Part 2

WATER PROTECTION FROM DISCHARGES

2.3. Treatment of industrial and surface waste water from power companies

2.3.1. Technologies of treating industrial and surface waste waters from power companies

2.3.1.6. Waste water polishing at activated coal

Ksenofontov B.S., MSTU of Bauman

The term “polishing” refers to methods and processes supplementing common treatment of water of a given composition. Due to wide spread of bio-chemical treatment (BCT) of general waste water flow mechanical treatment is considered to be a primary treatment, biological-secondary, polishing tertiary. There at polishing yields achievement of any required and achievable degree of pollution removal or destruction. Sorption at activated coals allows additional extraction from water after BCT of more than 80 % of remained impurities.

Polishing of bio-chemically treated waste water at activated coals, i.e. combination of BCT and sorption has found considerably wider application compared to treatment of raw (initial) waste water at activated coals. The above is caused by the following:

- Presence of BCT;
- Need for removal of maximum pollution from waste water prior to its clearing at activated coals by means of the cheapest method and BCT is one of the cheapest methods of water treating;
- low sorption ability of hydrophylic organic compounds in absorbers with activated coals in comparison with a biochemical method that leads to necessity to increase absorber sizes;
- the unified composition of a bio-chemically treated waste water, therefore results of investigation obtained at one object can be wider applied at another object compared to raw waste water.

Skip of non-sorbing pollution after waste water polishing is less possible. Organic pollution remains in waste water even after well performed BCT. Its residual concentration is not less than 50 mg/dm^3 (on chemical oxygen consumption — COC). Here should be noted that steady operation of closed water supply systems is possible, if supplied with water with concentration <10 mg/dm^3. It is almost an unreachable level for BCT and sorption polishing of returned wastes is required. Organic substances remaining in waste water after long-term biochemical clearing are referred to conservative and in considerable extent to biologically unoxidizable.

Organic impurities in water after BCT are mostly products of active silt (biofilm) vital activities. After treatment of industrial waste water products of incomplete oxidation of conservative substances and actually unoxidizable impurities remain, but it is a specificity of industrial drains. Urban waste waters after BCT differ inconsiderably.

In order to lower loading on sorbent deep preliminary clarification of water is required prior to waste water sorption polishing, the same as for waste water treatment.

Deep clarification of water improves sorption kinetics, considerably extends activated coal service life, simplifying its subsequent regeneration. Decrease in concentration of coarsely dispersed impurities before sorption up to approximately 10 mg/l is considered reasonable. Macroporous (quartz) fast filters are applied for clarification of biochemically cleared waste water prior to sorption in overwhelming majority of cases.

Manufacture of any sorbent, even from wastes, —is a special technological process, where profitability sharply decreases at decrease of a plant production. On local treatment facilities where 1 … 10 tons of sorbent are used in a year, its regeneration is inexpedient. Natural carbon sorbents: peat, brown coal and charred coal may be also used. Sorption capacity of these materials is 3 … 10 times lower than of industrial activated coals, however their low cost and possibility of further utilization as a fuel allow their wide application both for preliminary clearing, and waste water sorption.

Peat is successfully applied for removal of synthetic surface active substances (SSAS) from water and charred coal and brown coal — for phenol removal from waste water of charred-coal-chemical factories. Various grades of brown and hard coals serve for decolouring of waste water of textile and colorific enterprises.

Extraction of organic and inorganic pollutants by means of natural carbon materials (charred coal, coal) is in many respects determined not only by physical, but chemical sorption — interaction of a sorbate with functional groups, in a significant amount being on sorbents surface. For example, extraction of cationic floatation agents occurs due to chemical interaction of substance amino groups with acid components of peat.

Physical and chemical and mechanical properties of activated coals do not always meet the up-to-date technologic requirements — they are insufficiently strong, ineffective at extraction of polar and dissociate molecules, and their regeneration is possible under observance of rigid requirements, therefore intensive work on creation of synthetic sorbent free form lacks of activated coals is carried out.