MICROBE-LIFT® Technology Helps Pharmaceutical Plant in Saudi Arabia Avoid Shutdown

Location: **Al-Hayat Pharmaceutical Manufacturing Company, Jeddah, Saudi Arabia**

Background: Al-Hayat Pharmaceutical is an old manufacturing facility that was built in 1972. This company produces the following range of products:

(1) Antibiotics: (syrup & tablet) including Ciprofloxacin (broad-spectrum) Clindamycin (gram-positive) Ampicillin (broad spectrum)
(2) Anti-diarrheal product (syrup) a product that contains "Neomycin", a broad spectrum anti-biotic
(3) Dextrose and Saline solutions.

When the plant was constructed in 1972, there was no plan for a wastewater treatment plant. All industrial wastewater was piped out into the city-draining network directly. Almost 30 years later, new regulations required that the wastewater be pre-treated on site before it is allowed to go through the city drainage system. At that point, it was decided to construct a 500 m^3 collection tank, which allows 4.1 days of retention time. The hope was to allow for some of the residuals of antibiotics to precipitate in the bottom of the tank, and cleaner effluent could then be piped to the city drainage system but the system proved unsatisfactory.

On January 10, 2006, a final closure warning letter from the local authorities was received by the top management of Al-Hayat Pharmaceutical stating "Treat your water within the next 60 days or you will be shut down". Two days later, after considering options, the plant maintenance manager, engineer Khalid Al-Hanbali called Nahhas World Business Center for assistance. Nahhas is a distributor for Ecological Laboratories Inc's MICROBE-LIFT® wastewater treatment technology.

Objective: This plant was given effluent parameters that they must meet to avoid plant shut down. Nahhas agreed to work with Al-Hayat Pharmaceutical to attempt to meet those parameters. Initial Actions Taken:

1. Two samples from influent and effluent were collected and sent to the lab for analysis for COD, BOD, TSS, NO_3, and PO_4. Results are listed below.

Parameter	Influent	Effluent
COD	45,600 mg/Lt	46,811 mg/Lt
BOD	28,412 mg/Lt	28,315 mg/Lt
TSS	13,490 mg/Lt	8,920 mg/Lt
N-T	0.9 mg/Lt	0.9 mg/Lt
PO_4	62.5 mg/Lt	62.5 mg/Lt

***Fig**.1: Initial results show very poor treatment.*

2. Another sample from influent was taken to Nahhas' in-house lab to determine if the waste will support bacterial growth and what DO level is required. The initial sample showed no bacterial growth. As DO was added to achieve 10 mg/l a bacterial count of 3 million/ml was achieved which was adequate for a start. It was determined that there were insufficient nutrients in the wastewater so nutrients, mainly urea nitrogen, also had to be added.

3. A plan was devised to divide the 500 m^3 collection tank into a four-stage treatment facility to include the following: a 50 m^3 collection tank, followed by a 50 m^3 primary clarifier, to a 350 m^3 aeration tank, and a 50m^3 secondary clarifier. The daily flow was known to be 120 m^3/day.
4. Discussions with local authorities resulted in the extension of their warning period from 60 to 120 days.

The following treatment plan was developed:

Aerators were installed on both the collection and aeration tank resulting in a DO Level of 10 mg/L in both tanks.

A dosage schedule for applying MICROBE-LIFT®/IND (ML/IND) was devised as follows:

Day1: Apply 2 gallons ML/IND to the collection tank and 9 gallons ML/IND to the aeration tank. Add 40 kg of urea to the aeration tank and 10 kg of urea to the collection tank.

Days 2, 3, 4, 5 & 6 (daily): Apply 0.5 gallon ML/IND to the collection tank and 2.25 gallons ML/IND to the aeration tank. Add 5 kg urea to the collection tank and 20 kg of urea to the aeration tank.

Every 3 days X 10 times: Apply 1 gallon of ML/IND to the collection tank and 5 gallons of ML/IND to the aeration tank. Add 10 kg urea in the collection tank and 40 kg to the aeration tank.

Maintenance Treatment Plan (weekly):

Apply 1 gallon ML/IND to the collection tank and 3 gallons ML/IND to the collection tank. Add 10 kg urea in the collection tank and 40 kg urea in the aeration tank.

Results Achieved:

Effluent parameters were monitored throughout the treatment program with the goal of meeting the following effluent limits:

COD	1500 mg/l
BOD	500 mg/l
TSS	50 mg/l
Ammonia	5 mg/l (added later)

Significant improvement was seen in the first 30 days of treatment.

Parameter	Starting Effluent	30 days after ML	60 days	90 days	120 days
COD	46,811	31015	15,321	2,701	1200
BOD	28,315	11,326	3,237	1001	480
TSS	8,920	3,121	1007	452	117
Ammonia	---	720	412	201	70

Fig.2: *Results of effluent monitoring shows substantial reductions in all parameters.*

The parameter targets to be achieved were:

The program was successful in achieving the COD and BOD targets in 120 days. Although TSS was still in violation, the plant was allowed to continue and an average of 50 mg/l TSS was achieved in the next 60 days without any extra intervention.

Ammonia was not part of the initial defined parameters. But since it presented as a potential concern during the treatment process, it was added as an additional goal. The ammonia reached a plateau and did not continue to drop. It was decided to reduce urea input and adjust the aeration system to allow a short period of time for denitrification. The aeration system now injects air at 10 mg/l for 120 minutes and stops for 40 minutes, during which time denitrification kicks in. Nitrification in the aerobic phase converts ammonia to nitrate, which is then converted to nitrogen gas during denitrification. Nitrogen gas is returned to the atmosphere eliminating it from the system. Utilizing this process, the ammonia concentration was contained at 5-10 mg/l.

Based on bioaugmentation with MICROBE-LIFT® and the associated system modifications recommended by **Ecological Laboratories, Inc** technical team, this plant avoided shutdown.

For more information on MICROBE-LIFT® Technology contact
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