



## **Used Engine Oil Distillation Machine**

### **1. The name of machine:**

Distillate used engine oil to diesel and gasoline machine.

Raw material to be processed: used engine oil

### **2. The Production technology**

(1) Adopt the new technology of Horizontal Rotating (Static) Continuous (Batch Type) Distillation Reactor.

(2) Adopt atmospheric pressure fractionating, atmospheric distillation with vacuum negative pressure, catalytic pyrolysis, catalytic distillation, Refinery Filter and other new technology.

(3) Adopt self-designed catalyst, filter composite material, no acid, no alkali, no white clay or other material which cause second-time pollution.

### **3. The brief introduction of the machine:**

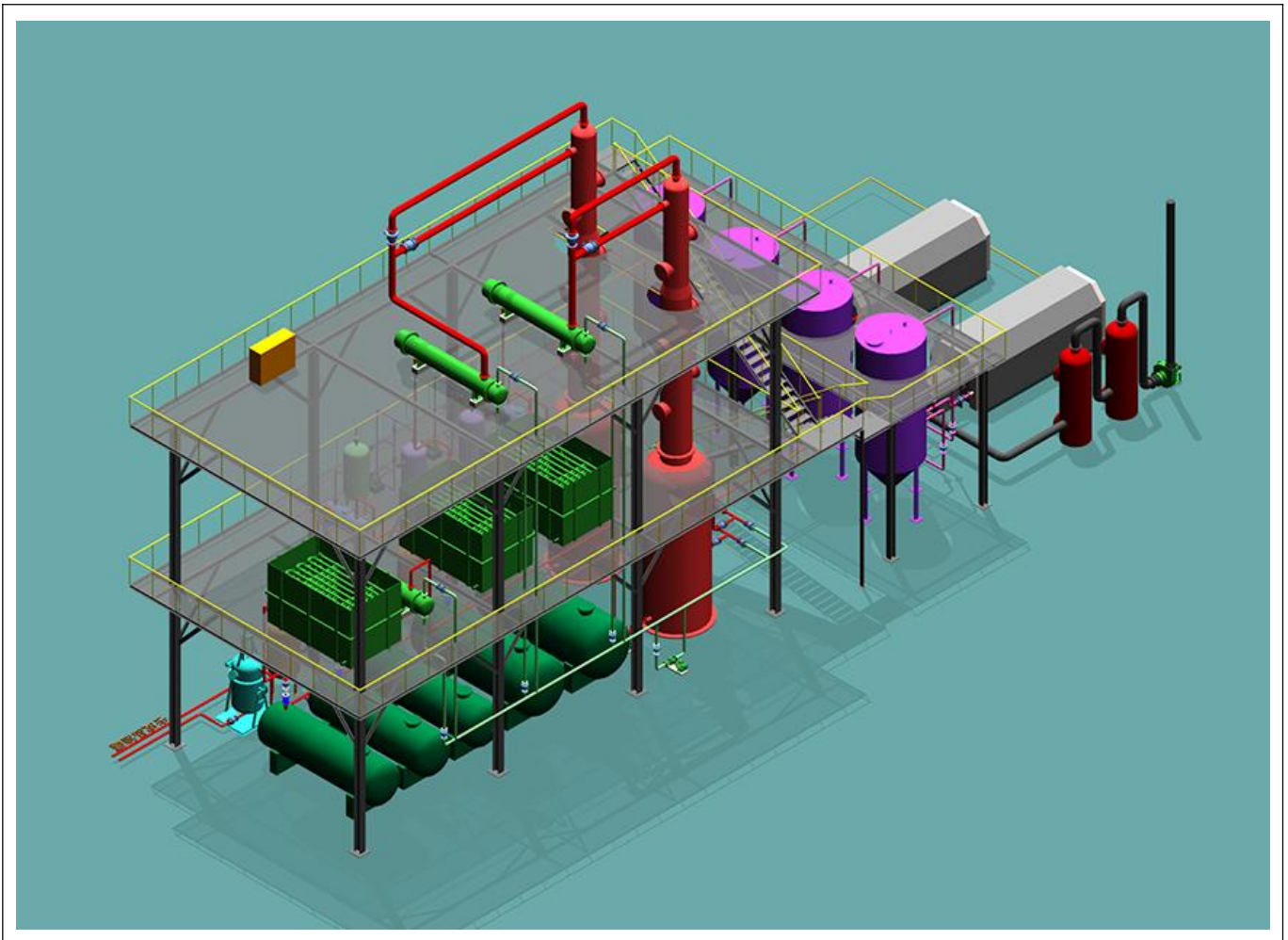
The machine aim at distilling diesel and gasoline from used engine oil. Main configuration device as below:

- Pretreatment reactor
- Horizontal rotary heating furnace
- Atmospheric fractionating tower
- Condenser
- Cooling water tank
- Oil-water separator
- Filter
- Refining filter system
- Heating system

- Distillation system
- Cooling system
- Vacuum system
- Exhaust gas recycling system
- Smoke and dust removal system
- Fire safety, explosion-proof, electrostatic grounding system
- Water treatment & recycling system
- Automatic control system.

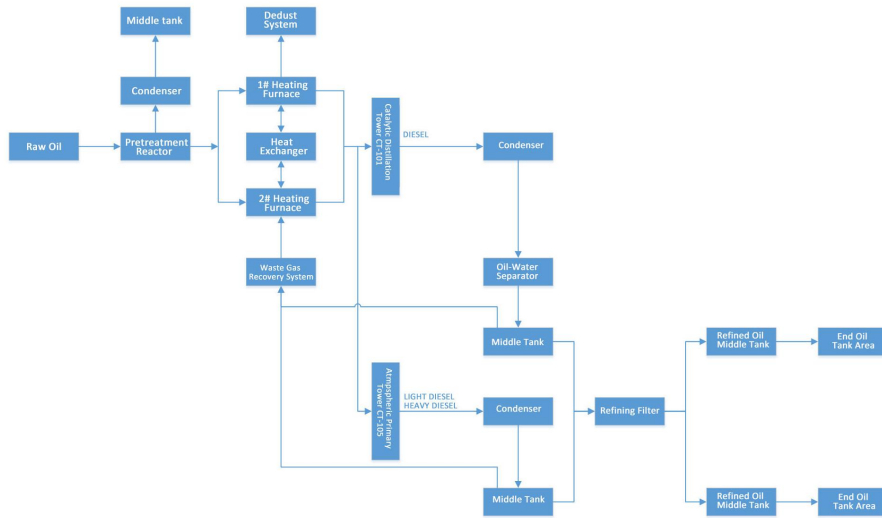
This machine can be continuously working, heated by horizontal rotary(static) heating furnace. Daily capacity can be 5-10 tons ( batch type production line can be customized).

#### 4. Flow chart and 3D drawing





10-15 TPD Continuous Distillation Diesel and By-production from Waste Engine Oil/ Tire Oil Flow Chart



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标记	数量	更改文件号	签名	日期	参考图号
设计		标准化			流量
					比例
FLOW CHART OF 10-15TPD USED OIL REFINING DIESEL TEST					

## 5. Brief introduction of technological process:

Used engine oil is delivered into the **pretreatment tank** through oil pump, then adding flocculant and other additives for removing water, impurity and colloid. Compressed air injected by air compressor for oil stirring. Stirring intensity controlled by air compressor valve, Meanwhile, start pretreatment heating cycle pump, deliver used engine oil from reactor tank to waste heat energy saving processor for exchange heating, gradually heating oil until 40-80°C. Heating while stirring for around 40-60 minutes, then static precipitation around 3-4 hours for water and slag removing. Finally the waste water and slag will be delivered to sewage treatment plant for special treatment, and treated water will be recycled for cooling. Treated slag will be dry out for the material of ash brick. Add liquid pyrolysis catalyst to the treated oil, get them stirred and heated for 30 minutes, until the temperature to be 40-80°C.

Deliver used engine oil into **1# horizontal rotary heating furnace** via oil pump, meanwhile, start-up heating system like oil burners, natural gas burners etc. for pyrolysis distillation, when temperature of each fraction gradually reach 120 - 360 °C, each fraction of



gas go to high efficiency **atmospheric fractionating tower** (CT-101) for fractionation. Top oil gas go to reflux tank, liquid back to tower while gas run from combustible gas pipeline. Tower have two exits from side: top one for light diesel oil, lower one for diesel. Respectively enter condenser --cooling tank -- oil-water separator -- mid oil tank (light diesel ,diesel) -- refining filter for filtering through pump-- end oil tank (light diesel, diesel).

Via high temperature oil pump, bottom oil of atmospheric fractionating tower (CT-101) can reflux to 1# horizontal rotary heating furnace anytime, go on heating for pyrolysis distillation. according to oil pyrolysis distillation process, irregularly check oil quality and estimate yield , spot check the bottom oil. Regularly deliver the residue oil to condenser and cooling pool via high temperature residue oil pump,finally go residue oil tank.

**Vacuum negative pressure technology** is adopted during process. After condenser system, top of middle oil tank have non-condensable gas outlet, then the gas enter vacuum negative pressure system. Via vacuum pump, extract the non-condensable combustible gas from middle tank to vacuum system, then go to exhaust pipe.

**Waste gas recycling:** When non-condensable combustible gas enter exhaust pipe, treated by vacuum tank which is for secondary filtration. Treated exhaust gas together with the non-condensable combustible gas from reflux tank of top tower, enter non-condensable combustible gas pipe network. In case of fire, they should run through retardant storage cabinet, finally go to furnace for burning, act as fuel. By this way, not only save energy and economical, but also avoid pollution.

**Smoke and dust removal system** also be adopted during production. Once start working, light up heating furnace, start-up draft fan, the smoke extracted from reactor first treated by waste heat energy processors, then handled by Tower spray smoke desulfurization secondary processor , finally go to draft fans, emissions until they are white and standard.

## **6. Brief description of production process characteristics:**

### **(1) Pretreatment system**



This system focus on pretreatment the water, colloid and impurity out of raw oil. Relieve the pressure of heating furnace and airflow in tower. Also can improve oil quality and yield, it is a key process of the whole production.

2 sets pretreatment reactor for interchangeably using. Add flocculant and other additives into pretreatment reactor, with oil circular heating system, oil pumps units,waste heat energy processors, make full use of waste heat in heating furnace flue .

Advantage:Take full advantage of resources, energy conservation and environmental protection.

## **(2) Heating furnace system**

Have below devices: #1 horizontal rotary heating furnace units, oil burners units, fuel oil filtering tank, raw oil pumps etc.

Speed reducer along with reactor can fix rotation speed, avoid coking, fast and high efficiency heating, low heating consumption and can ensure the effective pyrolysis distillation.

Oil burners with safety control valves and fuel oil amount supply control valve, so we can adjust heating energy and speed anytime that ensure stable oil gas. With above device , the whole system can work well.

Advantage: Reasonable configuration, safety, reliable and convenient operation.

Continuous and batch working both can be achieved.

a) Continuous working need install the alloy steel pipe oiler (which is high temperature and corrosion resistance) at heating furnace outlet. Two tracks check valve (which is high temperature resistance) installed, flowmeter control appropriate oil amount that in and out. Base on above devices, we can achieve efficiently, continually and safe production;

b) Batch working(Static intermittent working) is one-time inject the pretreated raw oil into the heating furnace before starting production.

## **(3) Distillation (tower) system**

Have below devices: atmospheric fractionating tower CT-101, tube condenser, cooling pool, oil-water separator, middle oil tank and so on.



Atmospheric fractionator tower suit for small-scale production, Inside of tower have 3 tray assembly for filling and catalyst. Reasonable layout can meet the demand of oil gas catalytic gasification, got good reaction. Gas reflux tank installed at tower top, liquid oil back to tower, gas flow to exhaust pipe network. Two outlets setted up at the tower side, can extract different fraction oil according height and temperature. Finally get diesel with different quality level .

Condenser adopt tubulation design, Nice condensation, and change quickly from gas to liquid. Both ends with flanges floating, easily open for cleaning and maintenance.

Oil-water separator take advantage of gravity separation method, separate oil and water by density difference and outlet height difference. Oil outflow from side outlet, water outflow from bottom outlet automatically. This system is core technology of the whole working, according to the requirements of oil refining technology and the characteristics of catalytic pyrolysis distillation, the device has reasonable design,simple structure, convenient operation, highly suitable for small-scale production.

#### **(4) Refining filter system**

With vertical screw rod type pressing filter tank, have flanges can be easily open for maintaince, two groups filter sieve plate assembly, layered filling, spiral lifting plate, composite material feeding and discharge door, oil in and outlet, special positive pressure oil pump, set flow control valve and relief pressure backflow pipeline. This system focus on oil refining processing, ensure oil quality, fix color and remove smell. Resonable design, small area cover, simple structure, convenient operation constitute the necessary step for getting standard output.

#### **(5) Vacuum system**

This system is composed of vacuum buffer tank, water sealing tank and vacuum pump. This system adopted negative pressure distillation with such advantage as: lower each fraction temperature;reduce energy consumption; More importantly, this process can improve the oil output and quality.

#### **(6) Non condensable gas recovery system**



This system focus on C1-C4 combustible noncondensable gas, which released by atmospheric fractionator and vacuum pumping system. Take advantage of special secondary desulfurization filter tank and combustible gas flame retardant tank, successful process the combustibles gas. Treated gas will be transported by waste gas pipeline to combustion chamber for burning. By above process, we not only save energy, ensure safety operation, but protect environment via emissions reduction.

### **(7) Smoke and dust removal system**

Below devices included :waste heat energy-saving processor, lye tank, spray tower desulfurization dust tower and draft fan etc...

Treat raw oil with heat exchange by waste heat, not only take full use of waste heat energy, but also relieve the pressure of gas flue. For sulfur dioxide, will be neutralization by spraying lye. Through tertiary filtration, smoke will be white before emission. Based on above system, our production is energy-saving emission reduction, and emission standard is eligible.

### **(8) Intelligent electric control system**

Digital display cabinet and field parameter collector included.

Advantage: All of the liquid level, temperature and pressure parameters can be displayed from display cabinet. Give an alarm when the temperature, pressure and liquid level is overtop, great for timely and rapidly handling. Semi-automatic working, not only greatly decrease potential risk and waste caused by human, but also improve product quality and qty.

### **(9) Technology during production**

New technology like Catalytic pyrolysis distillation, refining filter and blended production are adopted. Like self-make gaseous and liquid catalyst, various fillers, refined filtration composite material.

① 3 kind of liquid catalyst added in pretreatment tank and heating furnace, adjust index to reduce temperature of pyrolysis distillation.

② Gaseous catalyst and filler added in atmospheric fractionating tower and vacuum fractionating tower before run machine (adjust below index: flash point, sulfur content, cetane index, color, freezing point);



③ 3 kinds refined filtration composite material added in refining filter ( Maintain end oil color, improve smell and color, maintain oil color for 3-6 months).

Advantage: Improve oil antidetonating quality, vaporability, fluidity, stability, corrosion resistance to ensure oil of perfect quality.

**(10) Safe and reliable device**

this system have 5 safety safety precautions, equipped with automatic alarm system, temperature control and pressure control operating system; explosion-proof, lightning-protection, static grounding system, fireproof, fire extinguishing system, fire-water pond, recycling pool, fire hydrant and extinguishing steam system etc.. ensure production is safety and civilization.

**7. Quotation and Machine list :**

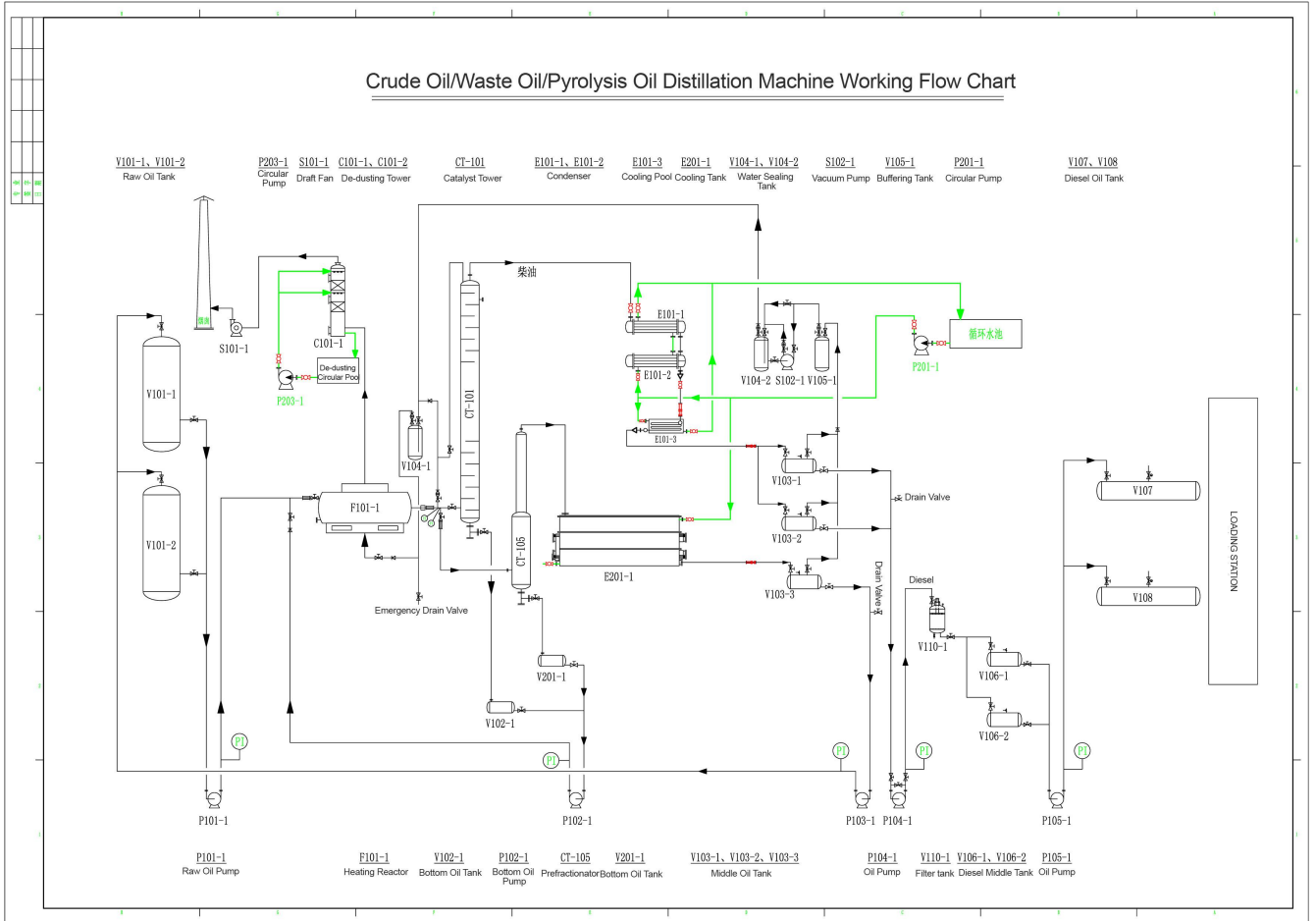
No.	Part number	Name	Unit	Amount	Note
1	V102-1-2	Pretreatment reactor	set	2	capacity is 11ton/set.
2	F101-1	Horizontal rotary heating furnace	set	1	Capacity 12tons
3	F102-1-2	Waste heat energy-saving processor	set	2	capacity is 5ton/set.
4	CT-101	Atmospheric fractionating tower CT-101	set	1	Working pressure: $\cong -0.05\text{Mpa}$
5	E102-1-3	Tubular condenser	set	3	Every condenser heat exchange area 24 m <sup>2</sup> $\cong -0.05\text{Mpa}$
6	E103-1-3	Cooling water pool	set	3	seamless steel tube $\phi 89 \times 6$ 20#
7	V106-1-2	Diesel oil-water separator	set	2	Working pressure: $\cong -0.05\text{Mpa}$
8	V110-1-2	refining filter system	set	2	
9	V103-1-2	light diesel middle oil tank	set	2	capacity is 7.5ton/set.
10	V103-1-2	diesel middle oil tank	set	2	capacity is 13ton/set.
11	V202-1-2	waste water treat tank	set	2	capacity is 16.5ton/set.
12	V103-1	Residue oil middle tank	set	1	capacity is 7.5ton/set.
13		big oil tank for storage end product	set	4	Not included
14		Fuel oil treat tank	set	1	Not included





15	V201-1	tower top reflux tank	set	1	
16	V104-1	Vacuum buffer tank	set	1	
17	V105-1	mashgas water seal tank	set	1	
18	V301-2	Combustible gas desulfurization purification treatment tank	set	1	
19	V301-1	Combustible gas back-fire relief valve	set	1	
20	C101-1	First step smoke and dust remove tower	set	1	
21	C101-2	Second step Capture adsorption desulfurization tower	set	1	
22	S102-1	Draft fan	set	1	Flow:16900-21100m <sup>3</sup> /h motro:Y160M-4
23		Cooling tower	set	1	
24		Air compressor	set	1	Exhaust capacity 2m <sup>3</sup> /min. pressure 0.8MPa
25		all pumps	set	12	
26		control equipment	set	1	
27		Electric control cabinet equipment	set	1	
28		Fire safety equipment	set	1	Not included
<b>FOB Lianyungang:</b>					<b>USD 73,000.00</b>

**8. Process flow diagram (in attachment)**



## 9. Material balance sheet

NO.	Material name	Unit	Amount (every year )	Input/output t	Note
<b>1</b>	<b>Feeding</b>	<b>ton</b>	<b>3000</b>	<b>100%</b>	
1.1	used engine oil	ton	3000	100%	
<b>2</b>	<b>Output</b>	<b>ton</b>	<b>3000</b>	<b>100%</b>	
2.1	Main product	ton	2550	85%	
2.2	Light diesel	ton	360	12%	
2.3	diesel	ton	2190	73%	
<b>3</b>	<b>By-product</b>	<b>ton</b>	<b>450</b>	<b>15%</b>	
3.1	Residue oil	ton	270	9%	
3.2	combustible gas	ton	90	3%	
3.3	other	ton	90	3%	Water and impurity 2% Loss 1%

## 10. Some technology parameters:

(1) raw oil: used engine oil.

capacity: 5-10T /24 H.

(2) cover area: 36m\*20m\*16m

(3) operator: 3 workers / group

(4) equipped with power: three-phase four-wire, 380V / 220V

(5) equipped with total power: 30 kw.

The power when working: 20-25 kw.

(6) working pressure: atmospheric , vacuum  $\cong 0.05\text{Mpa}$

(7) Fuel for heating: oil , natural gas, coal, firewood can be used.

## 11. End Production Diesel Quality and photos:

TEST REPORT				
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No.	Test items	Units	Test results	Methods standard
1	Density (15°C)	kg/m <sup>3</sup>	818	GB/T 1884-2000 GB/T 1885-1998
2	Sulfur content	mg/kg	280	SH/T 0689-2000
3	Flash point (closed)	°C	According to the standard operation, the sample flameout at room temperature 55°C	GB/T 261-2008 Step A
4	*Cold filter point	°C	-8	NB/SH/T 0248-2019
5	**Derivative Cetane number (DCN)	/	46.1	ASTM D7668-17
6	Kinematic viscosity (20°C)	mm <sup>2</sup> /s	3.126	GB/T 265-1988
7	Moisture (quality Score)	%	Trace moisture	GB/T 260-2016
8	Freezing point	°C	-23	GB/T 510-2018
9	Mechanical impurities (quality Score)	/	无	GB/T 511-2010

