REFERENCE 2012-12

TREATMENT OF MINERAL OIL DRAINING WATER TANK STORAGE

Waste water weakly laden with fuel and heating oil residues had been purified for some sixteen years in accordance with the strict regulations of the German environmental authorities, and conducted directly into a river.

An activation system installed previously had been taken out of service due to excessive energy and personnel costs, and replaced by the better suited biofilm process.

The waste water derives from roof surfaces, the floors of tanks, pumping stations, the tank area drainage system, and the flushing out of suction wagons used within the plant. In addition to this, the domestic waste water from the workforce, some 20 residential units, and rainwater from about two hectares of area used for transport traffic purposes was also included in the treatment. This results in a heavy dependency of the waste water situation on regeneration events. When the rainwater comes in contact with the products from the tank storage system, a partial extraction takes place in the boundary region of soluble hydrocarbons, and therefore to an organic loading which cannot be separated by mechanical means. In some cases this can reach concentrations of up to 20,000 mg/l COD.

Making use of the structures already in operation by the operator, the entire purification system consists of an inlet area with two parallel basins and devices for oil separation. The waste water is first buffered in a storm basin, and conducted to the biology section, metered in accordance with the loading, the biology section consisting of two fixed bed reactors: Reactor 1 exhibits a basin volume of 44.9 m^3, divided into two cascades, and Reactor 2 has a basin volume of 37.4 m^3, divided into 12 cascades. The entire fixed bed volume, at 76 m^3, has a specific surface of 100 and 150 m^2/m^3. According to the pilot studies, the reactor was dimensioned for a COD surface loading of around 8.0 [g COD/m^2*d], and during the investigation period was loaded with an average of some 6.6 [g COD /m^2*d]. With regard to the fixed bed loading, it therefore lay approximately in the range which is usual for communal waste water.

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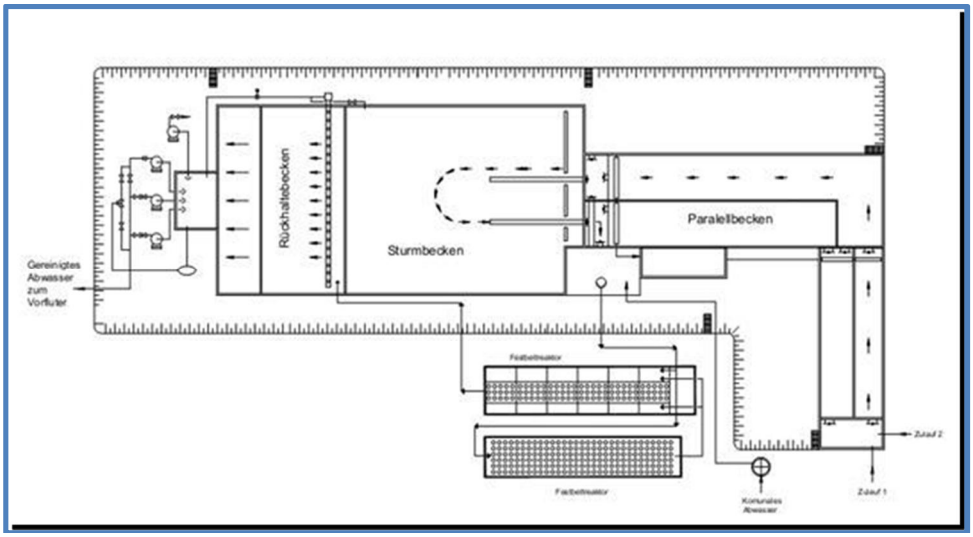


The influent of the fixed bed reactors amounts to a maximum of 20 m³ of water per hour, which after successful biological purification is first stored in a retention basin and, after analytical inspection and approval, is conducted into a body of flowing water.

In the event of highly concentrated loading peaks, the clarified waste water is run through the circuit via the retention basin and the reactor for as long as necessary until the value falls below the required monitoring value.

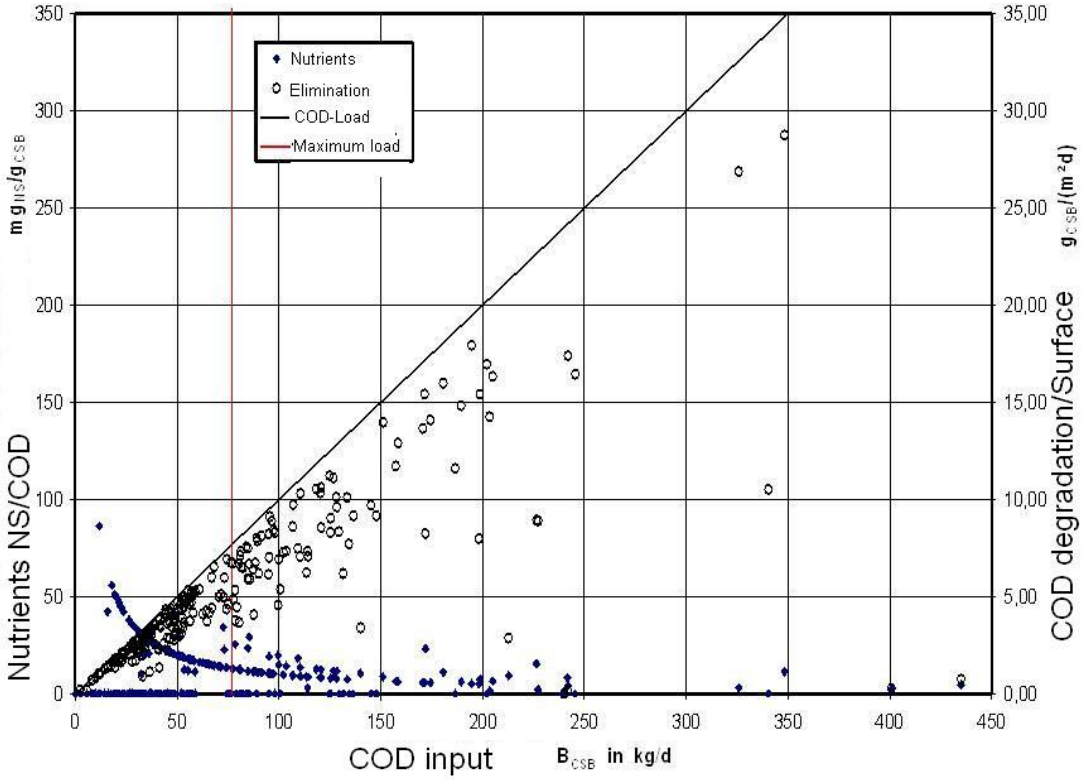
The analyses include, in accordance with the requirements for official approval, the monitoring parameters of COD, BSB_5, pH, phenols, Ammonium-N and total Phosphorous from the homogenised 24-hour mixed sample.

	CONTROL VALUE	EFLUENT VALUES
COD [mg/l	120	91
BOD_5 [mg/l]	25	7
pH		7,2
Phenol [mg/l]	0,15	0,1
NH_4-N [mg/l]	10	0,8
Total P [mg/l]	2	0,5

Table 1: Limiting values of the permission, given by the German authorities and average effluent values of quarterly maintenance analysis

With biological waste water, the ratio of carbon to nitrogen approximates 12:1 and Carbon to Phosphorous some 30:1, in order to allow an adequate call growth for the bacteria. With industrial waste water, as in the present case too, there was a shortfall in the stoichiometric ratio to the carbon of the elements nitrogen and phosphorous. The addition of mineral salts has the effect of improving the decomposition. With this system too, in the first year of operation a solution of ammonium phosphate was added, in order to accelerate the microbial settlement. After this period, the addition was constantly reduced without any negative effects, and finally terminated altogether, since the

growth rate of the specialised bacteria is low and the fixed bed was fully settled. Regular checks of the biofilm show a relatively thin growth of reddish-brown colour, permeated by Thecamoeba. For a time, snails (*Limnea stagnalis*) were observed, but these were easy to eliminate by the administration of common salt or potassium permanganate.



In the present case, because of the low COD load, a space decomposition capacity of less than 1.0 kg COD/m³*d is achieved. In the literature, with waste water from the petrochemical industry with higher concentrations, substantially greater space decomposition capacities of 4.32 to 6 kg COD/m³*d have been achieved with SFBBR. This allows for the presumption that there is still a large capacity reserve in the reactor, and that with a system of the same size it would be possible for even substantially more contaminated water to be purified.

In comparison with the previously used activated sludge process, the fixed bed system incurs only 10% of the former operating costs. The present energy requirement is about 0.38 €/m³ of waste water.

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