# Crude oil blending: Improve refinery economics and protect environment

Efficient crude blending achieved by the integration of the on-line quality analyzers with deep learning AI software.

LONDON, UNITED KINGDOM, June 4, 2021 /EINPresswire.com/ -- In the past refineries were based on the distillation of conventional crude oils available in the local market. Current economics, variations in the price of crude oils and market demand fluctuations force refineries to reduce their cost of distillation feedstock by blending high value light crude oils with heavy crude oils of inferior quality, or to buy readymade blends of lower cost.

The global refining capacity is expected to register a CAGR of more than 1.25% during 2021-2026. The COVID-19 pandemic has negatively affected the market due to a reduction in consumption of refined petroleum products and declining economic development across the major nations of the world. The COVID-19 pandemic coupled with the high volatility of crude oil prices delayed many refinery projects across the world. The growth in refining capacity is expected to be driven by the increasing demand for petroleum products in the coming years. However, the refining market is restrained by factors such as lack of funds and delay in commissioning projects, which makes effective feedstock management even more important for economic development.
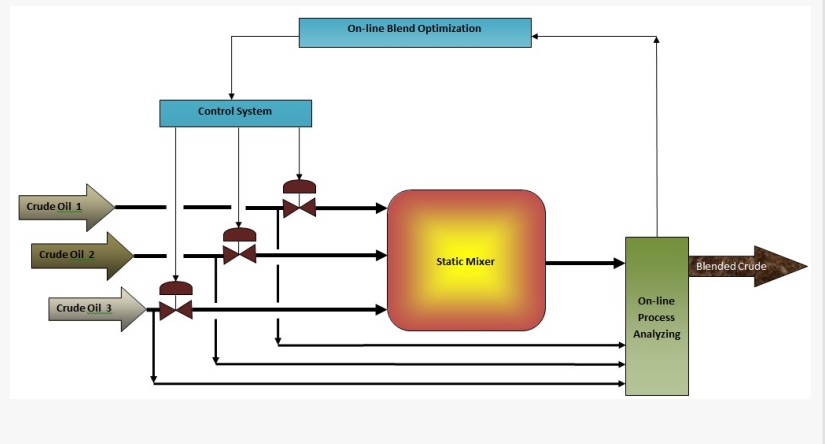
Crude oils are the major part of the expenses which influences the cash flow of refineries. Therefore, during the last decades a large number of refineries in the US and in Europe were forced to close their distillation facilities or to change their activities towards crude blending that provides better revenue. The major operational cost of the refinery is contributed by the price of the crude oil which is estimated by 80% to 90% of the cash flow. Reducing the cost of the crude feedstock, without changing the range and volumes of high valued distillates, increases the refining margin and by that the profit of the refinery. Refinery profits are a direct outcome of the strategy applied by the refinery in purchasing low cost crudes and to produce distillates with a high market value. Improved refining margins can also be achieved by shifting the volume of distillates towards those products that have high market values, caused by high demand. That requires the availability of crude quality real-time data and prediction the quality of final products to optimize the process control setpoints. Unlike previous investment cycles, the prospect of growing electric vehicle demand reducing future gasoline and diesel demand, coupled with shareholder demands for return of capital, has prompted greater capital discipline amongst refiners.

Many refineries are not capable do distill low cost distillates or blends from an engineering point of view. This, in combination with an increasing demand of diesel instead of gasoline drastically reduced the refining margins for many refineries. Inefficient and inaccurate crude blending reduces the production capacity of crudes that do not comply with the required specifications. It will definitely lead to "giveaways" or to the need of time consuming expensive re-blending. Stringent monitoring of physical and chemical properties of required crude blend to be produced minimizes these losses. Process analyzers provide a highly efficient tool to online and real time monitoring the physical properties of the crude blend, allowing on-line process adjustments to be executed. Efficient blending will reduce the cost of the feedstock.

This goal is achieved by the integration of the on-line quality analyzers, with crude oil blending deep learning AI software. Its data will automatically adjust the blending procedure to provide the most economic blend with the highest refining margin. It will definitely contribute to improve the refining margin, and the profitability of the entire refinery. Successes that can be attributed to the use of process analyzers include saving in production, product giveaway, operating manpower and energy conservation.

The newly redesigned by Modcon Systems Ltd. (UK) MOD-4100 crude analyzer represents a breakthrough in crude oil on-line analysis and blending optimization. It is a single analyzer, that performs on-line a variety of different critical crude oil measurements to provide real time analytical data, which is highly important for optimized operation processing of crude oils. The new design of the MOD 4100 analyzer system is based on a "Modular Package concept". It is inspected and tested by the factory, and ready for immediate installation on-site. The following crude oil critical parameters can be measured on-line and correlated to ASTM:

* Salt Concentration (D3230)
* Distillation (D2892, D86)
* SARA (IP-143 and D893-69)
* Emulsion stability (F3045, D4007 and D3707)
* Hydrogen Sulfide content (D5705)
* RVP (D6377 and D323)
* Viscosity (D445 and D2501)
* Water Content (D4928 and D4006)
* Density (D4928 and D1250)

The proprietary blending optimization software, based on AI neural-networks modelling is used to predict the ratio between individual components that are used to prepare the blend. Based on composition data of the various crudes applied, and using the proper algorithm this software applied to calculate and predict physical properties of blends to be produced. This software also calculates the ratio of different crudes to be blended, resulting in a crude blend with properties that distillation will lead to the desired distillates at optimal yield. Adequate blending simulation models is not only restricted to the chemistry of the crude oil distillation, but also to its economics. It has the capability to calculate the composition of different crudes that provide the most economic blend of the lowest cost. In such a blend, volumes of those crude oils of lowest cost should be maximized, but the blend should still bear the most attractive refining properties.

Incorporation of on-line crude analyzer and deep learning technologies enables to increase the blending efficiency and to reduce unnecessary giveaways. Efficient blending reduces the cost of the feedstock and contributes to improve the refining margin, reduce energy consumption and environmental impact of the entire refinery.

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