

AdESulfur™

Catalytic Sorbent for Ultra-Deep Desulfurization



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ADEM Technologies Inc. (ADEM) has developed a new AdESulfur™, catalytic sorbent for ultra-deep desulfurization applications such as ULSD production or fuels with <1 ppmw. AdESulfur™ represents active metals anchored onto nanowires-based supports for high performance desulfurization sorbent with high sulfur removal capacity.

ADEM introduces the new generation of sorbent (AdESulfur™) made with improved production techniques following years of R&D and scaleup tests. AdESulfur™ contains single crystal surfaces of uniform metal oxide nanowires as carrier with highly dispersed and more number of active sites. AdESulfur™ specifically removes 'S' containing chemicals and retains 'S' within the sorbent without releasing any H₂S.

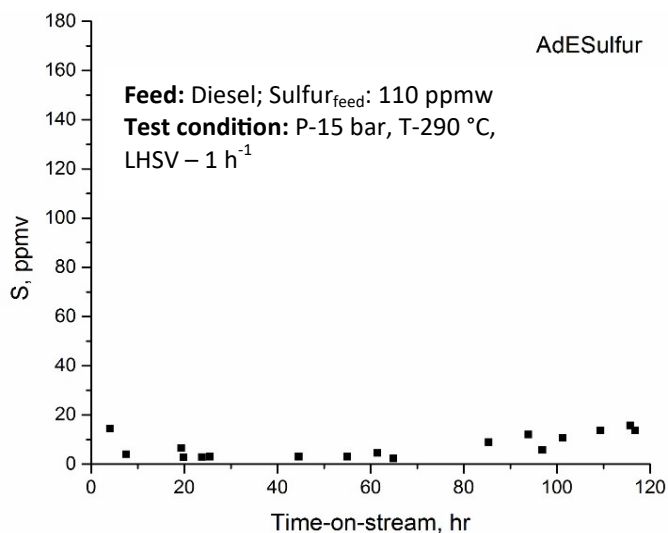
AdESulfur™ is an advanced catalytic sorbent solution for deep to ultra-deep desulfurization in the production of ULSD and other fuels such as kerosene, naphtha and jet fuel. The advantages of this product include the high dispersion of active phase, high mechanical stability and attrition resistance. AdESulfur™ has been demonstrated to operate at milder conditions (pressure ~ 5-15 bar and temperature ~ 200-290 °C) and low hydrogen requirement (H₂/Oil – 280 - 560 SCFbbl). This makes it more suitable for refiners having issues reaching 'S' specifications for ULSD and other fuels. Since no H₂S released using AdESulfur™, recombination of H₂S and olefins forming mercaptans can be avoided.

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Table 1: Test results with AdESulfur

Feed	Diesel, kerosene, Naphtha, Jet fuel
Sulfur, ppmw	50-150
H ₂ pressure, bar	5-30
H ₂ /Oil, SCFbbl	280-560
LHSV, hr ⁻¹	1-6
Temperature, °C	200-290
Product Sulfur, ppmw	≤ 10

Fig 1. Desulfurization activity of AdESulfur™ vs Process Time



Applications

Feedstocks AdESulfur™ is an excellent choice for the removal of sulfur from various fuel streams as diesel fuel, naphtha, kerosene, jetfuel, pipeline natural gas, biofuels, biogas and waste lube oil re-refiners.

Oil Refineries AdESulfur™ is developed specifically for use in small to medium scale refineries who are not able to revamp the hydrotreaters to meet the fuel specifications because of high CAPEX to revamp. Refineries can implement AdESulfur™ in the add-on reactor next to the hydrotreater without any change in hydrotreater. Let the refinery hydrotreater removes 'S' to the extent of 50-200 ppmw at much less severe conditions than usually required, and the remaining 'S' will be taken care by AdESulfur™ in the downstream to reach to <5 ppm. As shown in Figure 1, AdESulfur™ is a highly active S sorbent, and the S capacity is estimated as 26 g of S (0.8 mol of S) per 100 g of AdESulfur™.

Cetane Number Improvement

AdESulfur™ is an excellent catalyst for hydrogenation of aromatics and PNAs present in diesel, selectively opening the ring structure improves the cetane number by 8-10 units, thereby making premium diesel with volume swelling and ultra-low sulfur.

Table 2. Cetane index measurements using ASTM D86 and ASTM 4737 methods

Feed	Process	Density (g/ml, at 15°C)	Cetane Index
LCO from Refinery (900 ppm 'S')	Measured as received	0.83	46±1
LCO from refinery (900ppm 'S')	After desulfurization using AdE-Sulfur™	0.82	55±1
Diesel	Measured as received	0.84	47±1
Diesel 120ppm 'S'	After desulfurization using AdE-Sulfur™	0.83	57±1

Waste lube oil re-refining The AdESulfur™ is a good catalytic sorbent for desulfurization applied in waste lube oil re-refiners and plants cracking waste lube oil -to -diesel, especially for those with low availability of on-site hydrogen to produce oil with S < 15 ppmw at atmospheric pressure.

Pipeline gas desulfurization for fertilizer companies As per regulations, pipe line gas contains 6-10 ppm of organic sulfur, COS added as odorants and H₂S. AdESulfur™ having high mechanical strength, low attrition resistance and low pressure drop makes it an excellent choice for desulfurization of pipeline gas and no H₂S produced as byproduct.

Regeneration

Spent sorbent can be regenerated and recycled for desulfurization process.