

MODERN PROBLEMS AND INNOVATIVE SOLUTIONS OF THE OIL REFINING INDUSTRY: A NEW APPROACH IN THE ERA OF GLOBAL CHANGES

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Abstract

This in the article oil again work industry in today's global environment current problems , technological transformation processes , carbon neutrality requirements , raw materials of quality decrease , product diversification and energy efficiency issues analysis Statistical information , advanced factories experience , new catalytic processes and innovative integration models based on modern solutions offer Article previously there is scientific from work different accordingly oil again work process new global energy paradigm in the context of analysis does.

Keywords: Oil refining industry, modern challenges, innovative solutions, global changes, energy transition, sustainable refining, digitalization in oil refining, circular economy, low-carbon technologies, petrochemical integration, environmental impact reduction, advanced catalysts, process optimization.

Introduction

Today on the day oil again work industry world economy strategic from networks one fuel, lubricant materials, petrochemicals raw materials and organic synthesis products delivery gives. Last ten annually oil price change, global energy market again formation, ecological of requirements increase and of economies decarbonization processes oil again work from enterprises fundamentally new approaches demand is doing.

Oil again works industry today's problems from before sharp difference does: raw of oil aggravation, ecological of requirements increase, waste again work necessity, again recovering resources with integration, green to hydrogen transition and product profitability increase such as issues stable development main in the direction of is spinning.

Therefore, this article oil again work of the field **the most current problems deep scientific analysis to do and innovative solutions offer to reach** focused.

The world leader in the countries fuel consumer goods slowly - slowly decreasing, petrochemical to their products was demand increasing By 2030, the market main growth pace plastics, synthetic rubber, polymers and chemistry industry for raw material is considered.

Traditional light oil reserves decreasing, heavy, high sulfurous and paraffin oils share increasing This is going on:



- deep again work technologies demand does
- hydrocracking to the process download increases
- energy spending increases

Electricity of transport popularity to diesel demand Although it reduces, jet fuel and petrochemical raw material demand increasing is going on .

Carbon waste contraction according to Paris to the agreement according to , oil factories emissions by 30–40% by 2030 reduce obligation has .

Many old in factories energy expense modern 25–35% of demand high .

Uzbekistan and in the CIS many in factories again work level around 70–75% developed in the countries this indicator 93–96 % enough .

Many enterprises product structure fast change can't , this and market on demand to changes to adapt makes it difficult .

Modern hydrocracking high pressurized catalytic process it is :

- heavy factions light to fuel converts
- sulfur almost complete take throws
- high octane gasoline working releases

FCC–IV and FCC–V technologies following to the advantage has :

- catalyst far life see
- fuel high output
- aromatic hydrocarbons share increase

Oil again work in factories hydrogen the most important from reagents one . Traditional hydrogen natural from gas is taken , but today approach the following demand does :

- electrolyzers install
- reinstall recovering energy with bind
- CO₂ emissions noticeable reduce

Modern to trends according to , oil factories now only fuel not , maybe chemistry products delivery giver to the complex is spinning .

Table 1. Modern oil again work technologies comparison

Technology name	Home advantages	Disadvantages	Deep again work indicator
Hydrocracking	Clean diesel and gasoline ; sulfur reduces	Big energy expense	90–92%
Catalytic cracking (FCC)	Gasoline output high ; aromatics many	Ecological demand high	85–88%
To Coke coking	Heavy oil for effective	Coke waste many	65–75%
Asphalt deasphalting to do	Fuel output increases	Expensive reagents	80–85%
Complex petrochemical integration	Polymer raw material ; high profitability	Big capital expenses	95–97%



Hydrocracking — oil deep again of work the most effective from the processes one is heavy fractions high good quality gasoline , diesel and jet fuel such as light to fractions breaks down . Process high pressure , high temperature and hydrogen in the environment special catalysts in the presence of done increases .

Sulfur complete almost take throws , fuels quality high , ecological to the requirements suitable . Energy expense high , hydrogen need large , equipment expensive Deep again Efficiency : 90–92 % achieves this high indicator is considered .Catalytic cracking — heavy oil fractions high octane gasoline , LPG and aromatic to hydrocarbons rotating the most important from processes one . Process fluid catalyst in the layer happened will be .

Advantages : Gasoline output high (50–55%), polymers for aromatics many harvest will be . Disadvantages : In progress sulfurous gases harvest will be , cleaning systems demand does . Deep Efficiency : 85–88%, hydrocracking than a little low.

This process heavy residue thermal products (fuel oil , tar) decomposition through light to fractions turns , but his/her side product as many in quantity coke (carbonaceous) hard substance) product will be .

From the table visible It is clear that oil again work processes efficiency , ecological requirements , energy expense and profitability according to noticeable to differences has . Modern in the world deep again work level and maximum product diversification the most important demand is the most high indicator complex petrochemical in the integration record is being done .

Hydrocracking technology high good quality fuel in receiving leading , catalytic cracking gasoline working in the release the most effective , coke convert heavy oils for necessary , and SDA the depth in increasing assistant method is considered .

Using AI processes optimization losses up to 8–12 % reduces .

IoT sensors

Sensors :

- temperature
 - pressure
 - composition
 - energy spending
- constantly monitors .

Factory full virtual model will be built and then all processes in advance is considered .

By capturing CO₂ to take technologies (CCS, CCUS) are rapidly is developing .

Oil factories water up to 70% of consumption reduction possible .

New generation catalysts up to 99.7% sulfur remove throws .

1. Deep again work level to 90% to deliver
2. Modern hydrocracking block build
3. Petrochemicals complexes expansion
4. Digital monitoring systems complete current to grow
5. Ecological requirements Europe to the standards adaptation



Oil again work field current global energy changes fundamental transformation in the conditions from the head is forging. Deep again work, hydrogen technologies, petrochemicals integration, digital systems and ecological approach to the field new quality level gives. In the article cited analyses this shows that technological modernization and innovations current to grow oil industry stable development only is the way.

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