



## Equipment for thermochemical destruction for recovery of hydrocarbon waste

- recovery of waste
- production of electricity from waste
- production of hydrogen from waste





## ABOUT COMPANY

### Innovations

The AURORA BOREALIS GROUP are innovative, scientific and technical companies in the development and production of modern industrial equipment for waste recovery and green energy production.

The manufactured mobile equipment for the recovery of hydrocarbon waste, the production of gases, liquid hydrocarbons, represents modern and effective solutions.

### Technologies

Equipment for the recovery of hydrocarbon waste, operates in a continuous, constant mode, has several standard sizes and capacities.

Our equipment:

- recovers different types of waste;
- produces recovered products from waste;
- produces synthetic liquid hydrocarbons from waste;
- produces synthetic hydrocarbon gas from waste;
- generates electrical energy from waste;
- produces hydrogen from waste.

Our Group conducts continuous research and development aimed at improving its equipment, including with the involvement of leading research centers.

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## USE OF TECHNOLOGY

TDP equipment can recover the following wastes:

### Electrotechnical

E-waste

*phones, electronic boards, tablets, monitors, televisions, computers, used printer cartridges and more*

### Battery

Solid state batteries

CDs, audio drives, floppy disks

Telephone cable, electrical cable

Medical waste

*syringes, dropper systems, gloves, shoe covers, masks*

Medicines

Hard paraffins

Waste from paint and varnish production

Coals, coal tar

### Plastic, polyethylene, film

Waste of industrial rubber goods

*car tires, rubber insulators, conveyor belts, other rubber products*

### Insulation materials

Expanded polystyrene, polystyrene

Acid tars, acid sludge, waste from oil refineries

Oil sludge

Drill cuttings

Rubber personal protective equipment, including for employees of nuclear power plants

*gas masks, overalls, boots, gloves*

Used oil

Oiled Scale at metallurgical plants

Water contaminated with oil and oil products

## Types of industrial waste that our equipment can recover

### Automotive industry

- solid state batteries for electric cars;
- car tires;
- paint and varnish waste;
- used oil;
- electrical wires, cables;
- interior;
- plastic.

### Aviation industry

- aviation tires;
- accumulators;
- used oil;
- interior;
- plastic.

### Sea and river ports

- used oil;
- water contaminated with oil and oil products;
- tar.

### Oil production, Oil refineries

- oil spills;
- oil sludge, acid sludge;
- bitumen, refinery waste;
- water contaminated with oil and oil products.

### Petrochemical industry

- polymers, plastic, polyethylene, film;
- polystyrene, expanded polystyrene, facade heaters, insulating materials;
- non-vulcanized rubber;
- cartridges from printers.

### Medicine

- syringes, dropper systems;
- gloves, shoe covers, boots, rubber personal protective equipment;
- expired drugs.

### Electronics industry

- accumulators;
- electrical waste;
- electronic boards;
- mobile phones, tablets, laptops;
- monitors, televisions, computers;
- printers, used cartridges;
- batteries.



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## After waste recovery

After the recovery of hydrocarbon waste, a product group is produced, which is:

### Recovered Liquid hydrocarbons

The chemical composition depends on the type of waste and is a mixture of liquid hydrocarbons from which can get:

- gasoline, diesel fuel, kerosene, ethers, solvents, benzenes and more.

Liquid hydrocarbons can be used for:

- refineries as a substitute for fossil fuels;
- petrochemical enterprises as a substitute for fossil raw materials;
- production of electrical energy.

### Recovered hydrocarbon gas

The composition of the gas depends on the type of waste and is a mixture of hydrocarbon gases such as hydrogen, methane, ethane and other gases..

Synthetic gas can be used for :

- production of hydrogen;
- production of other gases;
- electricity generation.

### Recovered carbon, Ash residue

The chemical composition depends on the type of waste and is:

- carbon;
- inorganic compounds, depending on the type of waste.

Can make from carbon:

- activated carbon;
- filters;
- recovered Carbon Black (rCB).



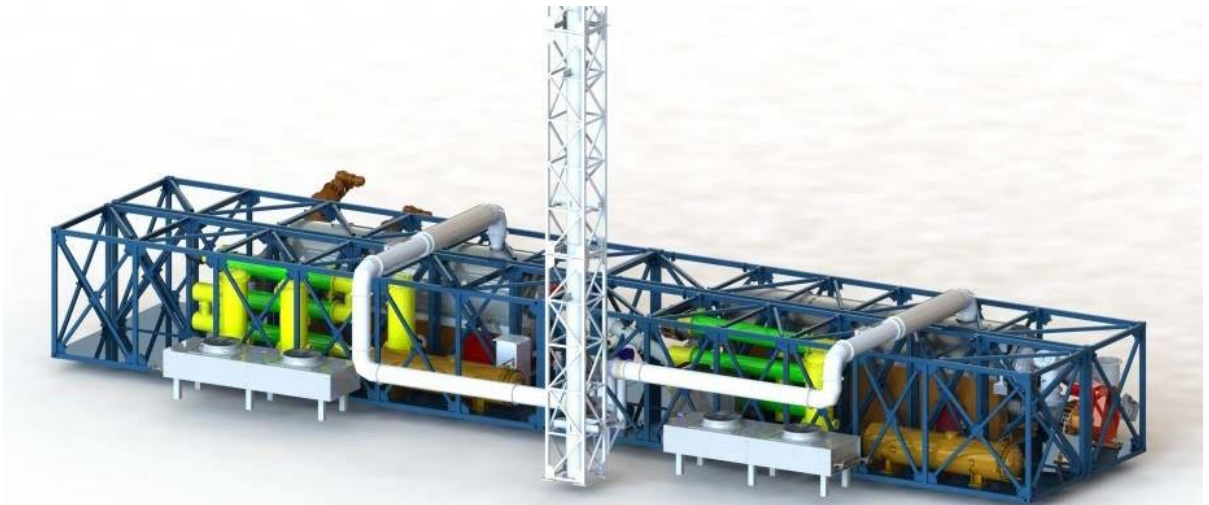
## Equipment for THERMOCHEMICAL DESTRUCTION of hydrocarbon waste

The equipment is modular and manufactured for the size of a 40 ft sea container. No foundation is required to place the equipment.

The unique feature of this equipment is :

- full autonomy and provision of its own energy resources;
- energy efficiency;
- low operating costs;
- long term of exploitation (30 years +);
- environmental friendliness;
- small dimensions;
- installation and launch speed, mobility;
- the possibility of recovering different types of waste;
- automation of the work process;
- 100% transfer of waste into commodity groups.

Type of equipment	TDP 200	TDP 500	TDP 800	TDP 2000	TDP 5000
<b>Productivity for processing raw materials - hydrocarbon waste, organic waste</b>					
kg/hour	200	500	800	up to 2000	up to 5000
tons/day (24 hours)	4,8	12	19	48	120
tons/month	144	360	570	1 440	3 600
tons/year	1 600	4 000	6 400	16 000	40 000



## How waste is recovered

Prepared waste is collected in a storage container. From the container, these prepared waste are fed by an automatic screw to a thermochemical reactor. In a thermochemical reactor, thermal decomposition / destruction of waste occurs without oxygen access.

The operating temperature of the process depends on the types of waste and the requirements for the resulting product, and can range from 360°C to 650°C. The thermochemical reactor is heated through the walls of this reactor. For heating, burners are used that operate on any gas, synthetic gas or liquid synthetic hydrocarbons that are formed after waste disposal.

The vapor-gas mixture from the thermochemical reactor enters the synthesis gas filter for condensation of the heavy fraction. The condensed heavy ends are automatically fed to the recovery reactor. After the synthesis gas filter, the vapor-gas mixture enters the heat exchanger. In the heat exchanger, the vapor-gas mixture is cooled by the coolant circulating in the system. The circulation and cooling of the coolant is carried out by a pump through an air cooler. To compensate for the change in the volume of the coolant during heating and cooling, an expansion tank is installed on the suction line of the pump.

The products from the heat exchanger enter the gas-liquid separator, where the liquid and gaseous fractions are separated. The liquid fraction enters the storage tank, the synthesis gas enters the gas drying column. After the gas drying column, the synthesis gas enters the hydraulic seal.

The cleaned gas enters the gas receiver for storage.

From this gas can get: hydrogen, electricity or use to heat a thermochemical reactor.

Liquid hydrocarbons from the storage tank are pumped to the fuel tank or to the finished product warehouse. In this case, the separation of water is carried out using a separator and a filter system. Liquid hydrocarbons can be used as fuel or to heat a thermochemical reactor.

The unloading of cooled recovered carbon or ash from the reactor is carried out continuously using an automated screw. In case of emergencies, to prevent air from entering the reactor, an automatic supply of nitrogen from the receiver of the nitrogen generator is provided.





## Recovery of hydrogen from syngas

Our Group of Companies is constantly working on the analysis of existing and new innovative methods for extracting hydrogen from different gases.

To extract and concentrate hydrogen from syngas, which is obtained from THERMOCHEMICAL DESTRUCTION equipment, the latest world achievements in gas separation membranes and ultrashort cycle technologies of adsorption.

Membrane gas separation plants make it possible to obtain enriched gas with a hydrogen content of 92 - 99%.

Adsorption hydrogen plants make it possible to additionally concentrate hydrogen after the membrane plant and bring it to a concentration with a hydrogen content of up to 99.9995%.

The gas separation membrane plant is fully automated and manufactured in a modular design. The service life of the membrane unit is 120-180 thousand hours.

The ultra-short-cycle hydrogen adsorption unit is manufactured in a modular design, which ensures easy installation.

The amount of hydrogen produced from the waste recovery process depends on the type of waste.

From 1 ton of waste it is possible to receive from 20 to 80 kg. hydrogen.

**Economic viability of various types of hydrogen production**

