

**INNOVATIVE,  
COST-EFFECTIVE  
CRUDE TREATMENT PROGRAMS**



**PROVEN  
IN THE WORLD'S  
LARGEST REFINERIES**

## Introducing *Dorf Ketal*

Dorf Ketal is a global manufacturer that is basic in manufacturing the specialty chemicals used in hydrocarbon processing treatment formulations. Our products are produced in modern, automated plants operating under ISO 9001, ISO 14001, and OSHAS 18001 certifications.

In just 15 years we have become India's largest manufacturer of formulation-based specialty chemicals for refineries and petrochemical plants. In that time, we have also established a growing presence in Brazil, Europe, the Middle East, Singapore and China, as well as the U.S.A.

## Innovative Technology *that Works*

Innovative, cost-effective Dorf Ketal chemistry has earned more than 25 patents in the last 8 years alone.

Our technology has proven superior in head-to-head field trials against top-tier competitive brands at the world's leading refineries and ethylene plants.

## Success *in the World's Largest Refineries*

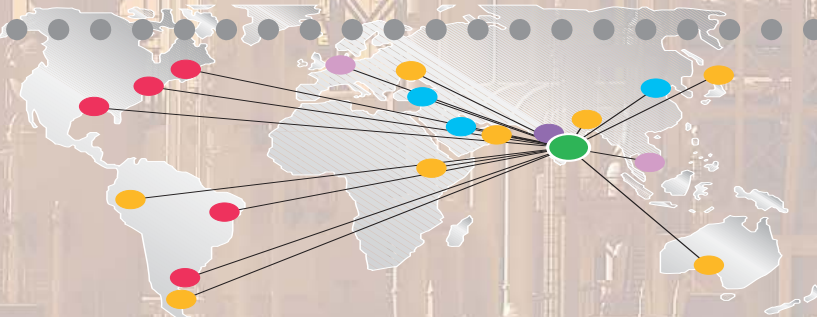
One out of three large refineries worldwide (400+ kbd) and two of every 10 of the world's ethylene plants rely on Dorf Ketal chemical treatment to extend run length and extract maximum value from opportunity crudes and changing feed stocks.

We treat more than one of every 10 refinery desalters worldwide, including units at some of the largest refineries in the world -- in Malaysia, Thailand, India, China and the Middle East.

## Global Scale, *Regional Service and Support*

Dorf Ketal is a Tier 1 strategic supplier for many of the world's largest refineries and petrochemical companies.

Dorf Ketal products are now available everywhere, supported by regional headquarters and warehouses in the USA, Europe, Singapore, China and Brazil.



### **Depend on Dorf Ketal to help you:**

- **Increase run length**
- **Extract maximum value from marginal crudes**
- **Cost-effectively manage crude blend changes**
- **Reduce total operating costs**

**INNOVATIVE  
TREATMENT**

FOR OPPORTUNITY CRUDES

**DORF KETAL**

Innovation isn't just what we do. It's who we are.™

## We Treat Refineries, Not Symptoms

We approach every treatment challenge from three perspectives: operational, chemical and mechanical.

Our technicians and scientists are supported by modern laboratories and the latest analytical tools, including portable electric desalters for emulsion-breaker screening and the ALCOR® hot-liquid process simulator for fouling tests.



We analyze refinery operating parameters as well as your crude blend API, ionic species, metals, filterable solids and water content.

We note key performance indicators and we take into account available sampling points and the role of hardware design and operating limitations.

### Global Crude-Oil Knowledgebase

Your samples are analyzed by Dorf Ketal scientists who characterize your blends based on two decades of experience with crudes from every major producing region around the world.

*Heavy crudes and poor-quality wash water?* No problem.

*Running at or above design throughputs?* We can help you operate safely and profitably.

### Proven Performance in Competitive Trials

We rigorously benchmark our products in head-to-head field trials against competing products at some of the world's most demanding refineries.

The result is a growing portfolio of proven performers, from single-component compounds to highly prescriptive multifunctional formulas designed for very specific applications, many of which are available only from Dorf Ketal.

## Selected Dorf Ketal Refinery Treatment Products

Function	Application	Features and Performance Notes
Demulsifiers	Desalter	Designed for demanding desalter applications
Demulsifiers for Heavy Crude	Desalter	Excellent salt removal in heavy, high-sulfur and high-calcium crudes
Solids Wetting Agents	Desalter	Manage higher solids in challenging conditions
Calcium and Metal Removal Agents	Desalter	Effective removal of calcium and other metals without downstream problems or oil carry-under
Acid-free Corrosion Inhibitor	Desalter	pH-independent calcium removal
High-acid Corrosion Inhibitor	Atmospheric and Vacuum Units	Proven performance under tough, high-TAN, sweet conditions in high-velocity furnace outlets
Antifoulants	Crude Units	Substantial improvement in pre-heat energy efficiencies
	Cracked Streams Upstream of Hydrotreaters	Reduced fouling with unsaturated streams
	Delayed Coker Furnaces	Control fouling, reduce cycle times, increase throughput without silica contamination
Silicone-based Antifoams	Oil Systems	Various viscosities, effective at low rates
Non-silicone Antifoams	Water Systems	Excellent foaming control in amine and sour water systems
Corrosion Inhibitors, Oil-soluble	Crude Unit Overheads and Heavier Streams	Improved unit reliability, reduced corrosion
Corrosion Inhibitors, Oil-soluble	Lighter Streams	Improved unit reliability, ideal for lighter strippers and condensate streams
Corrosion Inhibitors, Water-soluble	Sour Water Systems, Amine Units	Improved unit reliability, reduced corrosion and better control of heat-stable salts



**Whatever you're blending,  
however you're refining it,  
we can probably treat it successfully.**

**In fact, we probably already have.**

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## CASE STUDY

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### Desalter Treatment Improves Refinery Margins

One of the largest refineries in Asia runs a 2-stage Bilectric® desalter at high throughput. Residence times are low and, to make matters worse, blends are complex and variable. Ten or more crudes from fields in the Middle East and Central and South America are typical, and crude slates change daily.

Four-month plant trials were conducted on a range of products from multiple suppliers.

Dorf Ketal's demulsifier outperformed all other tested products by 20 percent or more in spite of crude blend variability, delivering faster water-separation rates and improving desalter effluent water quality.

**Bottom Line:** Dorf Ketal treatment not only improved desalter performance, it did so at roughly half the cost of the highest-performing competitive product.

**Performance Observation:** Dorf Ketal's demulsifier portfolio includes robust formulations with solids wetting agents and reverse breaker features. They perform well at lower dosages on a wider variety of feedstocks than competing products, and do so at lower overall cost.

Parameter	Dorf Ketal	Competitor
Oil in brine, ppm	30	> 530
Desalting efficiency, %	95.12	85.10
Dehydration efficiency, %	94.62	80.03

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### Managing Blended Pyrenees Heavy and Middle East Sour Crudes

A Southeast Asian refinery processing relatively light, sour Middle East crudes wanted to process blends containing increasing proportions of heavy Pyrenees feedstocks. They anticipated desalter problems and crude unit overhead corrosion from higher acidity and sodium content, as well as inorganic fouling downstream due to high solids levels.

Dorf Ketal prescribed a proprietary combination of demulsifiers and solids wetting agents that minimized water carry-over and removed nearly 80 percent of the filterable solids. By carefully coordinating treatment rates with operating parameters, desalter water remained clear and oil-free. BS&W decreased to less than .2% by volume in the desalted crude, and salt levels were stabilized at less than 1ptb.

Pyrenees crude can contain alkaline compounds that tend to increase crude unit water pH. The effects are visible in crude unit sour water and desalter effluent brine. Under these conditions, ammonium chloride salt deposition increases, leading to corrosion. With this in mind, Dorf Ketal technicians fine-tuned dosages to minimize ammonia and maximize dew-point neutralizer effectiveness.

Pyrenees crude is relatively high in sulfur, which can cause coker furnace performance to degrade, effectively limiting the ratio of Pyrenees crude that can be processed. To prevent this problem, caustic was injected downstream of the desalter and high-temperature sulfidic corrosion rates were monitored closely. Rates remained below control limits with Pyrenees crude loadings as high as 15 percent of the blend.

**Bottom Line:** The refinery was able to improve operating margins by exploiting a challenging opportunity crude without reducing throughput and without experiencing unacceptable corrosion rates or failures.

**Performance Observation:** Dorf Ketal's extensive global crude knowledgebase helped Dorf Ketal technicians anticipate the impact of the blend change system-wide and prevent problems before they occurred.

#### Pyrenees Crude Analysis Report

Specific gravity, kg/l	0.941
Crude API	18.9
Salt content, ptb	52.55
BS & W, vol %	< 0.05
Sulfur content, wt %	0.229
Nickel content, ppm	1.6
Vanadium, ppm wt	0.43
Sodium, ppm	56.15
Acidity, mgKOH/g	1.601

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### Dorf Ketal Antifoulant Saves Refinery \$3 Million

A large Indian refinery experienced heat exchanger fouling problems that decreased throughput and increased furnace fuel consumption. As fouling accumulated, furnace approach temperatures declined and the furnaces burned more fuel to maintain targeted coil outlet temperatures, increasing operating costs.

Problems were so severe that the refinery commissioned a standby exchanger train to maintain throughput while the primary preheat exchangers were taken off line for periodic cleaning.

Refinery operating data revealed heat exchanger run lengths of just 30 days on a competitive antifoulant before furnace inlet temperatures would decline 10 °C or more to the refinery's 235 °C minimum – the temperature at which the heat exchangers were taken off line for cleaning to maintain process stream quality and avoid throughput reductions.

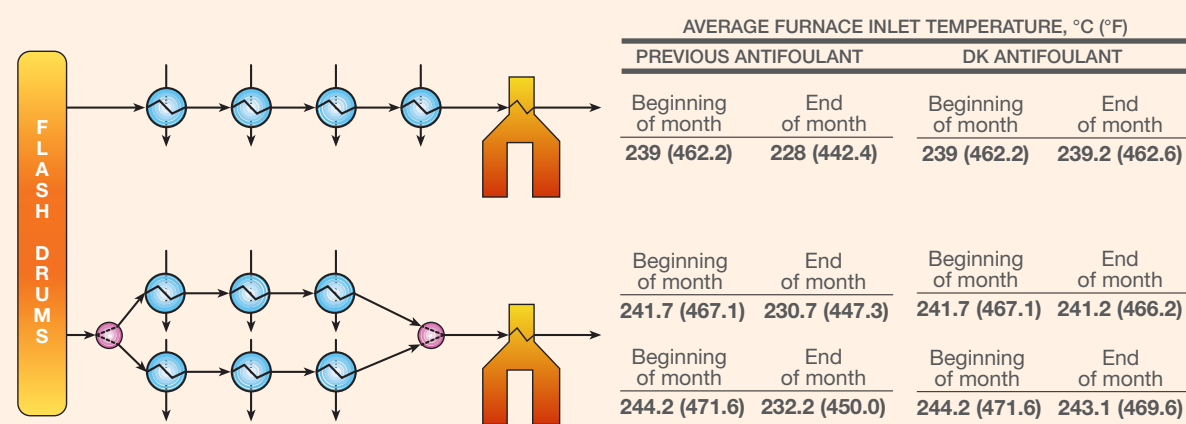
We recommended testing a Dorf Ketal antifoulant in the standby train to evaluate heat exchanger run time and furnace fuel consumption. Results were immediate and obvious: Furnace inlet temperatures declined just 0.5 °C in the first 10 days.

Based on this data the refinery projected very substantial reductions in fuel consumption and twice the run length between exchanger cleanings without degrading throughput or process stream quality. Dorf Ketal's treatment program was implemented in 2005 and the refinery continues to rely on it today.

**Bottom Line:** The refinery calculated \$3 million in annual fuel savings after subtracting treatment costs.

**Performance Observation:** Dorf Ketal analyzed operating data and ran process stream simulations to develop a treatment program that delivered more than 70 percent fouling control efficiency, increasing unit throughput and dramatically reducing fuel consumption.

#### Preheat Train Scenario



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### High-acid Corrosion Inhibitor Protects South American Refinery

A South American refinery processing naphthenic, high-TAN heavy crudes invested heavily in design changes and metallurgy upgrades to reduce corrosion, but the 317L stainless atmospheric residue lines, low-carbon steel vacuum furnace coils, 316 stainless furnace outlets and other systems remained vulnerable.

Our technicians analyzed TAN content and evaluated system metallurgy and turbulence before recommending Dorf Ketal's patented high-acid corrosion inhibitor.

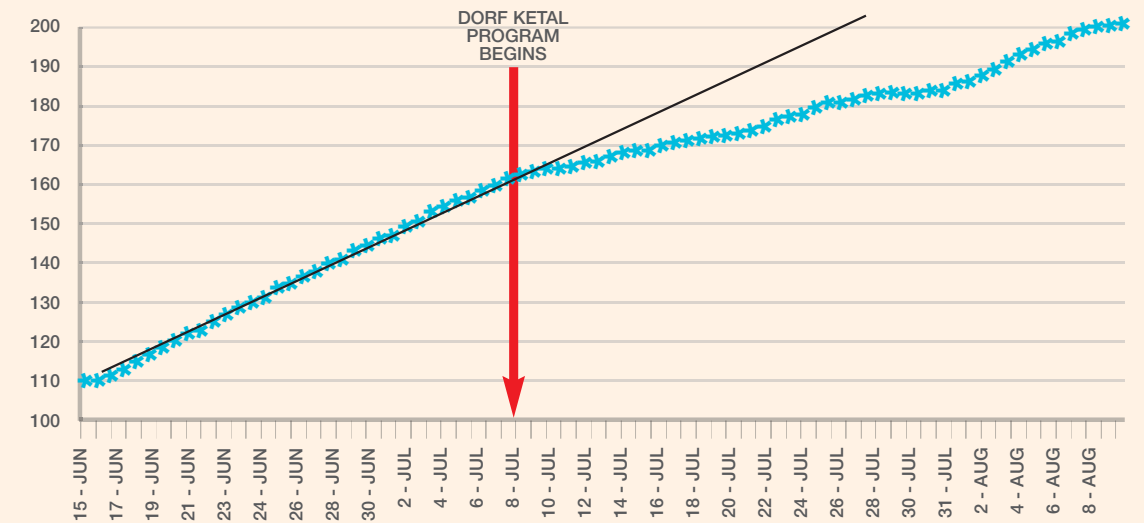
The product's chemistry is unique. It is an oxygen-free filming formulation that contains sulfur and phosphorus but does not liberate phosphoric acid, has no tendency to foam and remains stable at high temperatures.

When the trials were run, refinery atmospheric residue TAN measured 0.7-1.6mg KOH/g. Corrosion rates monitored by corrosion coupons declined markedly as soon as the test began.

**Bottom Line:** Dorf Ketal's high-temperature corrosion inhibitor for high-TAN crudes reduces maintenance costs and extended maintenance intervals in applications where metallurgy alone was not sufficient.

**Performance Observation:** Costly corrosion is a risk when processing high-TAN crudes in spite of careful system design and corrosion-resistant metallurgy, but it can be managed cost-effectively.

#### PROBE - Mass Loss



## CASE STUDY

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### Successful Processing of High-calcium Crude on Short Notice

A busy refinery in South Asia accustomed to relatively heavy, high-acid crudes from the Middle East, Africa, China, Asia and Venezuela discovered too late that a new crude shipment contained unexpectedly high levels of calcium naphthenate and abnormally high TAN. Such crudes are difficult to process because calcium naphthenate is not soluble in water or oil, so it tends to accumulate at the desalter oil-water interphase, where it acts as a soap to stabilize the emulsion, degrading desalter performance and increasing fouling.

With the high-calcium crude only a few days away, the refiner contacted Dorf Ketal's local team for recommendations. Dorf Ketal's global crude knowledgebase and refinery experience included successful results with similar crudes using a proprietary calcium-removal agent.

The formulation includes an organic acid that hydrolyzes calcium naphthenate, forming naphthenic acid and calcium. The calcium reacts with the acid to form a water-soluble salt that the desalter easily removes. Downstream systems protected by a Dorf Ketal high-acid corrosion inhibitor manage the naphthenic acid, which is soluble in the oil phase.

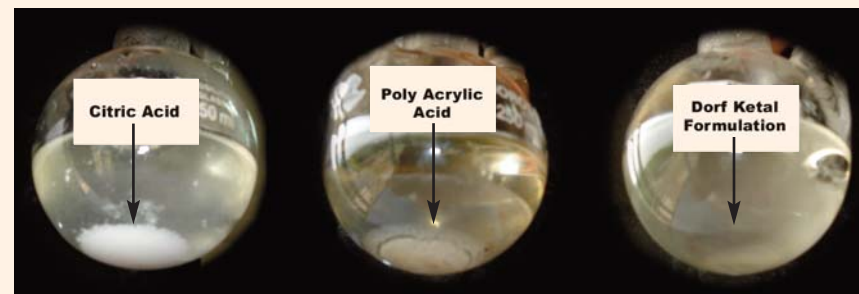
The product, which contains an inhibitor to protect refinery systems from the effects of the acid, was injected upstream of the first-stage desalters. Treatment rates were designed to maximize calcium removal without hindering desalter performance. Continuous monitoring and lab support managed the entire process.

The crude was processed successfully for more than three weeks at blend rates of up to five percent with no significant problems. Calcium removal rates ranged from 76 percent to more than 93 percent, substantially exceeding the refinery's 70 percent KPI, as well as other key performance indicators for salt removal, dehydration efficiency, brine oil content and COD.

**Bottom Line:** The refinery avoided costly problems and maintained throughput in spite of poorer-than-expected crude quality.

**Performance Observation:** Proprietary chemistry and extensive experience with opportunity crudes help Dorf Ketal solve difficult problems quickly and effectively.

### High-calcium Crude Treatment



Proprietary Dorf Ketal formulation outperforms competitive products.

# IMPROVE YOUR REFINERY'S BOTTOM LINE

Profit from Dorf Ketal's experience  
in the world's most demanding refineries.

Call your Dorf Ketal representative today  
to arrange a trial.

"Our quench oil tower  
has run continuously for  
more than 5 years  
without cleaning and it  
is still on line."

- Senior V.P.,  
Olefins

"Dorf Ketal provides us  
with superior technology."

- Senior V.P.

"Depropanizer run length  
has been more than 5 years  
without any need to clean  
the column."

- Senior V.P.,  
Olefins

"We are happy with the  
performance of (Dorf  
Ketal) chemicals and  
excellent technical  
support services."

- V.P., Olefins

"Your unique technology  
(solubilizing polymers in the acid  
wash tower) helps to improve the  
performance on our caustic tower."

- Operations Manager,  
Ethylene Plant

"Depropanizer reboiler run length increased from  
2-3 months to 9-12 months."

- V.P., Olefins

"Benzene stripper operations have been  
much more stable... run length increased  
from 2 months to more than one year."

- Senior V.P.,  
Olefins

"Your patented... inhibitor  
has resolved long-standing  
fouling issues in our Amine  
Section that negatively  
impacted plant profitability  
and consumed valuable  
maintenance man-hours."

- Plant Production  
Manager

"Unique technology helps reduce  
the quantity of chemical used."

- Production  
Department Manager

"Dorf Ketal chemicals prevented  
unavoidable quench oil tower shutdown."

- V.P., Olefins

"Dorf Ketal monitoring with proprietary software has  
been quite useful for us to understand chemical  
performance and column health."

- V.P.

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**E-mail: [innovation@dorketal.com](mailto:innovation@dorketal.com)  
[www.dorketal.com](http://www.dorketal.com)**

Dorf Ketal Chemicals (I) Pvt. Ltd.  
#1 Dorf Ketal Tower, D'Monte Street  
Orlem, Malad (W), Mumbai 400 064  
Maharashtra, India  
Tel: +91-22-2883-3900

Dorf Ketal Chemicals (I) Pvt. Ltd.  
Manama, Kingdom of Bahrain  
Tel: +97-33-678-0547

Dorf Ketal Brasil Ltda  
Rua Luiz Manoel Gonzaga 450/601  
Porto Alegre – RS – Brasil  
CEP: 90470-280  
Tel: +55-51-3061-2211

India Dorf Ketal Chemicals Pvt. Ltd  
Pudong District, Shanghai - 200 122  
China  
Tel: +86-1560-225-5419

Dorf Ketal B.V.  
De Ring, Weegschaalstraat 3  
5632 CW Eindhoven  
Netherlands  
Tel: +31-40-290-1385

Dorf Ketal Chemicals Pte. Ltd.  
#04-56 German Centre  
25 International Business Park  
Singapore 609916  
Tel: +65-6562-8250

Dorf Ketal Chemicals LLC  
11200 Westheimer Road – Suite 400  
Houston, Texas 77042  
USA  
Tel: +1-713-343-2377

***Discover what Dorf Ketal can do for you.***