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CASE HISTORY

Arabian Industrial Fibers Company Ltd, Saudi Arabia

End User Arabian Industrial Fibers Company Ltd
Process Anaerobic Digestion and Aerobic Treatment
Application Industrial Effluent Treatment

Introduction

ACWA was awarded the contract for the design, supply and installation of the mechanical and electrical equipment for a two-stage biological treatment plant, including commissioning, based on a process route specification by Bechtel.

Arabian Industrial Fibers Company Ltd is an integrated chemical complex producing PET materials at Yanbu, Saudi Arabia. The major wastewater sources to be treated included sources from the Ibn Rushd PTA facility and the Aromatics Project. The treatment plant is a two-stage biological treatment plant – anaerobic treatment followed by aerobic treatment, consisting of duty/duty process units with 100% capacity through a single process unit. The treated wastewater from the plant is to a standard suitable for discharge to sewer.

Design Information

The following table indicates the Influent and effluent quality to the first anaerobic treatment stage, and the influent and effluent quality to the second aerobic treatment stage.

Description	Influent to Anaerobic Treatment (Ave)	Treated Effluent from Anaerobic Treatment (Ave)	Effluent to Aerobic Treatment (Ave)	Treated Effluent from Aerobic Treatment (Ave)
Flow m^3/day	3680	3680	4200*	4200
BOD mg/l			690	100
BOD kg/day			2904	420
COD mg/l	4883	1135		
COD kg/day	16896	4224		
Suspended Solids mg/l	100	300		300
Cobalt mg/l	30	2.0		2.0
Manganese mg/l	60	2.0		2.0
pH	6 - 8	7 – 8		7 – 8
Temperature °C	40 - 50	+/- 1		35 – 40

*Flow to aerobic treatment includes streams that are not treated within the anaerobic system

Description

Wastewater from the Aromatic Process and contaminated storm waters are passed through a CPI separator prior to entry to the raw effluent balance tank. Wastewater from the PTA processing facility is sent directly to a raw effluent balance tank. From the balance tank the combined effluent gravitates to the precipitation tank where pH adjustment using sodium hydroxide to pH 8.5 promotes the precipitation of cobalt and manganese as hydroxide salts. The precipitated effluent gravitates to the flocculation tank where an anionic polyelectrolyte is dosed to flocculate the hydroxide precipitates and suspended solids. The effluent gravitates to a primary settlement tank. Clarified effluent overflows a peripheral weir to the pH correction tank. Settled solids are removed from the tank periodically and transferred to the sludge stabilization tank.

Prior to anaerobic digestion the pH of the effluent is corrected to 7.0 using carbon dioxide gas. The pH corrected effluent is pumped to two anaerobic reactors operating in parallel, via a cold water heat exchange system; the heat exchange system reduces the effluent temperature from 40 – 50°C to 35°C. A nutrient solution is also added to the feed effluent to anaerobic treatment. The anaerobic reactors are hybrid reactors consisting of a lower biomass bed, middle random packed media bed for gas, liquid, solid separation and an upper gas separation zone. The incoming effluent enters the reactor through an inlet distribution system via a series of valves and flows upwards through the sludge blanket where carbonaceous treatment occurs. The biogas produced is either reused within the main processing facility or sent to flare stack for safe disposal. Excess sludge is periodically removed from the reactor and transferred to the anaerobic sludge storage tank.

The treated effluent from the anaerobic reactors gravitates to an anoxic tank where it is mixed with return activated sludge and nutrient solution. The mixed liquors are pumped from the anoxic tank to the aerobic treatment stage via a cold water heat exchanger to reduce the temperature to 25°C. The aerobic treatment stage consists of two aeration tanks each fitted with a fine bubble diffused air system. Air is supplied to each aeration tank by one fixed speed air blower and one variable speed blower which; is controlled by a residual oxygen monitor.

The mixed liquors from the aeration tanks gravitate to two final settlement tanks. Clarified effluent overflows a peripheral weir and gravitates to a buffer tank before being pumped to two treated effluent storage tanks for effluent re-use or direct to discharge. The settled biomass from the settlement tanks is removed as sludge and either returned to the anoxic tank as return activated sludge (RAS) or sent to sludge storage as surplus activated sludge (SAS).

The anaerobic waste sludge is stored as suitable seed sludge in a dedicated storage tank. The primary sludge and SAS are stored in a sludge stabilisation tank equipped with a mixer and diffused aeration system to provide air for stabilisation. The stabilised sludge is pumped first to a belt thickener then to a belt press. Polyelectrolyte is added to assist the dewatering process. The sludge liquors are returned to the balance tank for processing. The sludge cake is collected and taken for off-site disposal.