

Pyrolysis: ENVIRONMENTAL AND TECHNOLOGICAL ISSUES

Dmitriy Yankov, Lev Bederov, Konstantin Ladygin, Semyon Stompel, Safe Technologies Inc.

Transition from incineration to pyrolysis is increasingly clear at waste thermal treatment, since the pyrolysis can reduce the accumulated waste amount from the process as get commercial grade products. Besides pyrolysis technology has generally much less environmental impact than incineration one. The only downside is that the range of waste that possibly cost-effective for pyrolysis process is limited.

These and other aspects of the use of pyrolysis plants (Thermal Decomposition Plants) for the disposal of waste were discussed at workshop in February this year in St. Petersburg, Russia. The complete operation cycle of Thermal Decomposition Plant was demonstrated to get acquainted the visitors with the principles and technological features of pyrolysis equipment on the first day of the workshop. The equipment is intended for the processing of hydrocarbon materials: from waste loading to unloading of the final product. Drilling muds and oil sludge were used as raw materials, the conditioning products such as liquid fuel oil and biochar can be obtained from which. The participants were asked to take samples of products obtained for laboratory tests.

The second day was almost entirely devoted to answering the questions of participants. We believe that these answers might be interested for specialists of oil production and refining companies that were unable to attend the seminar.

- What types of waste can be treated in the pyrolysis plant? What is the composition of this waste?

- List of the main raw materials (waste) allowed

for processing is the following:

- ▶ industrial rubber goods, used tyres
- ▶ oil sludge, drilling waste and waste of similar composition, including solid phase (mechanical impurities - soil, sand, and ext.) and liquid phase (oil, water)
- ▶ oil sludge, drilling waste and waste of similar composition in the form of an emulsion comprising liquid phases - oil and water
- ▶ drilling waste (cuttings, muds) and waste of similar composition, including solid phase (mechanical impurities - soil, sand, and ext.) and liquid phase (water)
- ▶ treatment plants residues (left after biological wastewater treatment).

Features of processing of each type of waste are taken into account in specific modifications of the plants.

- What are the environmental effects of operating plants of this type? What is the main source of emissions?

- The Plant is the source of the chemical and physical impact on atmospheric air. The main source of emissions is flue stack. Other sources of emissions are the 'breathing' of tanks with oil products, service vehicles, and dusting during reagents steaming. The sources of noise are certain types of technological equipment as

part of the plant: burners, exhauster, compressor, air coolers, refrigerated dryer, nitrogen generator, pumps, fans.

The plant affects the air in the allowable amount, which was confirmed by calculated and experimental methods mentioned in technical documentation.

The main type of wastewater that may be formed during operation of the plant is the condensate from the raw material with a high moisture content. The solutions for dealing with this type of wastewater are developed depending on the specific conditions of the infrastructure. The main waste type is dry mineral residue from the processing of raw materials. It is used for the production of biochar, which according to the applicable arrangement can be used for road construction and reclamation. Other types of waste are the used alkaline solution from the hydroseal, solid waste, packages of reagents.

- What is the composition of the principal emissions?

- The emissions exhausted from the flue stack are formed in the chamber as a result of combustion at the burner. They are the conventional flue gases. Emissions are not dependent on the feedstock composition (as there is no contact of raw material with the flame, no burning of waste) and consequently, are not contaminated by the oxidation products compared to emissions from waste incinerators.

- Is the biochar obtained after the processing?

- The residue of thermal destruction is classified as waste only if it can't be used in green application, there is no possibility of realization of it as commercial grade product.

The intended purpose of the plant is to provide a conditional (suitable for further use) products in the processing of raw materials (including waste production and consumption). The composition and the ratio of processed products is determined by the initial composition and type of the feed raw material,

and the products range listed in technical documentation of the system.

Usage of products of thermal decomposition, including the dry residue is carried out in accordance with requirements in each particular case:

- ▶ preliminary tests are conducted for experimental studies of samples of raw materials and the resulting product
- ▶ regulated by product type indicators;
- ▶ developed and coordinated in the established procedure the technical specifications to the type of product, technological regulations on manufacturing products. This documentation shall be approved by the future manufacturer of products (equipment buyer);
- ▶ sanitary-epidemiological expertise of products, voluntary certification of specifications compliance and other procedures.

- Is it possible to operate the pyrolysis plant at low temperatures (for example, at minus 50 °C)?

- At extremely low temperatures, it is recommended to install pyrolysis equipment indoors, in the hangar. If the customer is unable to mount the indoor premises, it is possible to design equipment in accordance with the technical requirements.

- Who carries out the maintenance of Thermal Decomposition Plant? Should it be specially trained people?

- Maintenance can be done either by trained personnel, or by representatives of the service company, or they may be representatives of the supplier of the equipment.

- Should the reactor be cleaned?

- There is no need. At batch scale systems, the dry residue is discharged into the receiving container from the tray. At continuous systems, the discharging occurs automatically. The automatic control system eliminates the premature termination of the process; in this regard, dry residue does not stick to the walls of pyrolysis reactor and the screw conveyor. Oil

industry waste treatment by means of pyrolysis is by far the best. Refineries and oil companies actively show interest in the Thermal Decomposition Plants and similar pyrolysis furnaces, so that the three main reasons can be called:

- ▶ perspective of complete elimination of sludge pits and transition to pitless production technology
- ▶ cost effective solution due to fuel on which the plant operates, the fuel is produced in the process of thermal decomposition of oily wastes
- ▶ minimal impact on the environment due to technological peculiarities, namely: the process is completely isolated from the external environment. Automation reduces the risk of emergency situations by the human factor. 🙌