopts the conventional spiral-wound RO technology. The spiral-wound RO has high requirements for wastewater pretreatment and poor adaptability to wastewater salinity. When the wastewater salinity (TDS) is 10000mg/L, water production rate of The spiral-wound RO is only 50%; and water production rate of the ultra-high pressure RO is 85%.
Core Technology
Oilfield wastewater treatment technology

The ultra-high pressure RO membrane column has an open, short and wide channel, and strong anti-pollution performance, and is more suitable for the complex and variable salt content environment of oil and gas field wastewater.
1 Oilfield wastewater treatment technology

2 Solid waste treatment technology

3 Oily solid waste treatment technology

4 Mud Non-landing technology

5 Centralized processing station
Core Technology
Solid waste treatment technology

Technological process

Waste mud/cuttings → Harmless treatment system → Sampling test → Safe landfill

- Stable agent
- Stabilizing adjuvant

Qualified → Safe landfill
Failed → Bricking/Paving

Waste mud/Cuttings Processing Flow Chart
Core Technology
Solid waste treatment technology

➢ Closed-loop treatment of drilling waste

- Recycle mud, collection of non-reusable
- Qualified transport vehicle
- Central station further classification processing
- Collection
Biodegradable

Biological treatment technology has the advantages of energy saving, low investment, low operating cost, etc., and is currently receiving attention from people in the environmental protection industry at domestic and overseas. As a final treatment of solid waste treatment, Biodegradation does not require the addition of chemicals, consumes less energy, and is environmentally friendly.

• Treatment process

- Collecting
  - Pretreatment
  - Settling basin
  - Biodegradable
    - Vegetation restoration
    - Harmless treatment
      - Tidy the site
      - Earthing
Core Technology
Solid waste treatment technology

➢ Processing effect

The biodegraded soil can be planted with preferred plants, and the rhizosphere microorganisms further directly or indirectly absorb, volatilize, separate or degrade pollutants, and restore and reconstruct the natural ecological environment and vegetation landscape.
Core Technology
Oily solid waste treatment technology

- Oil-based mud (drilling cuttings) treatment technology

  • Processing and equipment

  Waste cuttings ➔ Drying machine ➔ Concentrated treatment

  Recycling ➔ Centrifugal ➔ Collect cans ➔ Solid

  Feeder system ➔ Drying machine system ➔ Centrifugal system
- Effects and features

◆ The equipment is convenient for installation, disassembly transportation and operation.
◆ Maximum capacity of 30 tons per hour, and recyclable mud, saving cost.
◆ The cuttings oil content is 3%-7% after treatment, which is convenient for transportation and saves cost.
◆ Energy saving and emission reduction, resource reuse.
Thermal desorption

Technological process

The liquid phase was gasified by heating, and the oil content in the solid phase would be less than 0.3% after treatment.
Core Technology
Oily solid waste treatment technology

- **Product structure and characteristics**

  Skid-mounted, modular, automated.
Core Technology
Oily solid waste treatment technology

 Effects

Sludge to be treated
Recycled oil
Processed product - muck

Slag brick
Methane brick
demonstration
Methane planting
demonstration
Core Technology
Mud Non-landing Technology

- Composition of waste drilling mud: Waste drilling fluid, Drilling cuttings, Drilling wastewater

**Waste drilling fluid**
- Produce: drilling solid control equipment discharge.
- Composition: clay, weighting materials, various chemical treatment agents, sewage, sewage oil.

**Drilling cuttings**
- Produce: Rock debris that is cut from the formation during drilling.
- Composition: Rock fragments

**Drilling wastewater**
- Drilling fluid sewage, mechanical sewage, rinsing sewage, cementing operation sewage, acidification operation sewage, on-site oil material scattering, natural rainfall intrusion.
### Core Technology

#### Mud Non-landing Technology

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<tr>
<th>Processing mode</th>
<th>Technological introduction</th>
<th>Notes</th>
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<td>Collecting and treatment with mud non-landing while drilling</td>
<td><strong>Vibration, centrifugal, pressure filtration process.</strong> Firstly, the wastes are collected through the spiral conveyor, and then through the three-stage solid-liquid separation. Finally, the liquid phase is reused, and the solid phase is harmlessly treated on site or directly transferred to the central station. <strong>Collection with open tank and transportation process.</strong> After the waste is collected by the open tank, the liquid phase is transported to the centralized treatment point for treatment, and the solid phase on-site harmless treatment or on-site pretreatment is transported to the centralized station for further treatment.</td>
<td>According to the actual situation to determine the process, different process costs are different</td>
</tr>
<tr>
<td>Central treatment</td>
<td><strong>Establish temporary treatment stations.</strong> The waste generated on site shall be classified and collected, and the waste of different opening times and mud systems shall be classified and transported to the centralized treatment station for classification and treatment.</td>
<td>Cuttings from Surface, water slurry, Bantu slurry after treated can be making bricks, paving; Cuttings from polymer and polyclone system slurry after treated can be safely buried in landfills.</td>
</tr>
</tbody>
</table>
Core Technology
Mud Non-landing Technology

➤ **Vibrating screen + Centrifuge process**

**Process flowchart**

- **Solids Control System**
  - Auger conveyor
  - Shale Shaker
    - Liquid Phase
    - Centrifuge
      - Solid phase
      - Mixing Tank
        - Filtrate
        - Filter Press
          - Mud cake
          - Mud Tank for reuse
          - Optional Process
    - Solid Phase
      - Collection Tank
        - chemical agent
        - Harmless Treatment
          - Stacking Site
            - Safe Landfill
            - Bedding Roadbed
              - Optional Process
              - Or Making Brick
                - Optional Process
Core Technology
Mud Non-landing Technology

➢ Vibrating screen + Centrifuge process

Three-dimensional diagram
Core Technology
Mud Non-landing Technology

Collecting system (auger conveyor)
Core Technology
Mud Non-landing Technology

Integrated equipment for treatment
Core Technology
Mud Non-landing Technology

Frequency centrifuge
Core Technology
Mud Non-landing Technology

Filter press
Core Technology
Mud Non-landing Technology

Cuttings solidification stabilization system & Cold brick making machine
Core Technology
Mud Non-landing Technology

Completion mud treatment

1. Centrifuge (frequency conversion)
The completion mud is separated from the solid and liquid by the high-frequency centrifuge, and the liquid phase is reused next well, and the solid phase is solidified.

2. Centrifuge (frequency conversion) + filter press
the liquid phase produced by the centrifuge cannot be reused, that shall be flocculated and oxidized by chemical method. Then fresh water through pressure filtration can be recycled or transported to the place designated for recycling/reinjection, and the filter cake shall be cured.

3. Centralized treatment station
The parts that cannot be reused are directly transported to the central processing station.
Centralized processing

- Fracturing back fluid
- Workover waste
- Drilling waste water
- Upper waste liquid
- Cutting pool

Oil Reuse

- Grease trap
- Stir well
- Breaking gel
- Flocculant

Centralized processing station

- MVR distillation
- Harmlessly dispose
- Discharge
- UF/RO
- Fine filtration
- Multi-media filtering
- Air floater

Harmlessly dispose

- Concentrated water
- Brick making
- Subgrade
- Landfill

Oblique plate sedimentation

- Resuse/Reinjection

Core Technology
The flow chart

1. Collect/transport
   - Waste Cutting fluid
   - Fracturing back fluid

2. Dispose
   - Classified recycling
   - Remove oil slick
   - Concentrated water
   - UF/RO
   - Multi-media filtering
   - Air float
   - Chemical flocculation
   - Solid-liquid separation

3. Reuse, discharge
   - Storing Tank
   - Brick making system

4. Curing
Contents

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Main steps

1. Physical and chemical properties and component detection of the objects to be processed
2. Investigate policies, regulations and standards of local governments and customers
3. Technology selection, process design and demonstration
4. Equipment selection and process optimization
5. Economy and overall design optimization
6. Project construction
7. Operation management
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## The main results

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<td>Zhong yuan oilfield environment protection service project</td>
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<td>2</td>
<td>Jiang Han company oil base drilling cuttings harmless treatment project</td>
<td>Completion</td>
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<tr>
<td>3</td>
<td>Sheng LI company oil base drilling cuttings harmless treatment project</td>
<td>Completion</td>
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<tr>
<td>4</td>
<td>Nong lin chu company oil base drilling cuttings harmless treatment project</td>
<td>Completion</td>
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<td>5</td>
<td>Puy ang sanli oil base drilling cuttings harmless treatment</td>
<td>Completion</td>
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<tr>
<td>6</td>
<td>H4 oil drilling cuttings drying project</td>
<td>Completion</td>
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<td>7</td>
<td>H6 oil drilling cuttings drying project</td>
<td>Completion</td>
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<tr>
<td>8</td>
<td>H8 oil drilling cuttings drying project</td>
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<td>9</td>
<td>Chuan dong oilfield environment protection service project</td>
<td>Completion</td>
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<td>10</td>
<td>Da qing qi chang oil base drilling cuttings harmless treatment</td>
<td>Completion</td>
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<td>11</td>
<td>Da qing ba chang oil base drilling cuttings harmless treatment</td>
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<td>12</td>
<td>Cnooc cuttings dispose project</td>
<td>Completion</td>
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<tr>
<td>13</td>
<td>Jidong water base drilling cuttings harmless treatment</td>
<td>Completion</td>
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## The main results

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<th>Performance</th>
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<td>Zhejiang oilfield environment protection service project</td>
<td>Completion</td>
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<td>15</td>
<td>Zhejiang water base drilling cuttings harmless treatment</td>
<td>Completion</td>
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<td>16</td>
<td>Chang qing fracturing fluid treatment project</td>
<td>Completion</td>
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<tr>
<td>17</td>
<td>Chang qing di san cai qi chang Mud does not fall sound project</td>
<td>Completion</td>
</tr>
<tr>
<td>18</td>
<td>Chang qing di si cai qi chang Mud does not fall sound project</td>
<td>Completion</td>
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<td>Xi bu fracturing fluid treatment project</td>
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<td>Xi bu Mud does not fall sound project</td>
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<td>402 well base drilling cuttings harmless treatment</td>
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<td>23</td>
<td>Ethiopia drilling cuttings treatment project (18 well)</td>
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<td>Ethiopia workover fluid treatment project (20 well)</td>
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<td>Iraq project</td>
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Application

➢ Sludge treatment plant in china
Application

- Reduction treatment test project XX Well of Xinjiang

Cumulative treatment of water-based waste: 2690m³; Cumulative treatment of oil-based waste: 171m³, 60% reduction.
Application

◆ Treatment effect of high-frequency vibrating screen

◆ Effect after vacuum drum treatment
The treated water is used to flush the tank, mud preparation and prepare the medicine for the well team. Zero release.
Application

➢ Ethiopia project
Ethiopia project

- Accumulated treatment of 20,000 m³ of drilling waste (17 Wells) and 250 m³ of waste liquid (16 Wells' workover and acidizing waste liquid)

Acceptance inspection
Application

➢ Iraq project

• An oilfield environmental protection project in Iraq - the station. The treated water output index is superior to the national sewage treatment highest standard level A stander. The local squid was placed in the on-site production pond for live biological observation, and the carp lived in good condition. The treated water is used for greening and industrial production.
Processing capacity for treatment of water-base mud, drilling cuttings and workover flowback fluid is designed as per 300m³/d, > 90000m³/year.

Total inflow of waste slurry water and workover liquid is 180m³/d. Time of flushing, washing and the like of membrane part shall be considered in the operating process of membrane system. Allowance has been considered in the total inflow, so it will not be considered in the design process of the scheme.

Comprehensive rate of recovery of waste water in the Project: comprehensive rate of recovery of the device is ≥80%.

Oasis environmental protection station serves 5 well teams, 4 workover machines and 2 coiled tubing equipment at the same time.

As of February 12, 2018, a total of 91848.5 cubic meters of waste mud and 64586.3 cubic meters of cuttings have been processed.
Iraqi oil ministry experts and other companies visited the site.
THANKS!

Helping others succeed…

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