Technology and Specifications of CPD-500 Plants

The CPD-Technology will change our future in a sustainable way

The **CPD***-Technology (**C**atalytic **P**ressure less **D**epolymerisation) provides the unique opportunity in combining prospective development of new added value with active environment protection. No other Technology is more appropriate, in the endeavor to optimize and decentralize waste management into energy self-sufficiency - A revolutionary way! The global economy as well as the environmental potentials of the CPD-Technology of Dr. Christian Koch stands for hope and commitment in politics and economy.

(*Original German Abbreviation: **KDV**: **K**atalytische **D**urcklose **V**erölung)

0. Preamble

A new technology with worldwide unrivalled potentials for energy politics, waste management and optimal environmental protection is going to market: The technology is the Catalytic Pressure less Depolymerisation (CPD-Technology). After decades of intensive catalyst research and development of the CPD-Reactor as well as the successful application of this technology in a proven system, the way is open now for the world-wide use of this technology.

With regard to the growing prices of crude oil, alternative recycling methods will take a leading position, particularly the technology of the Catalytic Pressure less Depolymerisation, which is developed as well as patented several times by Dr. Christian Koch. With this technology it is possible to convert organic material residues like waste plastics, waste oil and used wax as well as renewable primary products like rape, wood, plant residues, energy plants and organic waste from the food and meat industry in an economic manner into diesel fuel.

Unlike previous methods which burn the waste materials and produce CO_2 and poisonous substances like dioxin and furan, which then have to be filtered out with costly and high-technology arrangements, the CPD-Technology enables a nearly complete utilization of the raw materials into a high-quality and unproblematic storable energy source – diesel fuel.

The final product – diesel fuel – of the CPD-Technology has an outstanding quality and can be used without restrictions as diesel fuel for vehicles and all diesel engines.

For 35 years Dr. Koch has been acting in the research of fuel conversion. For that he had to witness how the developments of technologies with lowest energy efficiency were aided with a maximum of subsidies and promotion from politic as well as the energy-lobby. Thereby the hopelessness of the different technologies and therewith the wasting of billion euro of taxes can be documented easily.

In contrast to other Technologies, the CPD-Technology enables the copy of the crude oil synthesis in three minutes.
It is clean, commercial and absolutely ecological as we can see at the result – diesel fuel with highest quality.

The CPD-Technology shows us the future way of producing synthetic oil products (e.g. diesel fuel) from residues and primary raw materials in an unrivalled and ecological way.

Facts summarizing the CPD-Technology:

- The technological reproduction of the natural crude oil synthesis is accomplished within minutes
- Synthetic fuel can be produced at competitive prices
- The quality of CPD-Diesel corresponds the EN 590
- No environmental pollution. The technology binds inorganic harmful substances in salt induced by the ionic changing characteristics of the catalyst.
- Environmental protection becomes a source of energy and jobs.

Dr. Ch. Koch, inventor and patentee

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1. Technical Description of a CPD-Plant

The **CPD-500** is a plant for producing synthetic light fuel oil from hydrocarbon materials like waste oil, plastics, paper or biological residues and biomass. The plant works with a liquid closed loop with temperatures of under 400°C. The use of special catalytic effects (catalytic cracking) create the reduction of the long hydrocarbon molecules.

The main item of the plant is the **separator** for the catalytic conversion of the input materials to synthetic light fuel vapor as well as the **distillation column** in which this vapor condensates. The energy input for the thermal process production takes place in the reaction container with the **Alphakat reaction unit** with a total operating performance up to 450 KW for a CPD-500.

The material input happens either as solid product or about a liquid closed loop. The solid product input should feature low humidity content and also a small particle size and reach the system over an **input conveyor worm**. The liquid input happens over a combined tank and pump system. The **catalyst** and further input materials will be introduced over **automatic dosing systems**. For an optimized efficiency of the plant the exact specifications of the input materials should be known. The adequate **customer specific preparation technique** (maceration equipment) is not included in the scope of delivery of the CPD plant (as option).

The discharge of inorganic materials (which can not be converted into light fuel) as well as the used catalyst happens in a high concentrated form through a **sedimentation system** with a special **discharging screw** into a residue container.

The control and monitoring of the plant happens with sensors, transducers and actuating elements in an interaction with an **intelligent technology component.** The electricity part of the CPD plant is modularly integrated. For safety reasons there are mechanical and electrical control units and monitoring systems installed.

The construction and dimensioning of the CPD plants comply with the guidelines of Germany and the European Union. Also the installed **safety features and equipment** complies with the state-of-the-art in technology. Required certification will be arranged from the TIA (Technical Inspection Authority). For safety reasons the whole plant has to be installed in a catch basin which corresponds to the site-specific instructions and obligations. This is not included in the scope of delivery.

A block heat and power plant (Combined Heat & Power (CHP) module) is destined for producing the own electricity and thermal energy of the whole process. The block heat and power plant can run with own produced synthetic light fuel oil and is a component of the whole CPD. Because of safety reasons an electric input of 10 kW should be given.

Without the preparation process technical systems as well as the block heat and power plant the CPD-500 has a base area of 15 x 12 m and is around 11,5 m high. The **modular construction** allows an efficient and safe assembly. The interface element of this plant with the ground will be a base plate which has to be made by the customer according to the specifications of Alphakat.

2. Scope of Supply and Service

The CPD-Plant which will be installed by the supplier and the customer includes the following essential machine elements and specifications which have a decisive relevance for the product quality and the performance parameters.

1. Two material feeding systems with caloric circulation (heat out of power generator)

   Thereto counts:

   a. A storage container for the input material, which should have a size of < 3 mm, a humidity of < 12 per cent and should be free from inorganic substances. The storage container (4 m^3 for a CPD - 500) is used for taking over the input materials from the handling device of the customer.

   b. In each case a storage container (1m3 for a CPD-500) with charge equipment for catalyst and lime.

2. A vacuum chamber on the input system of the turbine
3. Two Alphakat – Special turbines with an adjustable rotation speed drive motor and an input power of 300 kW each for a CPD–500.
4. Evaporator and oil collector (separator)
5. Distillation column with oil circulation
6. Condenser with a cooling circuit
7. Automatic control of the plant
8. Two adjustable rotation speed vacuum pumps with two circulation systems
9. Adjustable discharge system with an after vaporization of rest oil
10. Two electric power generators of 230 kW each (CPD-500)
11. The diesel disposal takes place in a diesel tank. This tank is connected with the fuel depot of the customer. The water output takes place in a water tank. The retrieved light oil fraction will be fed back into the process.
12. The ash-remover removes the non-convertible inorganic components as well as the salts out of the system. The vaporized hydrocarbon out of the ash remover reaches over the distillation column a storage container and the catalyst is being recycled back into the plant after a wet separation.
13. The hydro finer is reducing the residual sulfur content of the Diesel as well as stabilizing the final product.

3. Schematic Configuration of a CPD – 500 Plant

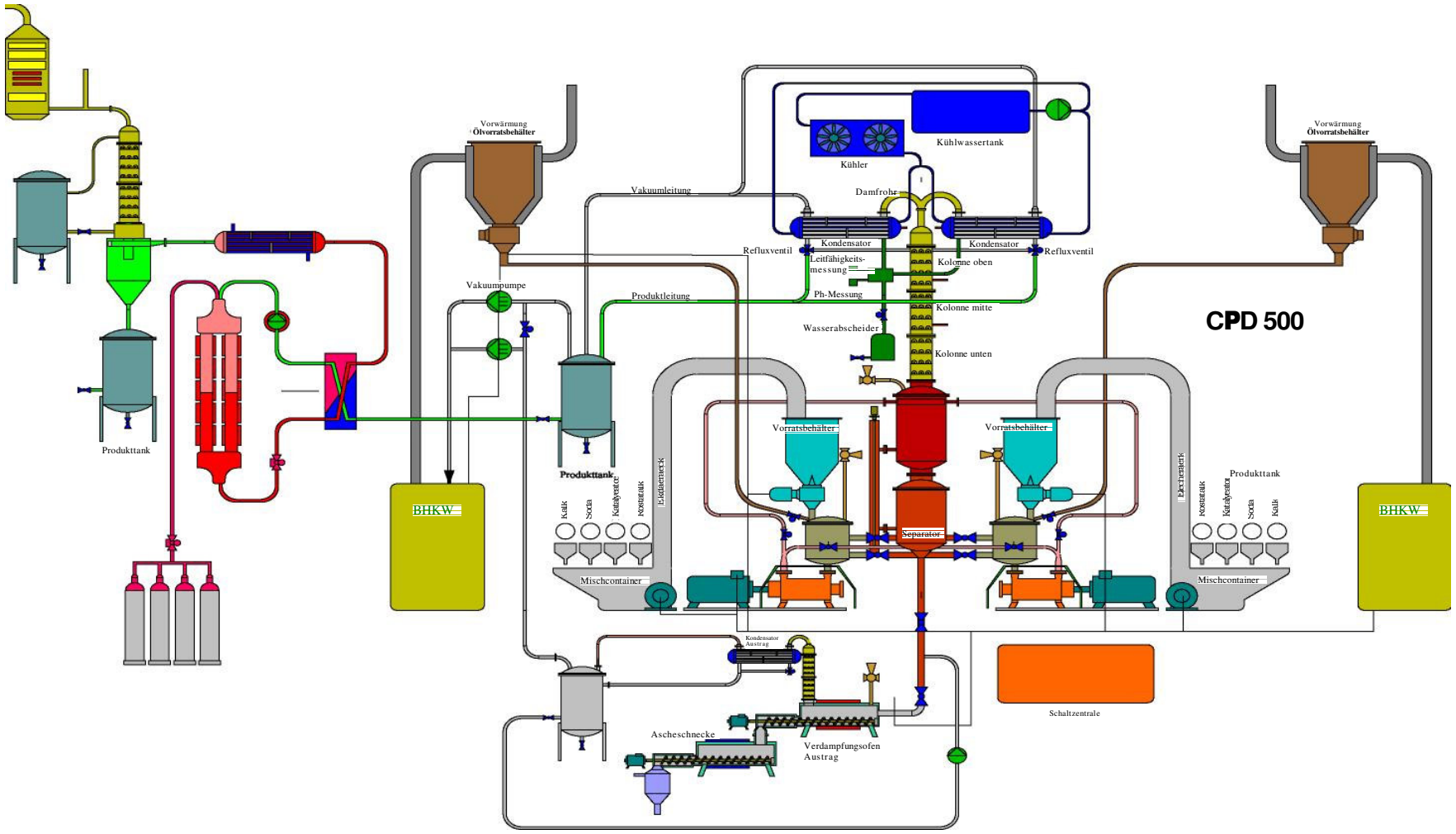


Figure 1 – Schematic Configuration of a CPD

4. Presentation of the System Technology Based on the Patents

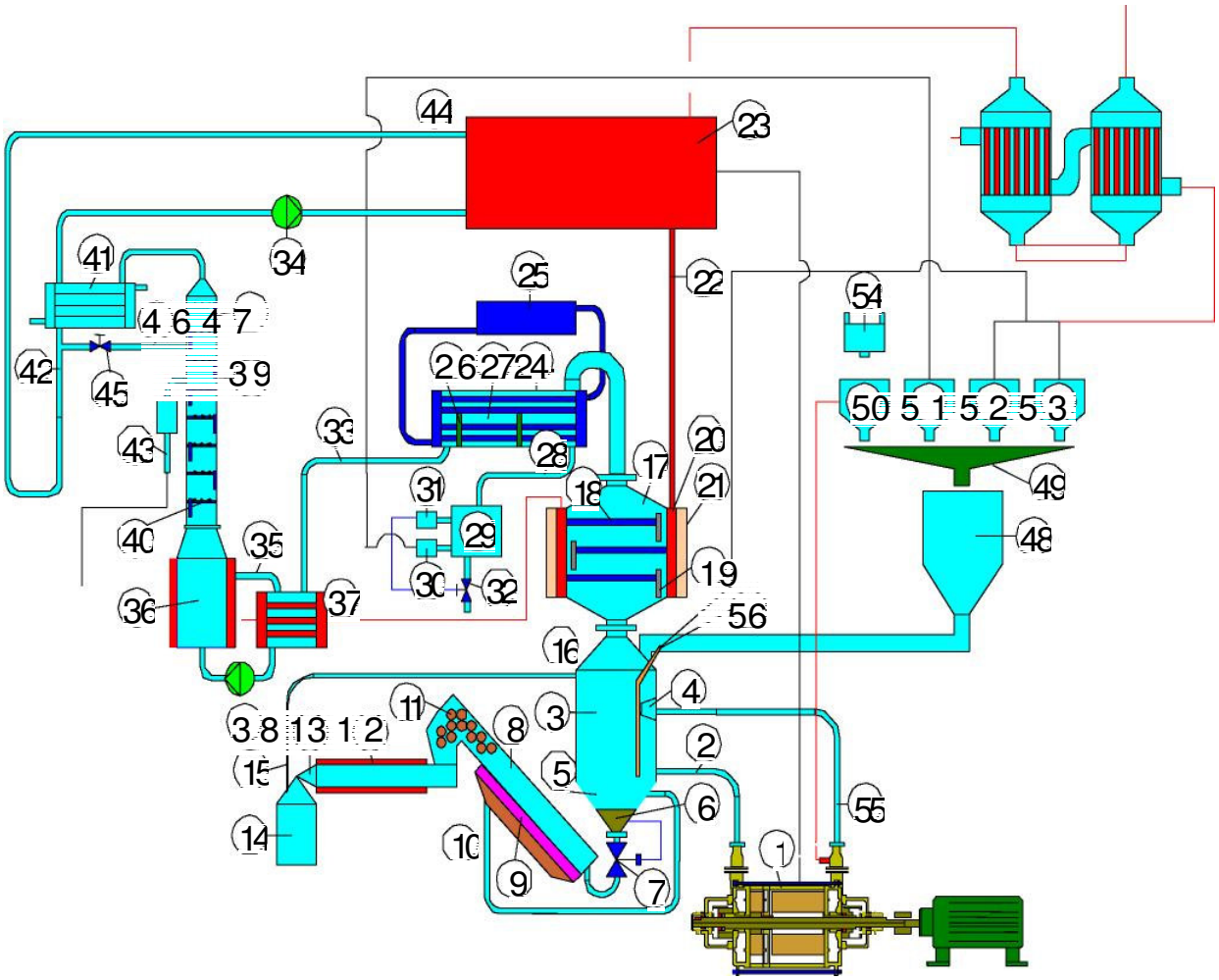


Figure 2 – Description of the Plant to be delivered with flow chart and CAD-diagram

The graph above shows the basic patent no. 10 2005 056 735 which is patented worldwide. The basic component of the plant is the turbine. The liquid turbine serves on one side as heating element and on the other side as reactor. The turbine is the baseline for the catalytic conversion at low reaction temperature and in this regard it allows a dirt free, continuous conversion of the input material into diesel without any byproducts like gases and coke.

The CPD Technology cannot be equated with the pyrolysis. Thanks to the low temperatures and the ion exchange system of the catalyst, there is no formation of poisonous substances like dioxins, furans, PCB's and metal vapors. Through the configuration of a vacuum chamber at the entrance of the turbine which can produce extreme under pressure it is possible to spare dedicated feeding systems for solid and liquid materials since the turbine can do it with the vacuum.

5. Functional Descriptions of the CPD-Plant

In the following the functional descriptions of a CPD-Plant is presented in a simplified representation.

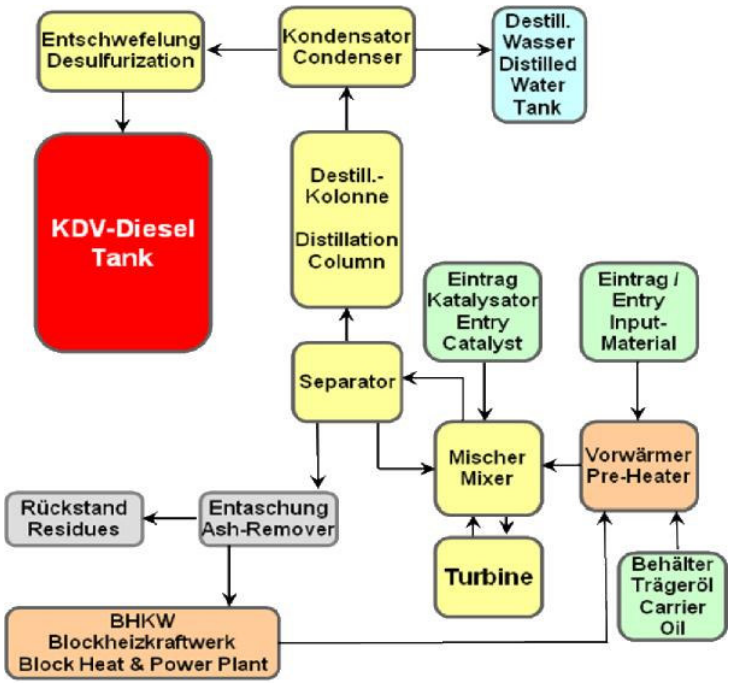


Figure 3 - Functional Description of the CPD-Plant

1. The input material is brought over an automatic dosing system into the pre-heater.
2. The brought in materials are heated up by the pre-heater at 300°Celsius and entered into the mixer.
3. The catalyst is entered directly into the mixer.
4. In the mixer the input material is mixed with the catalyst and the carrier oil.
5. The turbine in connection with the catalyst is the basis of the low catalytic transformation temperature and makes the continuous conversion of the entered input materials possible to a medium distillate without by-products, like combustible gases and coke. The carbon molecules of the input material are cracked under the effect of the catalyst in a fluid closed-loop system containing a 280 to 340°Celsius (depending upon input material) hot oil suspension.
6. The catalyst and the carrier oil remain in the process cycle. The separator induces the catalyst conversion of the input material into synthetic light oil steam.
7. The distillation column is an engineering equipment process for thermal material separation. The separation takes place over a multi-level distillation. As a final product the CPD-Diesel is obtained.
8. Light oil steam is condensed, caught by the condenser and arrived as CPD-Diesel over the desulphurization plant into the product tank.
9. The materials, which cannot be condensed into light oil steam, arrive in the ash-remover.

10. In the ash-remover pyrolysis oil is produced from the residues of the CPD-Plant over a catalytic pyrolysis process (no CPD-Diesel). This oil can be used as source of energy in the block heat and power plant. Surplus pyrolysis oil is pumped to the pre-heater for producing CPD-Diesel of it.

11. The removal of not convertible materials as well as the used up catalyst is made by the ash-remover in a highly concentrated form, over a lock system by means of a special screw conveyor.

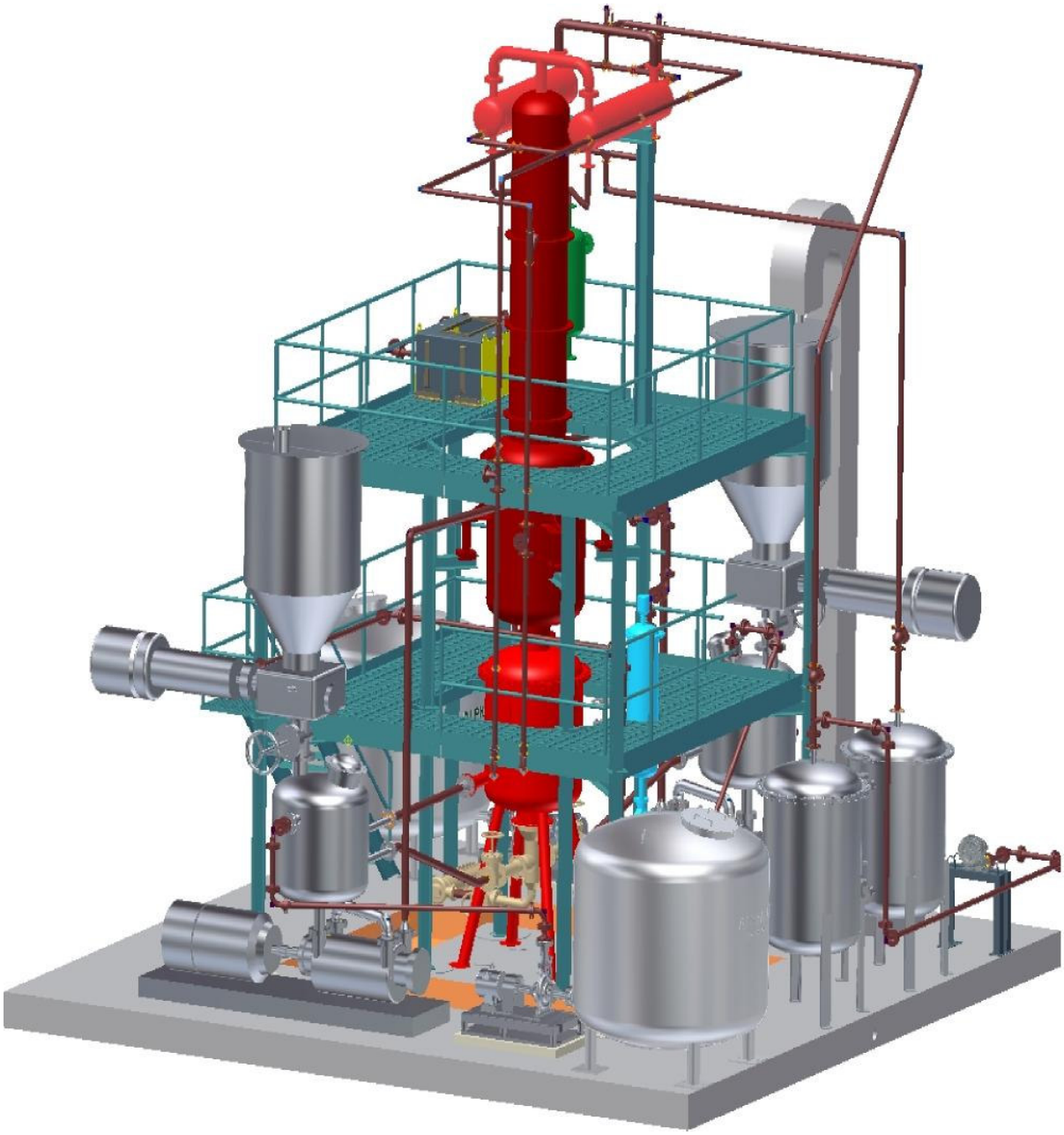


Figure 4 - CAD – diagram of a CPD Plant

6. Performance Parameter of a CPD – 500 Plant

1. **Ambient conditions**

- Temperature
  - Hall + 5°C to + 45°C
- Relative air humidity hall 20% to 95%
- Altitude until 1000 m above sea level

2. **Electricity**

- CPD-Plant
  - Feed-in 400 V, ± 10 %, 3 ph, 50 Hz ± 2 %

Additionally a 10 kW connection power for extern lighting as well as for the vacuum pump is needed.

3. **Input material**

- Solid
  - Material Residues with a minimum (< 1%) of inorganic material like stones, glass, metals, ceramics and porcelain
  - Quantity maximal 1500 kg/h (depending on input material)
  - Particle size < 3 mm
  - Humidity < 12 % (the higher the humidity of the input material the less is the quantity of diesel production)

- Liquid material
  - Material boiling range < 200°C
  - Quantity depending on input material

- Liquid material for starting up the plant
  - Quantity approx. 1,4 m³ carrier oil

4. **Final product** Synthetic diesel fuel according the EU- Norm 590, Performance: 500 liter/h (excl. 50 liter for own energy production of the plant)

5. **By-products which has to be disposed during process**

- Discharge material double quantity proportional to the amount of inorganic material (of input material)
- Condensate 1 Product condenser for water separation
- Condensate 2 Water from preparation of the input material

6. **Noise Level of the CPD-500** maximum 75 dB (A), the noise level in correspondent spaces will be achieved if necessary also with additional noise protection.

7. Molecule reduction (Depolymerisation) at low temperatures of 280°C – 350°C in addition of nearly depressurization (slight depressurization of 0,1 bar under-pressure).

8. Decontamination of dangerous halogens through their binding to salt in the fluid condition.

9. The efficiency of a CPD-Plant depends on the humidity and contaminant loads of the input materials. In doing so, the own energy consumption of the plant, and of the pre warming of the input materials is around 10 %.

10. Cadmium and other metals will be discharges in a controlled way with other inorganic residues. These metals could be extracted out of the residues with an additional electrolysis (see chapter options)

7. Customer Requirements

1. The CPD-Plant consists of an inside active part and a peripheral part. The basic dimensions of a CPD-500 are:

   - Length 10,0 m
   - Width 10,0 m
   - Height 11,5 m

2. Oil collecting tank for the whole plant as well as under the containers according to local regulations.
3. Fire protection requirements according to local regulations.
4. Fundament and bottom plate according to static requirements
5. Big Bag discharge construction for catalyst and neutralizer
6. Road access and safe distance according to local regulations
7. Noise protection requirements according to local regulations
8. Suitable access for data transmission, remote diagnosis
9. Supply and escape route according to local regulations

7.1. Layout – Suggestion of a CPD-500 Plant

The following graphic contents a suggestion of a layout of a CPD-500 with a corresponding storage, office and work and circulation area (road width for transportation: 6m). The total area is 1440 m².

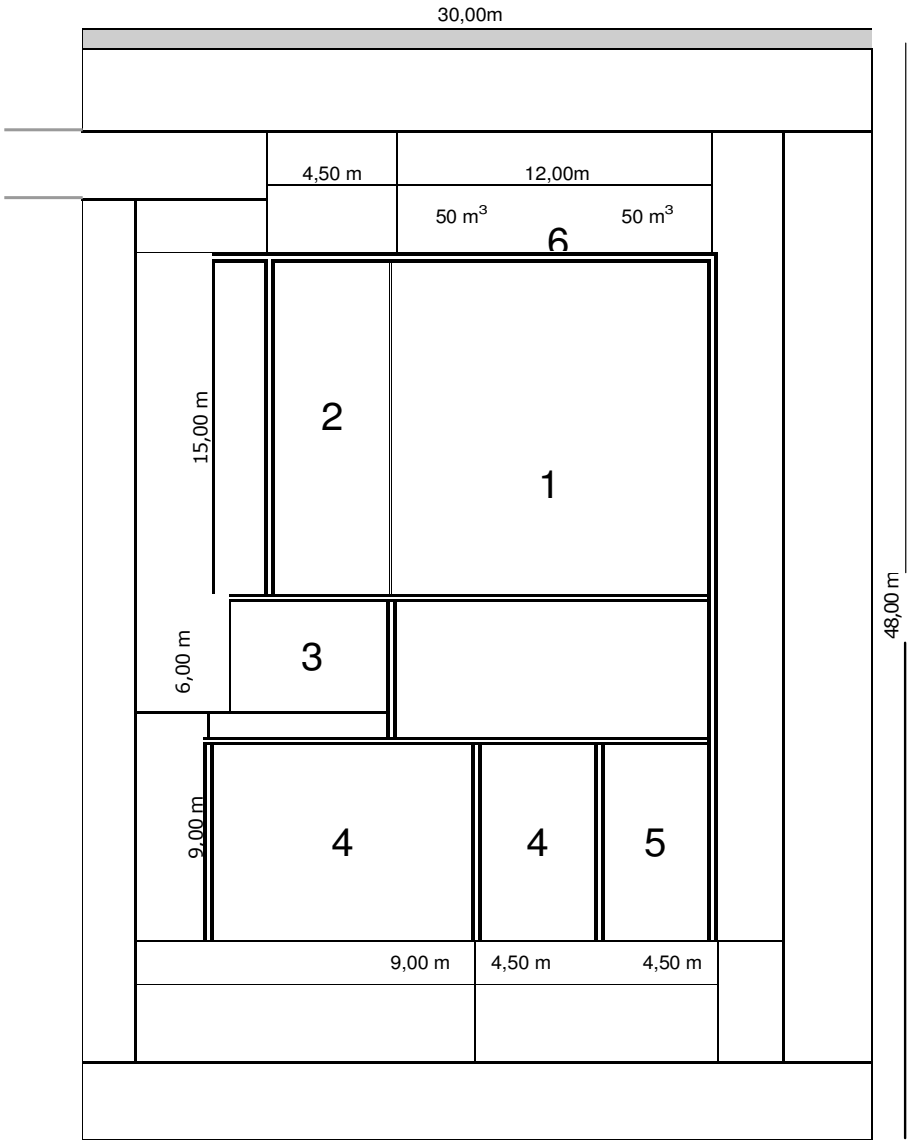


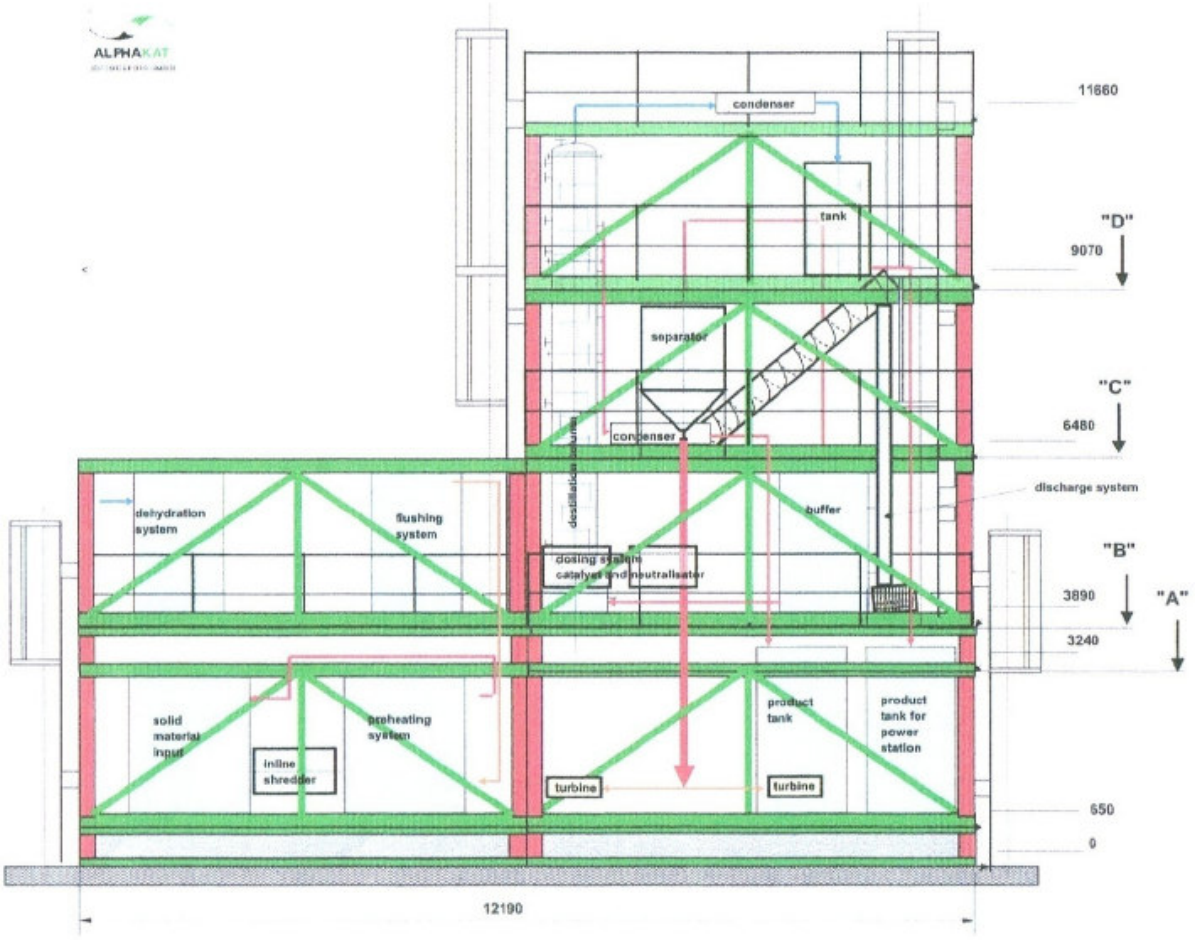
Figure 5 – Layout suggestion of a CPD-500

1. CPD-500 Plant: approx. 250 m²
2. Office, laboratory, common and changing room: 4,5 x 15 m = 67,5 m²
3. Parking space for residues: 36 m²
4. Store of input materials and catalyst: 9 x 13,5 x 5 m = 608 m³
5. Mobile supply dosing conveyor: ca. 162 m³
6. Fuel depot: approx. 100´000 Liter

The plant consists of an internal active component and a peripheral part.

Dimensions of the Core Components (the construction blueprints color shows the Dimensions of the Core Components):

- The base technology where the reactor component resides has dimensions of Length x Base = 1 2 x 6 m .
- The overall height of the plant is 9.5 m, which reflects the height of the distillation column with its condenser.
- For safety reasons, the entire plant stands in a safety tub, which catches liquids from any possible leakages.



8. Catalyst, Neutralization

1. For regeneration of the catalyst which has to be done when the input material is contaminated with chlorine and fluorine which is normal when PVC and PCB-oil is used, lime or soda has to be used for neutralization
2. The catalyst causes the reduction of the utilizable hydrocarbon molecules as well as a CO_2 extraction of oxygen content. The consumption of it is dependent upon the input material. Only the catalyst released by the plant manufacturer may be used.

9. Input Material

1. The input materials have to be delivered to the input system with a maximal particle size of 3 mm and a maximal humidity of 12 %.
2. During the start-up operation of the CPD-Plants, it can prove as necessary to change the mix of the input materials in order to get a higher efficiency of the CPD.
3. For prevention of an early revision of various components the input material must not contained inorganic materials like sand, metal, glass, ceramic residues, etc. A non observance of these requests results in a non-guarantee.
4. The operator is responsible to supply the required input material quantity in accordance with the nominal capacity of the CPD-Plant.

10. Options

The following plant-specific add-ons and supply of services are offered as options.

1. Heat recovery
2. Electrolysis for recovery of Cadmium and other metals which are discharged with the other inorganic residues.
3. Support for application and obtaining of permissions regulated by public law.
4. Service contract after end of guarantee time. (The exact conditions will be defined in a separate contract).
5. Maceration equipment
6. Ash-remover

11. Energy

A block heat and power plant with two generators (230 kW each) is powering the CPD-500 Plant. It is a component of the plant.

12. Service

1. The service during the first two years after final inspection is included.
2. Non wear and tear parts will be replaced for free during two years after final inspection.
3. A technical support package for the operating personnel during the first three months is also available.

13. Training Course

1. The training course usually takes place at the place of the plant manufacturer.
2. The number of participants is restricted to six persons.
3. Training course duration: as required (experience: 10 working days)
4. The training course is held in English or German.
5. Every participant gets a training certificate after successful completion of the course. This is the authorization for operating the plant independently.
6. Documentation and instruction handbooks will be given to the participants during the course.

15. Operation System

1. Only the personnel, who got a training certificate is allowed to operate a CPD-Plant.
2. Particularly during the period of guarantee the keeping of records with following daily records is obligatory:
   technical
   troubles with exact information, action taken, daily operation in hours, plant manager, etc.

16. Required Permissions and Authorizations

The creation of the necessary conditions on the customer location for the actual operating of the plant lies in the responsibility of the customer, inclusive the required permissions and authorizations therefore.

To the preparation of the plant setup belongs the adjustment with the legal norms (environmental protection, emission protection, waste management law, tax law, employment protection, building laws, etc.) on the authoritative place.

17. Attachments

General business conditions and terms of delivery for machines and plants	DO 000 101
Final acceptance protocols	DO 000 160A

18. CPD-500 Plant

19. CPD-500 (Mexico)

ALPHAKAT KDV 500 in Mexico (already operating continuously)

No other process technology offers more appealing possibilities to combine the development of future increase in value with highly efficient environmental protection. And no other system is similarly suited to lead the way of future optimization and decentralization of waste management and our striving towards an increasingly autonomous energy policy. The commercial as well as environmental potentials of Dr. Christian Koch's KDV technology are promising and, at the same time, also demanding responsible decisions of politicians and industrial agents.

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