Headworks® INTERNATIONAL

CASE STUDY: Bahrain Textile Effluent Treatment Plant

Headworks BIO's Experts Discover Root of Problem at Failing Textile Effluent Treatment Plant

Customer: Orta Anolou

Background

The textile industry in Bahrain dates to ancient times. In the time of Alexander the Great, the country was as known as a producer of clothes seen throughout Arabia and the Indian subcontinent. Modern day Bahrain maintains its strong tradition in textile manufacture.

One of the major producers of textiles is Orta Anolou. Founded in 1953, Orta Anadolou transformed from a spinning and weaving company into a denim manufacturer in 1985. Today, it produces over 60 million meters of denim in its Turkey and Bahrain factories. Renown as one of the major innovative leaders in jeans and sportswear, Orta Anadolu exports its denim fabric to global manufacturers and internationally recognized brands. In Bahrain, Orta Anadolu has three production units – a denim manufacturing unit located in Sitra Industrial Area, a spinning yarn manufacturing unit in Asker Industrial Area and a weaving unit in Salman Industrial City.

In a denim plant, dyeing, sizing and other finishing operations are carried out on the yarns and woven fabric. Conventional cotton production demands high levels of water which coupled with the production methods themselves results in using over 3,700 liters of water to create a single pair of jeans [http://levistrauss.com/sustainability/planet/]. The effluents discharged from sizing and dyeing units are highly polluted as compared to those of all other wet processing plants and cause substantial impact on the environment if not properly treated. Treatment of textile wastewater has always been particularly challenging due to its extreme variation in color content with each color created by different chemical combinations, dye residues, high pH, solids and COD fractions. Orta Anadolu works to minimize the environmental impact of its operations through regular monitoring and observance of regulatory compliance requirements, plus constant development and investment in more environmentally friendly new technologies.

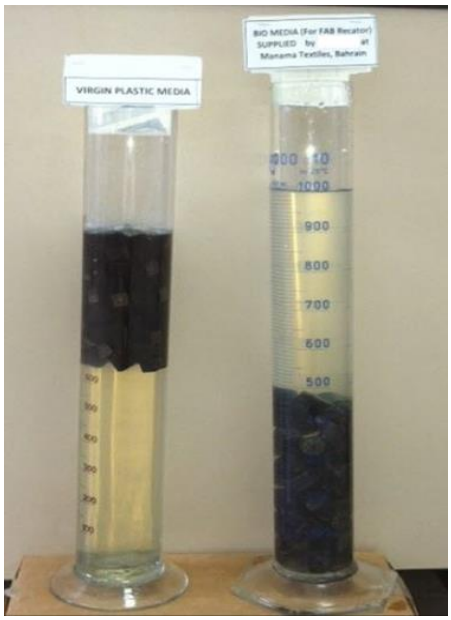
Equalization tank with pH correction and color removal

Challenge

With its commitment to the environment, in 2010 the company purchased a complete wastewater treatment plant from a wastewater equipment supplier with a capacity of 480 m^3/d, comprised of a three-stage MBBR (Moving Bed Biofilm Reactor), an attached growth process which uses bio carriers for the growth of biofilm to treat wastewater generated during the manufacturing process. Within 18 months of operation, however, Orta Anadolu began to experience problems with poor plant performance in terms of BOD/COD (biochemical oxygen demand and chemical oxygen demand) removal across the three-stage MBBR reactors. Unable to determine the cause, the company turned to experts at Headworks Bio Inc. ("HW Bio") to carry out a study of the existing system.

Solution

Not unusual in a textile plant, Influent COD levels in the wastewater reach as high as 3,000 mg/l and BOD of 1,200 mg/l. HW Bio carried out extensive trials at site including analyzing plant performance at different operating set points and testing for biofilm growth on the carriers. What was immediately noticeable was clogging of the plastic carriers which resulted in poor mixing and their sinking in the MBBR reactor tanks. This prevented any reasonable growth of biofilm needed for removal of COD/BOD from the wastewater. Upon further examination it was concluded that the reason for the clogging was due to the low quality of the plastic carriers themselves as demonstrated by their inability to mix well with aeration. This is typically seen with carriers made from recycled plastic. Recycled plastic can be a disaster for an MBBR treatment system as the exact buoyancy of the plastic is critical for the success of the process.



Recycled plastic media vs High density Virgin polyethylene plastic

HW Bio was awarded the contract to correct the problems on site as well as to provide an increase in the treatment capacity of the existing plant to 800 m^3/d. The expansion portion of the project was complicated by the fact that there was no land available for additional construction, so HW Bio was limited to using the existing reactors at the site to achieve the improvements and added capacity.

One of the key challenges at the plant was to reuse the existing infrastructure while providing a compact solution to retrofit the existing treatment plant. As the plant could not be shut down, an easy to implement retrofit solution was necessary. The existing three-stage MBBR tanks were retrofitted with HW Bio's proprietary Active Cell 920 media, offering over 680 m^2/m^3 of protected surface area. Along with the process design, HW Bio provided a maintenance free integrated diffused aeration system and retention sieves to hold the plastic carriers in their respective tanks. Upstream of the MBBR process, pretreatment is provided by adjusting the pH and using strong coagulant chemistry to break any emulsions caused by cleaning agents and dyes and to precipitate solids.

Active Cell 920 media loading into reactor

"We always recognized the benefit of MBBR technology, with its flexible design that allows for increased capacity in the future and ability to handle strong loads; however, we now also realize the importance of choosing the right carriers with the correct properties to ensure a trouble free working plant. It has been four years since the upgrade with Active cell 920 media, and there are no problems with media sinking or clogging. We now have a trouble free plant which consistently meets our COD effluent limit < 100 mg/l. We learnt it the hard way, but we know now it's more than just plastic!"

- Rajan Sirivastav

Plant Manager at Orta Anadolu, Bahrain

MBBR reactor in operation

System Overview

By ultimately selecting a design that incorporated the plant's existing tankage, rather than starting from the ground up with an all-new system, Orta Anadolu was able to significantly reduce capital costs for the upgrade and expansion. A great advantage of MBBR technology is that it can be installed in existing tanks. In this case, Orta Anadolu's existing reactor tank was determined to be structurally and operationally sound and adequate for the conversion.

What is MBBR technology? It is a treatment process based on bacterial biofilm principles where the bacteria consumes the contaminates to be removed. The process uses free-floating plastic media to provide additional surface on which to grow the biofilm and protection of the bacteria. The carriers are retained in a reactor tank using media retention screens while an aeration system provides the needed oxygen for growth by blowing air into the tanks to allow the bacterial biofilm to provide the treatment required.

Active Cell 920 media with biofilm growth

The HW Bio MBBR System is comprised of one or more reactor tanks based on the contaminants to be removed, HW Bio Active Cell media, retention sieves to drain the treated water and keep the media in the tank, air blowers and a coarse bubble aeration grid consisting of stainless steel laterals and diffusers. This type of wastewater treatment technology operates as a fixed-film process without activated sludge. It is a self-contained, self-regulating biological treatment system that does not require a significant amount of operator attention such as media backwashing and frequent chemical analysis. Aeration is supplied to the tank to provide the necessary oxygen for microbial growth and sufficient agitation to fully disperse the plastic carriers throughout the tank. The agitation also serves to control the biofilm thickness on the plastic media. As the biomass becomes too thick and heavy to hold onto the media, it is sloughed off when the cubes carriers come into contact in the agitated water. The dead biomass is then suspended in the liquid and drained from the reactor with the treated water to be captured in the clarifier downstream of the MBBR system.