

2017中美煤炭清洁发展论坛

中国煤化工发展现状及趋势简介

Brief Introduction of the Current Situation and Trend of

Coal Chemical Industry in China

煤炭科学技术研究院有限公司

CHINA COAL RESEARCH INSTITUTE





一、煤炭清洁转化利用现状

Current state of clean coal conversion and utilization

二、“十三五” 煤炭清洁转化利用趋势

Trend of "13th Five - Year" clean coal conversion and utilization

三、中国煤科煤炭清洁转化利用技术

CCTEG clean coal conversion and utilization technology

一、煤炭清洁转化利用现状

Current state of clean coal conversion and utilization



1、中国煤化工产业方兴未艾：政策护航

China 's coal chemical industry in the ascendant: policy escort

- 中国政府提出了“供给侧结构性改革”理念，煤炭工业是供给侧改革的重要领域。

- The Chinese government put forward the concept of "supply side structural reform", and the coal industry is an important area of supply side reform.

- 《煤炭深加工产业示范“十三五”规划》于2017年2月正式发布，系首次正式发布的新型煤化工国家政策文件

- “Coal deep processing industry demonstration” 13th five-year “plan” was officially released in February 2017, which is the first official release of the national policy document of new coal chemical industry.

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2、能源消费升级和环保的驱动需求

Demand of energy consumption upgrades and environmental protection

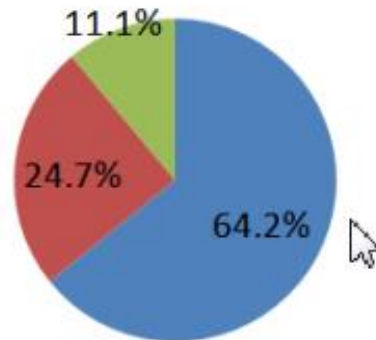
新型煤化工以生产洁净能源和可替代石油化工品为主，相关产品国内市场缺口大，是我国优化能源结构、保障能源安全、降低煤炭直接利用污染的重要途径之一。

New coal chemical industry mainly produces clean energy and alternative petrochemical products. There is a large gap of related products in the domestic . It is a important way to optimize the China 's energy structure, to secure energy safety, and reduce the pollution caused by direct use of coal.

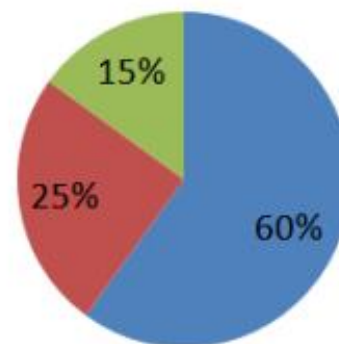
能源消费

- 煤炭 Coal
- 石油+天然气 Oil&Gas
- 非化石能源 Non-fossil

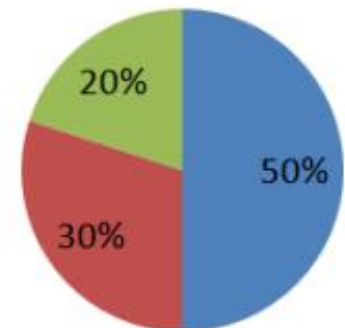
China Energy Mix 2014



2020 E



2030 E



一、煤炭清洁转化利用现状

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3、核心技术和装备取得重大突破

Breakthrough of core technology and equipment

- 形成了一批具有核心自主知识产权的技术装备体系

Formed a number of technical equipment systems with core independent intellectual property rights

- 核心技术和装备的国产化及持续升级，大幅降低了项目投资和运行故障风险，也一定程度降低了生产成本

The localization and continuous upgrading of the core technology and equipment significantly reduces the project investment and operational risk, and also reduces the cost of production to a certain extent.

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4、煤化工项目的市场需求保证

Market demand of coal chemistry projects

- 以煤制烯烃项目为例，2016年统计

Take coal to olefins as an example, statistics of 2016

项目 project	神华包头 Shenhua Baotou	中煤榆林 Chinacoal Yulin	延长榆林 Yanchang Yulin
聚烯烃产品，万吨 Polyolefin products, 10,000 tons	57.47	71	103
利润，亿元 Profit, billion	10.29	11.3	8.5

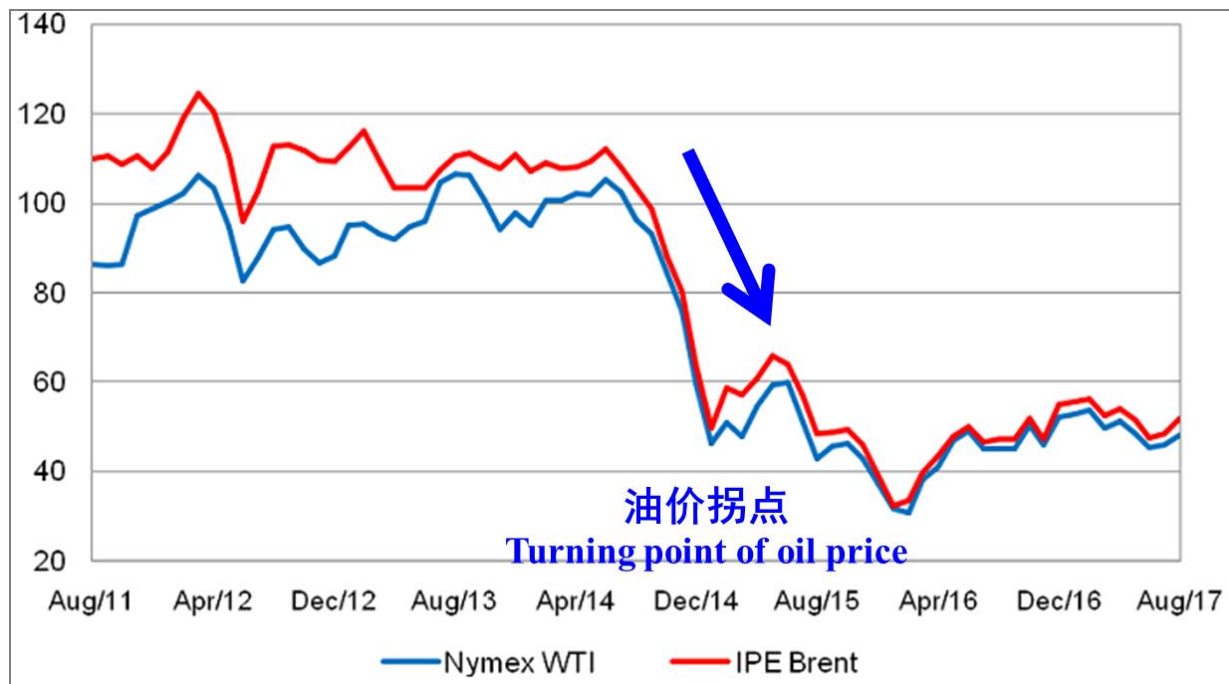
- 受当前国际油价的影响，煤制油、煤制天然气项目的盈利水平还较弱，尤其受燃油消费税的拖累，煤制油项目基本亏损。
- Influenced by the current international oil prices, the profitability of coal-to-oil and coal-based natural gas projects is still weak. Especially, because of the fuel consumption tax, the coal oil project is basically running at a loss.

一、煤炭清洁转化利用现状

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- 受国际经济环境、地缘政治、页岩气能源革命的影响，未来国际油价预期维持在50美元左右，这对**新型煤化工产业有潜在不利影响**。
- **Affected by the international economic environment, geopolitics, shale gas energy revolution, the future international oil prices are expected to remain at around \$ 50, which has a potentially negative impact on the new coal chemical industry.**



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5、新型煤化工产业格局

New coal chemical industry pattern

截至2016年底，国内新型煤化工产业总体情况如下：

Up to the end of 2016, the overall situation of domestic new coal chemical industry is as follows:

- 煤（甲醇）制烯烃项目：已投产产能达到862万t
- Coal (methanol) to olefins project: over 8.62 million tones
- 煤制油项目：已投产产能超过700万t
- Coal to oil project: over 7 million tones
- 煤制天然气项目：已投产产能 51亿m³/a
- Coal to NG project: over 5.1 billion m³/a
- 煤制乙二醇项目：已投产产能超过200万t
- Coal to ethylene glycol project: over 2 million tones

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6、一个成功的煤化工项目的3个关键条件

3 key requirements for a successful coal chemical industry project

- 充足的资金

Adequate funding

- 专业技术团队

Professional technology team

- 稳定的煤炭资源

Stable coal resource

二、“十三五” 煤炭清洁转化利用趋势

Trend of "13th Five - Year" clean coal conversion and utilization  中国煤炭科工集团

1、“十三五” 重点发展方向的政策环境

The policy environment of development tendency during the "13th Five-Year" period

- 《煤炭深加工产业示范“十三五”规划》
 - the 13th Five-Year Plan for Coal Deep Processing Industry
- 《石化产业规划布局方案》发改产业[2015]1047号
 - the Planning Layout Scheme for Petrochemical Industry
- 《现代煤化工产业创新发展布局方案》
 - the Layout Scheme for Innovation and Developments of the Modern Coal Chemical Industry
- 《石化和化学工业发展规划（2016-2020年）》
 - the Plan for Development of Petrochemical and Chemical Industry (2016-
- 《现代煤化工建设项目环境准入²⁰²⁰条件（试行）》（环办〔2015〕111号）
 - the Environmental Access Standards for the Modern Coal Chemistry Construction Projects
- 《能源技术革命创新行动计划（2016-2030年）》（发改能源〔2016〕513号）
 - the Action Plan for Revolution and innovation of Energy Technology

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2、把握在战略需求的情况下适度发展的中心思想：

Grasp the central idea of moderate development under the condition of strategic demand

- ① 强调科学规划，合理布局，总量控制；合理利用资源，加强生态环境保护。

Scientific planning, rational layout and total amount control. Utilize resources rationally, strengthen the ecological environmental protection.

- ② 突出示范升级为主线，**低阶煤分质利用**、甲烷化、甲醇制芳烃等技术完成工程示范，取得自主知识产权；

Highlight the upgrading demonstration to complete quality-based utilization for low-rank coal, methanation and methanol to aromatics demonstration projects, and to obtain intellectual property.

- ③ 注意市场风险，研发高附加值煤制化学品、特种油品新产品，延伸现代煤化工产业链、拓宽产品

Pay attention to market risk. Research and develop high value-added coal chemicals, special oil products, extend the modern coal chemical industry chain, and broaden product range.

- ④ 推进与关联产业融合发展，如煤-油共炼技术

Promote the integration and development of related industries, such as coal and oil co-processing technology.

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3、“十三五” 煤炭清洁转化产业示范重点任务设想

Priorities of industry demonstration for clean transformation of coal during the "13th Five-Year" period

重点开展煤制油、煤制天然气、低阶煤分质利用、煤制化学品、煤炭和石油综合利用等5类模式以及通用技术装备的升级示范。

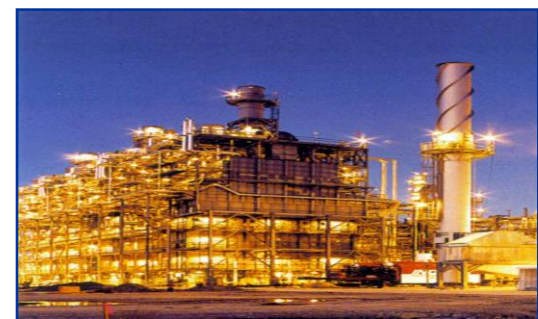
China focus on developing the upgrading demonstration of five modes of coal utilization and genera technologies and equipment. The five modes of coal utilization include coal to liquid (CTL), Coal to SNG, quality-based utilization for low-rank coal, Coal to chemicals and Comprehensive utilization of coal & oil.

二、“十三五” 煤炭清洁转化利用趋势

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预期规模（2020年）： Expected Scale（2020）

- ① 煤制油 1300万t
coal to liquids 13 million tons
- ② 煤制烯烃 1600万t
coal to olefins 16 million tons
- ③ 煤制乙二醇 600-800万t
coal to glycol 6-8 million tons
- ④ 煤制天然气 200亿m³
coal to SNG 13 million tons
- ⑤ 煤制芳烃 100万t
coal to aromatics 1 million tons
- ⑥ 低阶煤分质利用 1500万t
quality-based utilization for low-rank
coal 15 million tons



二、“十三五” 煤炭清洁转化利用趋势

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4、加大“低阶煤分质利用”研发与工程示范的力度

Increase the intensity of technology research and engineering demonstration of quality-based utilization for low-rank coal

- 中国褐煤和低变质烟煤占储量的**55%**；中变质炼焦烟煤占储量的**28%**；高变质的贫煤和无烟煤占储量的**17%**。
- Lignite and low metamorphic coal **55%**; the mid-metamorphism coking coal **28%**; high rank lean coal and anthracite **17%**.
- 低阶煤“深度”分质利用可集成**热解-气化-合成-发电-供热**等技术于一体的综合利用，**被期以厚望**

Great hopes are placed on the integration with **pyrolysis-gasification-synthesis-power generation**

- 但**目前还没有大规模工业示范装置取得长周期运行的成功例子**，尤其针对碎煤（块煤生产兰炭已很成熟），关键技术难点是**气液固分离、焦油除尘、半焦利用**等。
- **However there is no successful examples of long period operation of large-scale industrial demonstration unit**, especially for crushed coal. the key technical problems is **gas-liquid-solid separation, dust removal for tar, Semi-coke utilization** etc.

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5、“煤-油共炼”：煤化工与石油化工重要融合途径

Coal and oil co-processing: the important integration of coal chemical industry with petrochemical industry

- 与煤直接液化相比，设备简单、流程短、投资强度低，液体收率可提高10~20个百分点
- Compared with direct Coal-to-liquids, it has the advantages of simple equipment, short process and low investment, and it's liquid yield can be increased by 10% to 20.
- 世界首套“延长石油靖边45万吨/年煤油共炼工业化示范项目”2015年1月31日顺利打通全流程，生产出合格油品。
- Yanchang Petroleum Group has builded the first set of 450000 t/a co-processing of coal and oil industrial demonstration project in the world. This demonstration project successfully completed the whole process in January 31, 2015, and produce qualified oil.





节能环保技术

Energy saving and environmental protection technology

- 煤炭资源的转化、节能和高效利用技术，包括**煤炭液化、气化、焦化、清洁燃烧技术及其装备研究**，以及**脱硫脱硝、煤化工污水处理技术**等。
 - Coal resources transformation, energy saving and efficient use of technology, including **coal liquefaction, gasification, coking, clean combustion technology and equipment research**, as well as **desulfurization and denitrification, coal chemical wastewater treatment technology**.
- 研究开发成功的**高效粉煤锅炉、烟气脱硫脱硝技术、固定床熔渣气化、煤化工污水处理、煤焦油加氢技术**等都具有广泛的推广应用前景。
 - The research and development of **High efficiency pulverized coal boiler technology, Flue gas desulfurization and denitrification technology, Fixed bed slag gasification technology, Sewage treatment of coal chemical industry, Coal tar hydrogenation processing technology** and so on, have a wide range of application prospects.

三、中国煤科煤炭清洁转化利用技术

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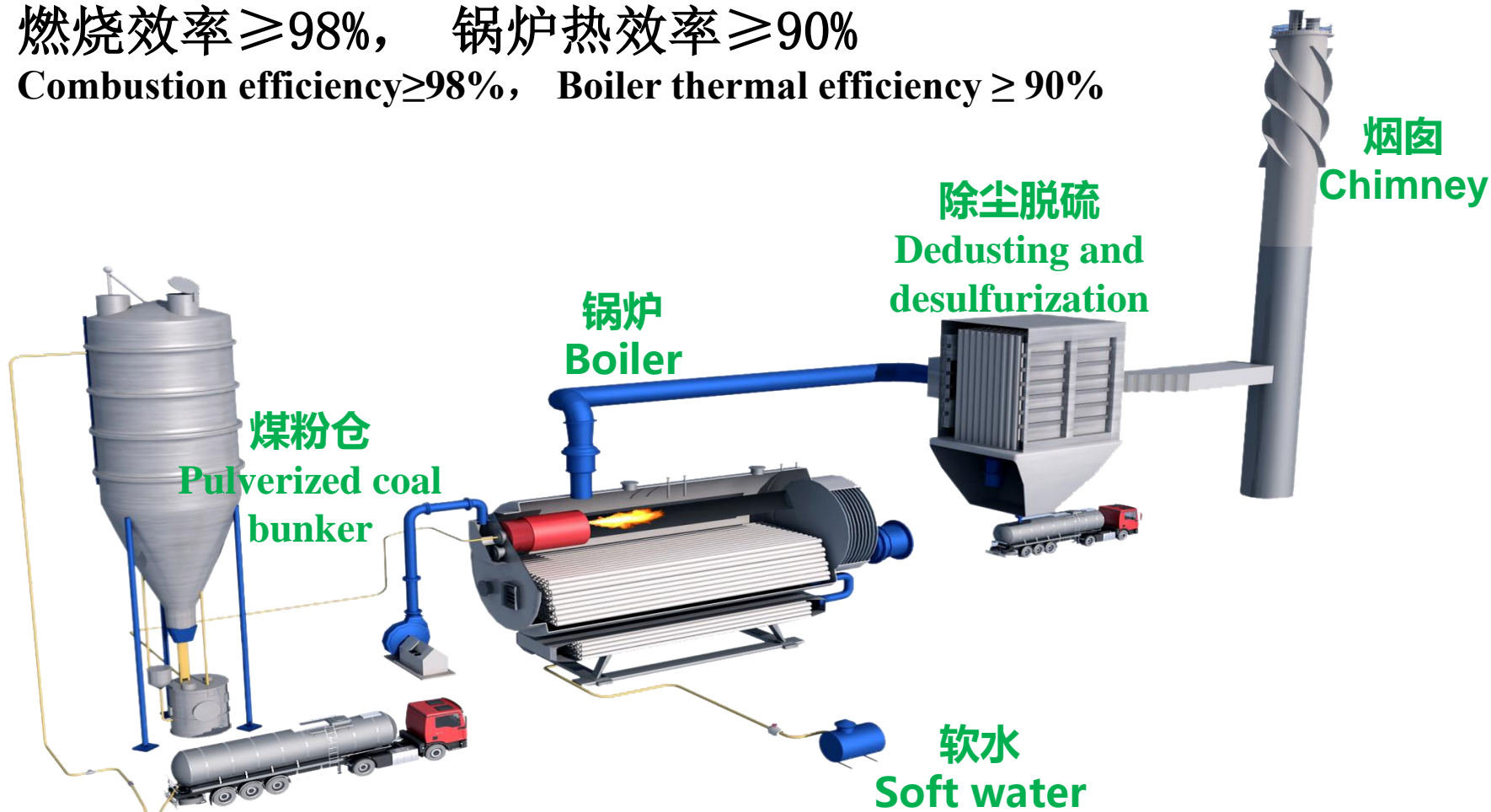
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1、高效煤粉锅炉技术

High efficiency pulverized coal boiler technology

燃烧效率 $\geq 98\%$, 锅炉热效率 $\geq 90\%$

Combustion efficiency $\geq 98\%$, Boiler thermal efficiency $\geq 90\%$





1、高效煤粉锅炉技术

High efficiency pulverized coal boiler technology

粉尘、SO₂、NO_x达到天然气排放指标

Emissions of dust, SO₂ and NO_x achieve natural gas emissions targets

	高效煤粉锅炉 High efficiency pulverized coal boiler (mg/m ³)	天然气 Natural gas (mg/m ³)
SO ₂	35	35
NO _x	50	50
粉尘 dust	5	5

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2、活性焦干法烟气一体化净化技术

Activated Coke Dry Flue Gas Integrated Purification Technology

技术特点:

Technical characteristics:

- ✓ 可同时脱除烟气中SO₂、NO_x和 Hg
Simultaneous removal of SO₂, NO_x and Hg
- ✓ 联合脱除，装置占地小
Small space occupation
- ✓ 脱除效率高(SO₂≥95%， NO_x≥70%)
High removal efficiency(SO₂≥95%， NO_x≥70%)
- ✓ 脱除过程不消耗水
The removal process does not consume water
- ✓ 无二次污染
No secondary pollution
- ✓ 可实现硫资源化利用 (≥90%)
Sulfur resource utilization can be realized (≥90%)



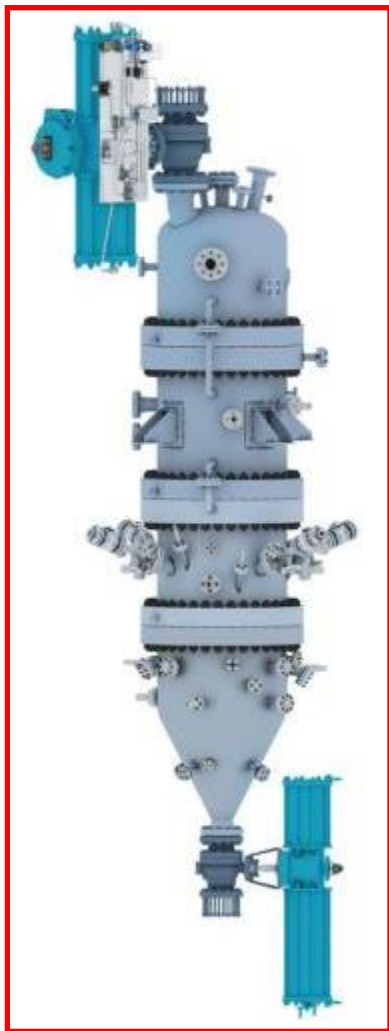
已在工业锅炉、有色冶炼、钢铁烧结等领域推广30套
30 sets have been popularized in the fields of industrial boiler,
nonferrous smelting and sintering of iron and steel

50万m³/h燃煤烟气联合
净化装置



3、煤科炉（MEKL）固定床熔渣气化技术

MEKL-Fixed bed slag gasification technology



➤ **投资成本低**：较国外相近技术降低50%以上

Low investment costs: comparing with foreign technology, reduces more than 50%

➤ **水资源消耗低**：为固态排渣的12~15%，蒸汽分解率超过 90%。

Low water consumption : 12~15% of dry ash gasification, and the steam decomposition rate is over 90%.

➤ **煤种适应性强**：拥有“中温干法排渣”和“高温液态排渣”两种技术形式。

wide adaptability : "medium temperature dry slag" and "high temperature liquid slagging" two technical forms.

➤ **适合焦炭气化**：可实现低活性焦炭的高效气化。

Suitable for coke gasification : The high efficiency gasification of low activity coke can be realized

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4、煤化工污水处理技术

Wastewater treatment of coal chemical industry

① 含酚废水新型高效萃取脱酚技术

New Efficient Extraction and Phenol Removal by Phenol Wastewater

萃取效率高达93%以上；萃取剂损失率低于0.1%，用于酚氨回收。

The extraction efficiency is more than 93%; the extraction loss rate is less than 0.1%.

② 废水高级氧化、浓盐水脱COD及结晶分质利用

Advanced oxidation of wastewater, removal of COD from concentrated brine and crystallization quality utilization

高氧化效率、无二次污染；用于废水预处理，提高可生化性；用于废水深度处理，高效去除废水中有机污染物。

High oxidation efficiency, no secondary pollution; used for wastewater pretreatment and deep treatment.



1m³/h超重力萃取脱酚中试
1m³ / h super gravity extraction phenol removal test



5m³/h高盐水脱COD及分质结晶中试
5m³ / h Removal of COD from high salt water and qualitative crystallization test

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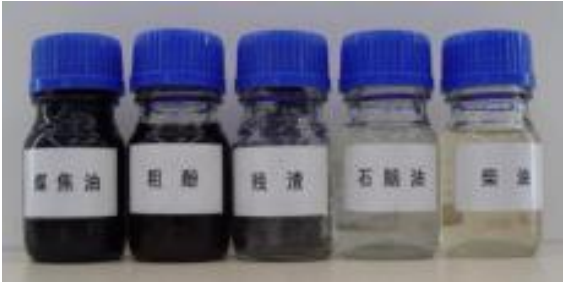
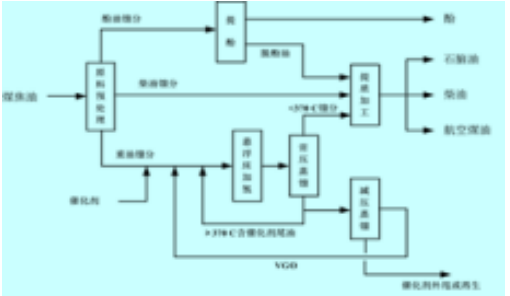
5、煤焦油加氢技术

Coal tar hydrogenation processing technology

■ 技术特点

Technical characteristics:

- ① **原料适应广**：高温煤焦油、中低温煤焦油、其它劣质油
Wide range of raw materials：High temperature coal tar, low temperature coal tar, other inferior oil
- ② **工艺灵活**：全馏分、间断馏分、重质馏分
Flexible process：Full fraction, discontinuous fraction, heavy fraction
- ③ **收率质量高**
High yield and high quality：
中温煤焦油：油收率在90%左右，柴油十六烷值 41-49
Medium temperature coal tar: oil yield of about 90%, diesel fuel cetane number 41-49
高温煤焦油：油收率在80%以上，柴油十六烷值 35-39
High temperature coal tar: oil yield above 80%, diesel fuel cetane number 35-39



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