Diesel Fuel Contaminated with Lighter Hydrocarbon Fuel

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Improper Fuels handling practices along the market supply chain can sometimes have the undesired impact of cross-contaminating Diesel Fuel (AGO) quality with lighter Hydrocarbon Fuels, commonly using Household Kerosene (HHK) or Premium Motor Spirit (PMS). In some other situations, deliberate adulteration of the Diesel Fuel by unscrupulous Fuel Vendors using HHK or PMS; aimed at taking advantage of pump price differentials between the fuel types for extra money, is prevalent.

The case-study under review, shares how a Company’s Power Plant running on diesel engines, successfully overcame the challenges of Diesel Fuel adulteration and saved over K$ 152 by simply insisting on 3-Parameters quick tests – Fuel Viscosity, Specific Gravity and Flash Point as part of their Receiving Procedure from Diesel Fuel Vendors.

Nigeria Government’s approved specification for diesel fuel - Select Parameters/Limits [1]

1. Viscosity @ 38C  1.6 – 5.5 cSt
2. Flash Point  65 – 100 C
3. Density @ 15C  0.820 – 0.871 g/ml

Contaminating Diesel Fuel with Lighter Hydrocarbon such as Gasoline or Kerosene will alter some or all of above Parameter to significantly shift off the specified range (acceptable Limits). It is near-impossible to visually identify contamination and/or adulteration, Laboratory Testing is required.

A Petrosave Laboratory Study tabulated below, illustrates how Diesel Fuel Parameters can gradually shift off Industry Specified range with increasing quantities of diluents – in this case Kerosene.
1. **Viscosity** is a measure of a Fluid’s internal resistance to flow. The greater the viscosity, the less readily the liquid flows.

![Viscosity Graph](image)

a) Fuel viscosity correlates to **Diesel Fuel Lubricity**; required for overall Fuel system lubrication – particularly Pump & Injectors. **Low viscosity** measurement directly relates to Injection Pump wear and Injector leakage.

![Injector Images](images)

b) Fuel viscosity influences **fuel spray pattern** atomization (turning the liquid fuel into small droplets injected evenly into the cylinder before combustion) [2]. Ineffective spray pattern & dribbling injector is one common cause of Fuel Dilution problem in Diesel Engines.

![Spray Pattern Images](spray)

2. **Flash Point** is the lowest temperature which fuel can be ignited. It is important for safe Fuel Handling/Storage practices. Flash Point Testing is excellent for detecting the lighter diluents – Kerosene & Gasoline.

![Flash Point Graph](flash)
3. **Density** is measurement taken to determine the quality of liquid product. Fuel density measurement correlates with **Fuel Heating Value** ... meaning higher density (API Gravity) has higher Heating Value (Energy Content).

![Diesel Fuel Density Trend](image)

Whenever either situation (Contamination or Adulteration) occurs, it has the effect to significantly tune down the viscosity of Diesel Fuel with consequential frictional wears to Fuel System components. The associated lowered fuel volatility often raises storage and handling safety concerns. Furthermore, the lowered Fuel Density short-changes on the expected fuel calorific content.

For the Case Study under review, in some very severe situation, it was thought provoking that such “trivial thing” as Diesel Fuel Quality was forcing production shutdowns, incurring expensive downtime and threatening the company’s bottom-line. The local business environment was getting increasingly competitive and burdened with above avoidable “cost-to-business” Company’s bottom-line was being eroded. Prior to adopting the 3-Parameters Quick Test, that Company was on the verge to lay-off workers and close business

Problems which arose from those situations that add up to the achieved K$152 benefits savings include:

1. Warranty Claims for Fuel Pumps and Injector Nozzles were sometimes in excess of K$15
2. Erratic engines performances impairing ability to sustain production load
3. Factory rejects; in FY2015, K$35 was the estimated value lost due to increased Factory Rejects
4. In a given year, K$ 57 was booked as expense incurred in the write-off huge quantities of 25,000 Gals of Diesel Fuel due to quality issues, apart from associated cost-to-dispose
5. Reduced uptime with consequential losses in Production; K$ 45 is estimated as cost resulting from losses in Production in a typical year.
6. Short-changed on expected Calorific Value
7. Rising cost of repairs, Spares replacement etc; 4% in excess of annual K$250 Maintenance Budget

References:

1. Diesel Fuel specification by NNPC (Nigeria National Petroleum Corporation)
2. Fuel Injectors Spray Pattern, by ProFlow Technologies

**Key Word**: Engines – Diesel Engines;