PLANT DESIGN INCLUDING PROCESS DESCRIPTION, OPERATION & MAINTENANCE GUIDELINE WITH LAB ANALYSIS RECORD

FOR

EFFLUENT TREATMENT PLANT

(Capacity = 40 M^3/Hr)

COMMISSIONED AT

CROWN MILL (BD) LIMITED.

BY
HKF ENGINEERING & TRADING

ETP OF CROWN MILL (BD) LTD.

1. Basis of the Plant Design

1.1 Source

The raw effluent shall be discharge to the proposed effluent treatment plant from the dyeing and finishing section of the Crown Mills Limited, Chittagong Export processing Zone.

1.2 Quantity

The quantity of effluent to be treated shall be of the order of = 960 m3 / day.

1.3 Capacity of the Effluent Treatment Plant (ETP).

The effluent treatment plant has been designed on the basis of the following

- Contaminated effluent is 50%
- Less Contaminated effluent is 50%
- Operated continuously for 18 hours a day.
- Flow rate of treatment envisaged is 40 m^3 / hr.

1.4 Inlet Effluent Characteristics

Sl. No.	Water quality parameters	Unit	**Values**
1	pH	……..	8 –14
2	BOD	mg/L	1,000 - 1,500
3	COD	mg/L	2500 - 3,500
4	TSS	mg/L	100 - 400
5	TDS	mg/L	2,000 - 3,000
6	Temperature	^{0}C	60^0 C

1.5 Outlet Effluent Characteristics-Bangladesh Standard

Sl. No.	Water quality parameters	Unit	Standard value for discharging into *	
			Inland river	On land for irrigation
1	PH	----	6-9	6-9
2	BOD	mg/L	<50.0	< 100
3	COD	mg/L	<200.0	< 400
4	TSS	mg/L	<150.0	<200
5	TDS	mg/L	<2100	< 2,100
6	Oil & Grease	mg/L	< 10	< 10
7	Color	Co-pt unit	<150	<150
8	Temperature	^{0}C	<30^{0}C	< 30 ^{0}C

*****The below table shows the detail discharges at various stages of processing, however the overall discharges of a Towel Dye house are as follows;**

Fibre	Dyes Class	Type of pollution
Cotton	Direct Dyes	1. Oxidizable material
Cotton	Reactive Dyes	2. Unfixed dyes 40% 3. Oxidizable material 4. Less BOD

SL.NO	**Processing Unit**	**Possible pollutants in the waste water**	**Waste water volume**	**Nature of waste Water**
01	Sizing	Starch, PVA, CMC, fats, oils etc	Small	Highly biodegradable, High BOD & COD
05	Dyeing	Various dyes, salts, alkalies, Acids, Na_2S, $Na_2S_2O_2$ and soap etc.	Large	Strongly colored, fairly BOD (6 % of the total)
06	Finishing	Different finishing agent,	Very small	Low BOD

Steps of Treatment:

5.1. PRE-TREATMENT

5.1.1 Screening - ***to remove coarse materials***

5.1.2 Equalization – ***To remove some BOD & COD, Oxidation is continued 24 hours.***

5.2. PRIMARY TREATMENT

5.2.1 Coagulation - ***to coagulate the suspended solid to coagulate***

5.2.2 Flocculation - ***to flocculate by coagulants***

5.2.3 Neutralization - ***to adjust the pH between 6.5 to 7.5***

5.2.4 Sedimentation – ***to precipitate small suspended solids***

All the above processes contribute to removal of substantial amount of all the polluting parameters.

5. 3. SECONDARY TREATMENT

Biological treatment (MBBR) - to remove BOD and COD & to decompose organic matter.

5. 4. TERTIARY AND OTHER TREATMENTS

5.4.1 **Granular Media Filtration-**to removes TSS and any other pollutants in the form of particle. This filter is also useful to protect the Activated Carbon Filter (ACF) from overloading by pollutants such as particulates, organics.

5.4.1 **Activated Carbon Filter-** Carbon adsorption is a proven process in tertiary treatment for the processing biologically treated wastewaters, and is one of the many processes used in the advanced treatment of wastewaters. The ACF is used to remove relatively small quantities of refractory organics, as well as inorganic such as sulfides and heavy metals remaining in an otherwise well-treated wastewater.

5. 5. SLUDGE MANAGEMENT & DISPOSAL

5.5.1 **Sludge disposal –** to separate the sludge from the thick slurry and then dispose of the sludge as dried cake.

2. Treatment Philosophy

2.1. PRE-TREATMENT

2.1 Screening - to remove coarse materials
2.2 Equalization & Skimming - to remove grease & oil and homogenize and to remove some BOD & COD.

2.2.1 PRIMARY TREATMENT

2.2.1 Coagulation - to coagulate the suspended solid to coagulate

2.2.2 Flocculation - to flocculate by coagulants

2.2.3 Neutralization - to adjust the pH between 6.5 to 8.5

2.2.4 Sedimentation – to precipitate small suspended solids

All the above processes contribute to removal of substantial amount of all the polluting parameters.

3. 3 SECONDARY TREATMENT

Activated Sludge Process (ASP) - to remove BOD and COD & to decompose organic matter.

3. 4. TERTIARY AND OTHER TREATMENTS

3.4.1 **Activated Carbon Filter**- Carbon adsorption is a proven process in tertiary treatment for the processing biologically treated wastewaters, and is one of the many processes used in the advanced treatment of wastewaters. The ACF is used to remove relatively small quantities of refractory organics, as well as inorganic such as sulfides and heavy metals remaining in an otherwise well-treated wastewater.

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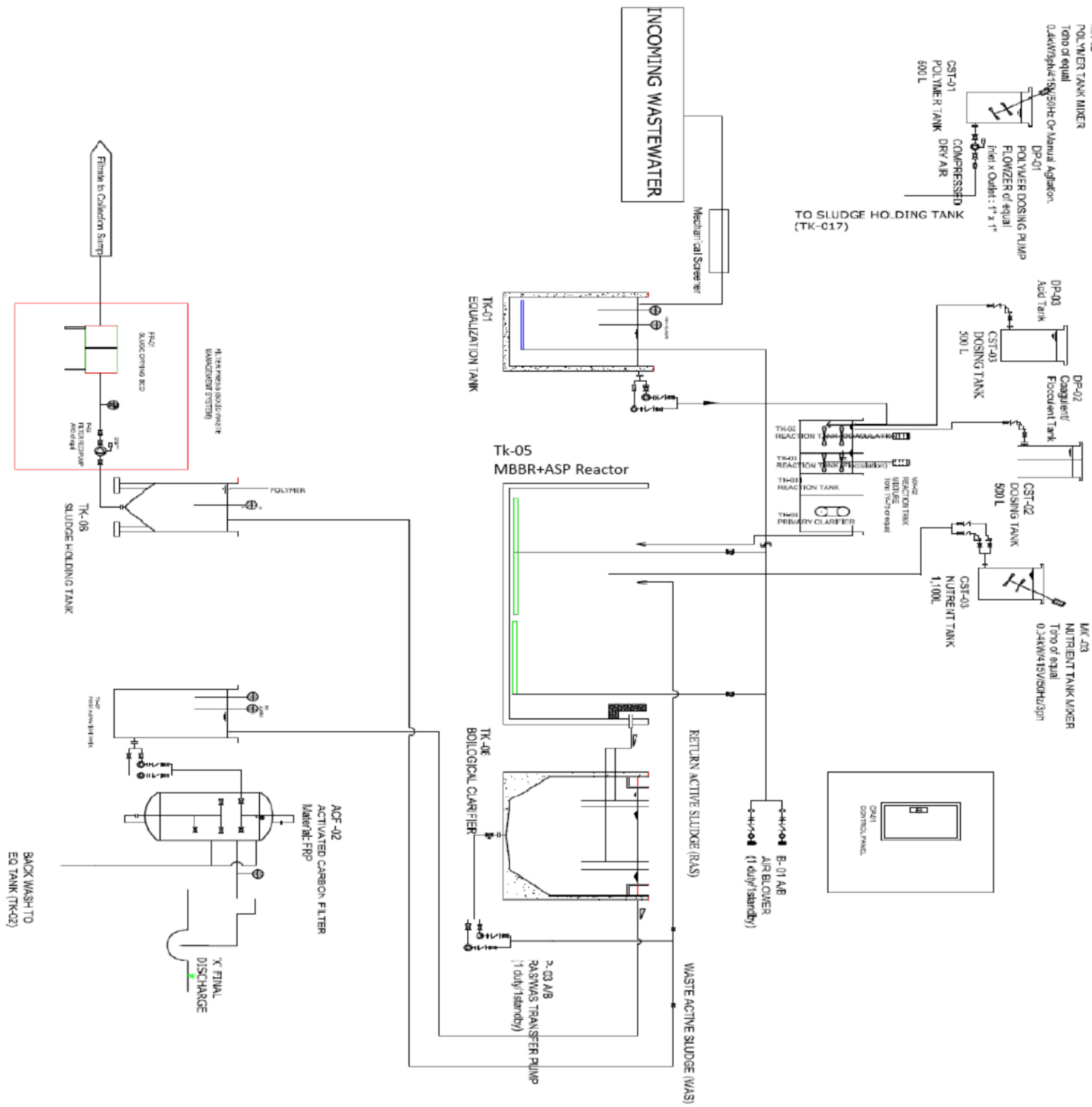
4. PROCESS FLOW CHART



5. Operational Processes

5.1. Pre-Treatment

The effluent generated in a textile wet processing plant can be broadly classified into two classes e.g i) Less contaminated and ii) highly contaminated. The Less contaminated waters are mainly generated due to machine washing, floor cleaning, waters coming from the last washing cycles etc. These less contaminated waters pose very little threat to the environment; therefore they can be discharged directly to the environment or may require little treatment. If however these waters are mixed with the main effluent, then the volume of total effluent will be very high and as a result overall install capacity running cost of the ETP will be very high. Therefore the less contaminated waters are stored in a separate tank and from time to time the effluent is pumped to the sand filter followed by carbon filter and finally to the discharge outlet. The more contaminated waters are guided through the bar screen to the equalization tank for various treatments.

5.1.1 Screening (To remove course and float materials.)

The raw waste water (Raw Effluent) from the process of the plant would first be screened through a manual bar screen strainer channel, where all particles with dia.> 5 MM as well as small pieces of the fiber and floating suspended matters like polythene paper, polythene bags, rags and others materials are removed by bar screen net. The bar screen consists of parallel rods or bars and is also called a bar rack. These devices are used to protect downstream equipment such as pumps, lines, valves etc. from damage and clogging by rags and other large objects. The bar screen is cleaned manually by means of rakes. The screening is disposed off suitably after they are de-watered. The screened clean effluent flows by gravity to an equalization tank.

5.1.2 Equalization and Skimming (To remove grease & oil and homogenize):

TANK	DIMENSION	CAPACITY
Equalization Tank	37 X 20 X 15 ft^3.	314.317 m^3

The equalization tank is designed for hydraulic retention time of around 7***.8 hours.***

The raw wastewater from the screen channel is collected in the equalization tank, where it is equalized with respect to its characteristics, homogeneity, flow and an uniform pollution load as well as to make bacteria acclimatized. High-speed aerating devices are fixed at the bottom of the equalization tank. The rising air tends to coagulate the grease and oils and cause them to rise to the surface where they can be removed by a scraper mechanism. Besides, the airflow accomplishes a proper equalization of both varying loading and fluctuating PH values. As the temperature of the effluent is higher than the atmospheric temperature it is necessary to be reduced to meet the temperature demand of the bacterial action as well as the environment.

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Certain amount of COD will also be removed by the dissolved air flotation process. The following benefits are derived from the flow equalization process;

1. Biological treatment is enhanced, as the shock loadings are eliminated or minimized, inhibiting substances diluted, and pH stabilized.
2. Chemical treatment is improved if chemical dosing is controlled to provide consistent performance

3. The effluent quality and thickening performance of secondary sedimentation units are improved through constant solids loading.

4. Effluent surface area requirements are reduced, filter performance is better, and more uniform filter-backwash cycles are possible.

5.2. Primary-Treatment

5.2.1 Coagulation and Flocculation (To remove color and effluent suspended)

TANK	DIMENSION	CAPACITY
Flash Mixture Tank	5 X 6 X 10 ft^3.	8.495 m^3
Flocculation Tank	5 X 6 X 13 ft^3.	11.04 m^3
Neutralization tank	5 X 6 X 6 ft^3.	5.09 m^3

REACTION TANK-01, 02 & 03:

Coagulation and Flocculation (To remove color and effluent suspended):

The homogenized effluent will then be pumped to a flash-mixing tank followed by a flocculation tank. In the flash-mixing tank coagulants like lime (Calcium Hydroxide) and flocculants like ferrous sulfate ($FeSO_4$) are dosed. This is done for coagulation and removal of the total dye particles. The basic idea of adding coagulant is to bring together all the suspended and dye particles so that they can be precipitated out in the flash mixing tank and flocculation tank by coagulation and flocculation mechanism. The chemical reaction that occurs in the coagulation and flocculation process is shown below;

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

The above reaction take place in lime dosing tank when lime reacts with water and we get calcium hydroxide solution. This solution reacts with the ferrous sulphate solution, which as follows

$$Ca(OH)_2 + FeSO_4 \longrightarrow CaSO_4 \Downarrow Fe(OH)_3$$
$$+ FeSO_4 \Downarrow (Unreacted) \quad + Fe(OH)_2$$

Adequate quantity of polyelectrolyte polymer solution is dosed in the flocculation tank to enhance the process of color removal by the flocculation process. A substantial amount BOD and COD etc. are removed in the coagulation and flocculation process.

5.2.2 Precipitation and Sedimentation in Primary Clarifier. (To remove the flocs materials)

From the flocculation tank the effluent is taken by natural gravity in to the Primary Clarifier tank where the dyes and suspended particles are precipitated. The flocs formed are removed in the downstream tube settler by the help of tube settler media. The effluent will further flow by overflow system to the pH correction tank where requisite quantity of acid will be dosed and pH will be adjusted as per the requirement.

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TANK	DIMENSION	CAPACITY
Primary Clarifier	17.3 X 24 X 10 ft^3.	117. 57 m^3

5.2.3 pH Correction (To adjust the inlet pH)

The effluent from tube settler- 1 tank is then taken by overflow method to the pH correction channel for neutralization, where 33% HCl acid is dosed for neutralizing the pH value around 7 to 8. The pH correction channel is designed for hydraulic retention time of around 1 -2 minutes and is provided with slow speed agitator for thoroughly mixing of waste with acid to maintained pH value.

5.3 Secondary-Treatment

4.3 Biological Treatment System: Moving Bed Bio film Reactor (MBBR).

a) From MBBR Tank, the partially biologically treated wastewater shall overflow to ASP Tank and Biological Clarifier to further treatment.

b) The detail of MBBR process is further described at 4.3A and 4.3B.

Picture: blowers for aeration **Picture: aeration system**

4.3 A Introduction of Bio-Chip™ MBBR

The Bio-Chip™ MBBR serves for biological treatment of highly loaded industrial and municipal wastewater. The treatment process is an aerobic and/or anaerobic operating at high volume loads, allowing the reactors and basins to be much smaller than conventional plants and thus reducing the cost.

The Biochip™ MBBR supplies a protected surface of approximate 3,000 m^2/m^3. The micro-organisms on the Biochip are protected in the pores and the open surface is cleaned by the shear-force during moving and attrition to each other. Slime, sludge and other deposits of materials inside of carriers are not favorable for the growth of the micro-organism. Therefore, the self-cleaning with the sheer force is one of the advantages of the Bio-Chip™ MBBR.

The Biochip™ MBBR carrier are not only used in new plants, they can be used also for the upgrading of existing activated sludge processes. The bio-film process can be used as stand-alone process, in combination with preliminary treatment steps and in final polishing stages.

The parabolic benefits in easy and active moving of the carrier and prevents clogging in retention areas. The carriers are suspended and in continuous movement in the bioreactor.

Advantages of using Bio-Media:

a. Lower reaction volume required;
b. Lowest energy requirement;
c. Extendable performance rate;
d. Highest safety in operation.

4.3 B. Introduction to the Moving Bed Bio-film Reactor-

The Moving Bed Bio film Reactor (MBBR) is a bio film variation of the activated sludge Wastewater treatment process. In the MBBR process, the bio film grows on bio carriers freely suspended in the mixed liquor of the reactor (basin). Bio carrier movement within the reactor is produced by an engineered aeration system. Effluent screens (referred to as sieves) keep the bio carriers in the reactor.

As the bio film grows a natural “sloughing” of the bio film off the bio carriers occurs. That
Sloughing maintains the bio film at a thickness supported by the incoming organic load.

Biomass that sloughs off passes through the effluent sieve. Clarification/sedimentation is then employed to remove the sloughed off biomass from the treated wastewater. The
Bio film carrier elements are made of high density polyethylene and have a specific

Gravity of 0.96.

The MBBR treatment process can offer numerous advantages over a suspended growth activated sludge treatment process. Those advantages include:

- Resilient Treatment Population: The bio-carriers provide the bio-films a protected environment. That protected environment often translates to providing a more resilient treatment population.

- Denser treatment population per unit volume: The treatment population per unit Volume is denser compared to conventional suspended growth activated sludge systems. That often translates into smaller treatment volumes (i.e. smaller foot print) and greater capacity to successfully treat incoming organic loads.

- Focus on Specific Treatment Populations: Within the bio-film layers develop favoring specific types of treatment organisms. That enables the bio-films to develop specifically focused for the organic load.

- Energy efficient

- Small foot print: MBBR footprint is smaller than comparable aerated wastewater treatment systems for either industrial or municipal wastewaters.

- Easy to operate: MBBR system does have a Return Activated Sludge component or sludge wasting.

High Loading Conditions: The ability of the bio-film to grow as organic loading increases enables a MBBR process to successfully handle extremely high loading conditions with very little operator intervention.

Bio-films are communities of microorganisms growing on surfaces. The microorganisms in the bio-films are essentially the same as those in suspended activated sludge wastewater treatment systems. Most of the microorganisms in the bio-film are heterotrophic (they use organic carbon to create new biomass), with facultative bacteria predominating. Facultative bacteria can use the dissolved oxygen in the mixed liquor or, if dissolved oxygen is not available, they will utilize the available nitrate/nitrite as electron acceptors.

At the surface of the bio-film is a stagnant liquid layer that separates the bio-film from the moving mixed liquor in the reactor. Nutrients and oxygen diffuse across the stagnant liquid layer from the moving mixed liquor to the bio-film. While nutrients (substrates) and oxygen diffuse through the stagnant layer to the bio-film, biodegradation products diffuse outward from the bio-film to the moving mixed liquor. These “back and forth” diffusion processes are continuous. Figure 3 above shows these diffusion processes.

As the microorganisms grow and multiply, the biomass on the Bio-Media grows or thickens. Biomass thickening affects the ability of dissolved oxygen and substrate in the reactor to “reach” all of the bio-film microorganisms. Microorganisms in the outer layers of the bio-film have “first access” to the dissolved oxygen and substrate diffusing through the bio-film. As the dissolved oxygen and substrate diffuses through each subsequent layer in the bio-film, more and more is consumed by the microorganisms in the preceding bio-film layers. The decrease of available dissolved oxygen through the bio-film produces aerobic, anoxic and anaerobic layers in the bio-film.

Different biological action occurs in each of those layers as specific microorganisms grow in the different environments within the bio-film. An examination of the microorganisms in each layer of the bio-film will show a population best suited for the oxygen/substrate environment in that layer. In the upper layers of the bio-film, where dissolved oxygen and substrate concentrations are high, the microorganism population will be aerobic higher level organisms. Deeper into the bio-film, where the oxygen and substrate concentrations decrease, facultative bacteria are the predominant microorganism present. In those layers nitrification occurs as nitrates become “electron acceptors of choice” for the facultative bacteria.

Eventually, microorganisms at the bio film/bio-carrier interface will be adversely affected by the decrease in substrate and oxygen reaching their layer in the bio-film. As the microorganisms in the bio film’s attachment layer weaken, the shearing action of the moving mixed liquor washes the bio film away from the Bio Media. The washing away process, referred to as sloughing, is a function of both hydraulic and loading rates in the reactor.

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5.3.1 Biological Treatment – Activated Sludge Process (To reduce the remaining BOD / COD aerobically).

The neutralized effluent is then taken by gravity in to the biological treatment aeration tank for biological degradation of available organic matter to reduce the remaining BOD and COD aerobically. The biological treatment tanks are designed on extended aeration principle.

In aeration tank basically aeration is occurred by means atmospheric air. Air from atmosphere is firstly filtered then blower sucks them and flows air to the aeration tank through diffusers. There are one blowers are used to perform their function and another keep stand by. Usually One blowers are running the time to *blow 600 cubic meter of fresh air per hour @ 180 diffusers are uniformly distributed around the 1303.1 sq feet area.*

to tank. Diffusers are kept at bottom of the tank floor. Blower takes air from atmosphere and then it passes though pipe to the diffusers. Then diffusers supply air as well as oxygen to the effluent. Blowers are highly stronger than the normal.
These are the description of plan for aeration tank. Now the question how does the function of air. This aeration does nothing but increase the quantity of dissolve oxygen. That's why increasing amount of dissolved oxygen is required to meet the demand. Without this the aquatic life in this tank ie, bacteria demands oxygen which is also filled up by this dissolved oxygen.

These are all about air at aeration tank. During aeration bacteria is also involved to do degrade effluents.

<u>The bacterial action:</u>

Organic matters + Activated Sludge $\xrightarrow{\text{Adsorption}}$ Organic matter = Activated Sludge $\xrightarrow{\text{Enzyme action}}$

Intake of organic matter $\xrightarrow{\text{Enzyme action}}$ Growth of activated Sludge + Water + Carbon dioxide

Oxygen + Nutrient

Endogenous Respiration

$$C_5H_7NO_2 + 5O_2 \longrightarrow CO_2 + NH_3 + 2H_2O$$

Apart from the above basics reaction there are some other reactions that take place in the aeration tanks. During aeration the oxygen reacts with C, S and N which is shown below.

$$C + O_2 \longrightarrow CO_2 \uparrow$$

$$S + O2 \longrightarrow SO_2 \uparrow$$

$$N + O_2 \longrightarrow NO_2 \uparrow$$

Some untreated ferrous sulfate and ferric hydroxide reacts with oxygen and the reactions are as follows,

$$FeSO_4 + O_2 \longrightarrow Fe_2\ (SO_4)_3$$

$$Fe\ (OH)_2 + O_2 \longrightarrow Fe\ (OH)_3$$

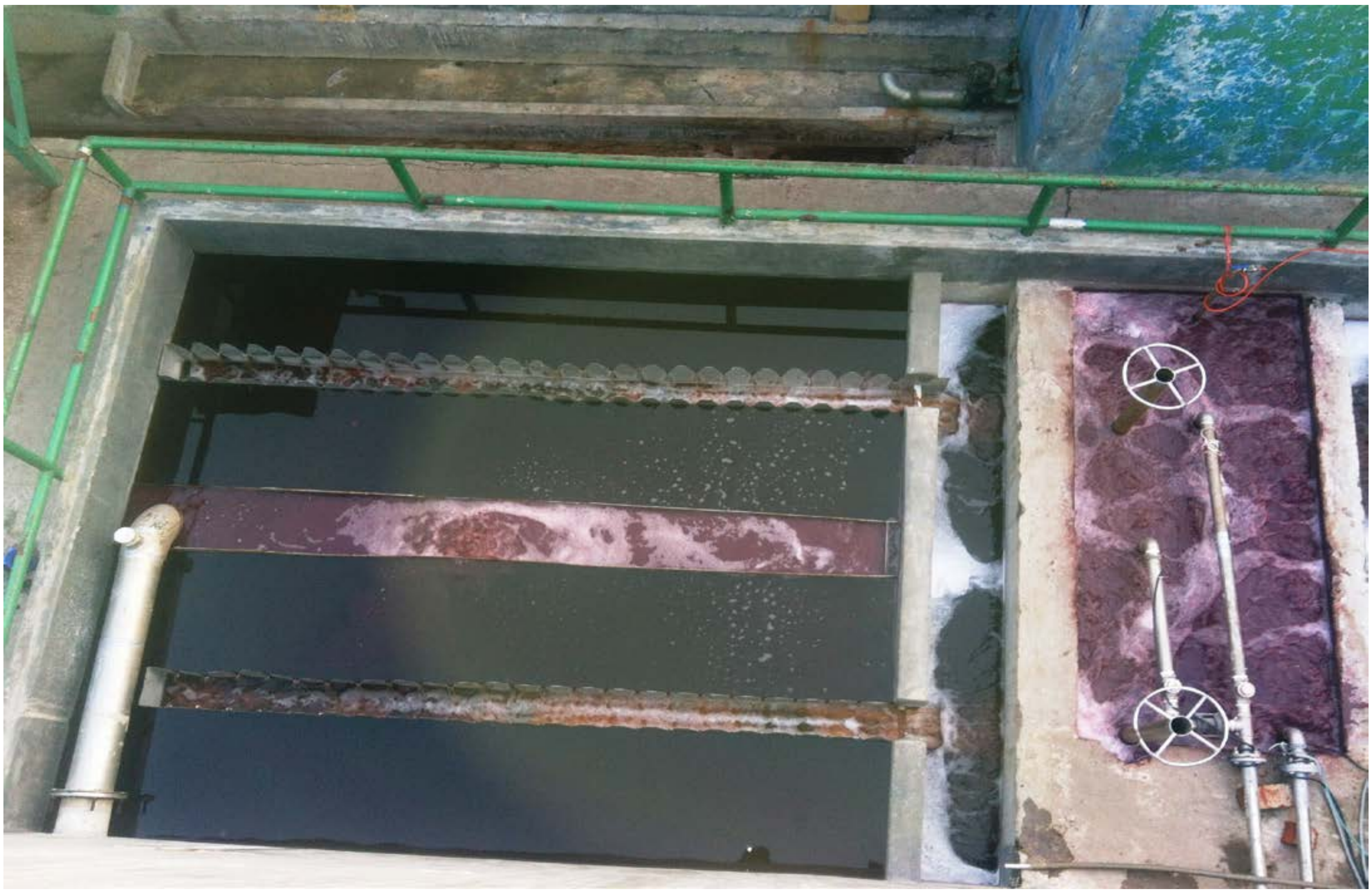
When the plant is kept shut down for short period of time, at that time, off course, it will be necessary to continue the aeration of Biological reactor. The biological degradation process in enhanced by the adding some Dia-mmonium Phosphate (DAP) and UREA, which acts as food for the microorganism. Therefore it will be necessary to supply food for the bacteria. Thus a combined solution of Urea and DAP are dosed in the biological tank to feed the bacteria.

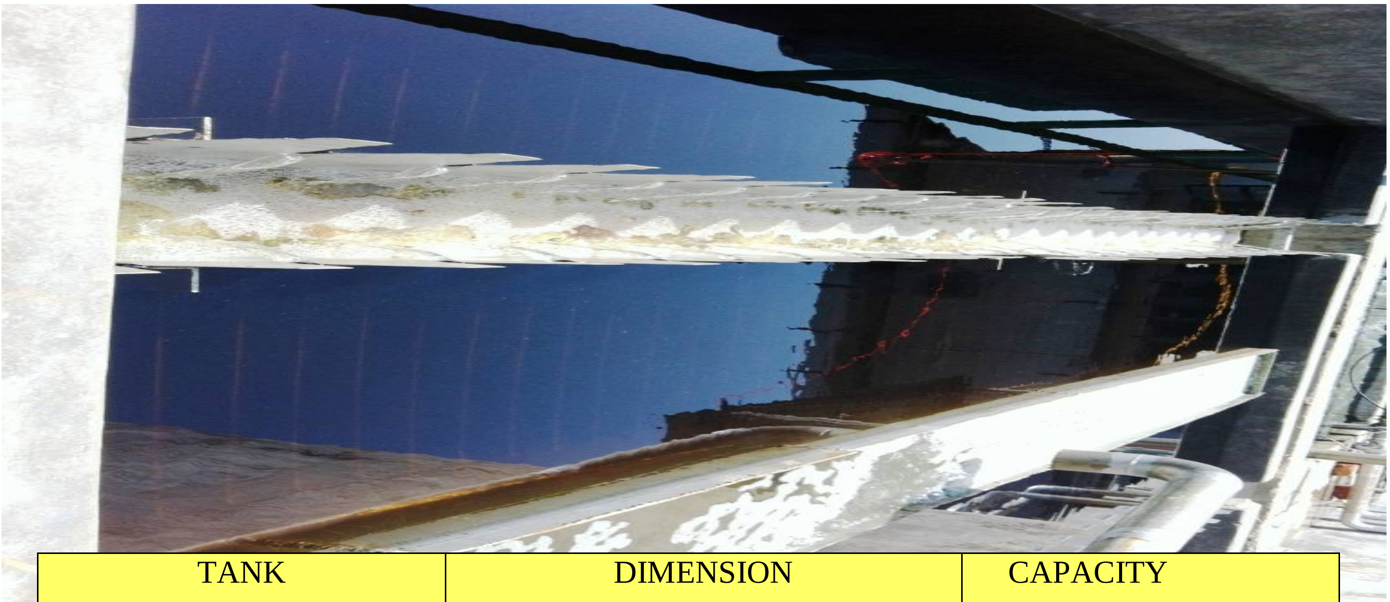
TANK	DIMENSION	CAPACITY
Aeration Tank	41.5 X 31.4 X 12.4 ft^3.	457. 55 m^3

5.3.2 Biological Clarifier - Tube Settler

(To remove the biological solids generation.)

From the biological reactor the treated effluent flows by gravity to the Clarifier (tube settler). The biological solids generated are removed from the tube settler –2 by the help of tube settler media.





TANK	DIMENSION	CAPACITY
Biological Clarifier	21.33 X 19.92 X 10 ft^3.	120.32 m^3
Inclined Plate	21.33 X 19.92 X 2.5	30 cubic meters.

5.3.3 Filter Feed Sump (Post Aeration Chamber)

The treated effluent from tube settler- 2 overflow in to the filter feed sump. From the filter feed sump the effluent is pumped to the activated carbon filter.

FILTER FEED SUMP	DIMENSION	CAPACITY
	21.33 X 19.92 X 10 ft^3.	117. 57 m^3

5.3.6 Treated Effluent Disposed Off (Ready for disposed off)

The treated effluent emerging from PAT is directly disposed off through the out let channel to environment.

5.3.7 Sludge Treatment and handling

The sludge generated in the flash mixing tank, flocculation tank, tube settler-1, tube settler-2 and biological reactor is taken to a sludge sump. Here also aeration is carried out. The waste is then pumped to a Sludge Drying Bed where the sludge is concentrated at the drying bed of the tank.

The de-watered sludge is transformed into cake form. The dried cake may be disposed of to deliver in the brickfield for burning. The overflow from the sludge thickener will be flow back to equalization tank for further treatment.

The water that has been separated from the sludge will be flown back to equalization tank for treatment.

6. Operational Procedure

6.1 Preparation of the chemical dosing

Before starting the operation it will be necessary prepare all the necessary chemical solutions. The procedures of preparing the solutions are described below.

6.1.2 Preparation of the PAC solution

The daily requirement of the PAC is calculated jar test. During preparing the dosing solution of PAC based on 300 ppm to 600 ppm dosaging. In this regard the dosing tank, which is fitted with a motor and stirrer, is at first filled with 1000 litres of water. After that 100 kgs of PAC is added and the motor is switched on to stir the solution. The stirring is continued for nearly 1 hour. After that the solution is ready for dosing in the flash-mixing tank. It is necessary to adjust the stroke of the dosing pump to get the desired flow.

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6.1.3 Preparation of the Poly Electrolyte (PE) solution

The daily requirement of the PE solution is calculated by jar test. During preparing the dosing solution of lime, a 0.05% solution is prepared. In this regard the dosing tank, which is fitted with a motor and stirrer, is at first filled with 1000 litres of water. After that 500 gms of PE is added and the motor is switched on to stir the solution. The stirring should be continued on a 24-hour basis i.e. as long as the plant runs. After that the solution is ready for dosing in the flash mixing tank as well as centrifuge tank. It is necessary to adjust the stroke of the dosing pump to get the desired flow.

6.1.4 Preparation of the Acid solution

The daily requirement of the Acid solution is calculated based raw effluents pH. During preparing the dosing solution of acid, a 2.5% solution is prepared. In this regard the dosing tank, which is fitted with a motor and stirrer, is at first filled with 1000 litres of water. After that 70 litres of 33% HCl is added. After that the solution is ready for dosing in the flash-mixing tank. It is necessary to adjust the stroke of the dosing pump to get the desired flow.

6.3 Important processing tips

6.3.1

1. Drain the sludge settled at the bottom of the tube settler at periodic interval to avoid carry over of sludge.
2. Changeover from operating to stand by equipment every day.
3. Regularly follow the lubrication and maintenance schedule for all mechanical moving items.
4. Take samples from the locations specified. Analyze them and maintain logbook regularly to ensure better control over operation of the plant.

6.3.2

1. Do not let effluent –having pollutants more than specified range in the plant .
2. Do not enter in to the closed tank without opening the manhole/without draining the contents of the tank.
3. Do not handle chemicals, dosing system without taking precautions.

4. Do not allow acidic pH < 6 or alkaline pH > 8.5 or hot (temp > 40^0C)
5. Do not drain the MBBR reactor under normal operation.

6.4 Trouble shooting guide

6.4.1 Aeration Problem

Low DO and/or septic odor in MBBR reactor

Possible cause	Necessary Check and possible corrective actions
Under aeration	1. Check DO, should be in the range of 1.0 to 3.0 mg/L throughout in the tank. 2. Check the air quality delivered by blower, in case the quantity is less than design; check the blower for any mechanical problem. In case of any mechanical problem refer the blower manual for the maintenance.
Blower operation not continuous	The blower should be in continuous operation
Grid are damaged	In case the grid is damaged, this will result in excessive turbulence but low oxygen transfer. The corrective action should be taken nfor reparing the diffuser/grid.
High inlet Organic i.e BOD/COD load	1.In case the BOD/COD load is higher than design, the same to be controlled prior to E.T.P. If the increase is for a small period the flow to the plant to be reduced to decrease the kg BOD/COD loading. 2.Solid level in the reactor very high, the settled solids (if any) to be drained. The draining frequency can be ascertained based on the site condition.

6.4.2 Foaming Problem

Possible cause	Necessary check and possible corrective actions
Over aeration	Check BOD loading (kg/d), in case the BOD level is much lower than the design basis. Adjust the air quantity to the bio reactor and maintain minimum D.O level as 2.0 mg/l
Low bacterial level in the MBBR reactor	Seeding should be done preferably by using activated sludge from an well-operated plant

Note- The foaming problem usually occurs during start-up and is only temporary. If you are under starting up do not be alarmed by it.

6.4.3 Low oxygen uptake in ASP reactor

Possible cause	Necessary check & possible corrective actions
High Temperature	At high temperature there will be decreased oxygen utilization. Maintain the inlet effluent temperature between 25^0C to 35^0C maintain organic removal
pH out of range	Eliminate source of pH upset Adjust pH in MBBR reactor to between 6.5 and 8.5
Spill	Eliminate source of spill Evaluate effect of spill on active Bio Mass.
Low organic loading	Adjust the air supply according to the inlet BOD load, simultaneously maintain the DO level >2.0 mg/l.

6.4.4 Low Bio Growth in the ASP reactor

Possible Cause	Necessary Check & Possible Corrective Actions
High Temperature	High process temperature can result in decreased oxygen utilization and as a result low bacterial growth. Apart from this at high temperature there is possibility of dyeing of the microorganisms. Maintain the inlet effluent temperature between 25^0C to 35^0C to maintain organic removal
pH out of range	Eliminate source of pH upset as it will adversely affect the Biological process. Adjust pH in ASP reactor in between 6.5 and 8.5
Insufficient aeration	Insufficient aeration may lead to decrease in bacterial population. The aeration should be continuously carried. Even if the effluent is not available for a short span in a day blowers should not be stpped.
Shock loading	The effluent having pollutant level very high should be segregated and stored separately.

	The effluent having toxic pollutant should be prevented from entering the ETP.

6.4.5 High suspended solids level in the Biological Clarifier (tube settler II) outlet effluent

Possible cause	Necessary Check & Possible Corrective Actions
Media position	Check the position of tube settler media by lowering the water level, in case any short circuiting is there, the same is required to be corrected by correctly positioning the media as per the drawing.
Excessive storage of sludge in the tube settler.	The sludge needs to be drained periodically from the tube settler. In case the sludge level increases in the tube settler the same will result in sludge carry over.
Trough are not cleaned	The trough should be cleaned manually periodically.

6.4.6 High COD (or BOD) level in tube settler II outlet effluent

Possible cause	Necessary Check & Possible Corrective Actions
Low Bio mass	Seeding of ASP reactor may be required.
High organic loading and/or excessive flow	Increase in the inlet BOD/COD load in comparison to Design. If the increase is for a short time decrease the flow to maintain the kg BOD loading as far design.
High effluent suspended solid (SS)	If COD increase is attributable to high effluent suspended solids, refer to corrective actions for “high effluent suspended solids”
Inadequate DO	Check organic loading by measuring COD. Increased oxygen utilization can result from increased organic loading. Refer to corrective actions for “low oxygen level in MBBR Reactor”

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a. At first sufficient effluent is allowed in the equalization tank. After that aeration should be continued. After aeration effluent is pumped to the flash mixing tank.

b. PAC and de-coloring agent solution should be dosed as soon as the effluent accumulated in the flash mixing tank. Soon after dosing, the color of the effluent will be changed and the dissolved matters will form small flocks. The effluent will then be flown to the flocculation tank by overflow and gravity principle.

c. The effluent is then goes to the pH correction channel due to the over flow. It is necessary to check the pH of the effluent at this stage and if the pH is above 7 then acid solution is dosed to bring down the pH within a range of 6.5 to 7.5.

d. Polyelectrolyte is then dosed when the small sludge particles will concentrated at the bottom of the tank.

e. From the flocculation tank the effluent is over flown to the Primary Clarifier- 1 and primary clarifier-2 where the effluent is flown upwards through clarifier. Under this condition a substantial amount of sludge will be accumulated at the bottom of this settler tank.

f. The effluent is then goes to the MBBR Reaction tank-1 due to the over flow and gravitation method. Microorganisms like bacteria are seeded ON the surface of MBBR which is described in MBBR process description 4.3 (A).
Nutrients are dosed reactor for nursing microorganisms like bacteria. At this stage the remaining BOD/COD will be reduced. From the Biological reaction tank, the effluent enters into the MBBR tank-2 and then ASP tank. After that Effluents enter Biological Clarifier (Inclined plate clarifier). This is also happening due to overflow.

g. As the effluent flows through the tube media the sludge is settled at the bottom of the tank.

h. From the Secondary clarifier the effluent goes to the filter feed sump (Post Aeration Chamber) due to gravity

i. The effluent is then flows to the Activated Carbon Filter. Carbon adsorption is a proven process in tertiary treatment for the processing biologically treated wastewaters, and is one of the many processes used in the advanced treatment of wastewaters. The ACF is used to remove relatively small quantities of refractory organics, as well as inorganic such as sulfides and heavy metals remaining in an otherwise well-treated wastewater.

j. The water at this stage is safe to be released into the environment.

8. Plant Shutdown

In cases when the factory is kept shut down for a short period of time then there will not be any effluent, in that case it will be necessary to continue aeration and nutrient dosing in the Biological reaction tank, Otherwise the bacteria will dye.

9. Maintenance of the plant

9.1 Bar Screen:

The bar screen should be cleaned everyday

9.2 Equalization pump:

The lube oil should be checked before starting the pump. The valve of the suction line should be opened and cleaned once every seven days.

9.3 Flash Mixing and flocculation agitator:

Apply lube oil before starting the agitator motor. The lube oil should be checked after every seven days.

9.4 Air Blower:

Check the lube oil before starting the air blower. If there is no lube oil then apply lube oil and start the blower. The lube oil pump should check frequently.

9.5 Sludge transfer pump and centrifuge feed pump:

After starting the sludge transfer pump and centrifuge feed pump it should be observed for a short period of time. If no sludge is found then stop the pump and open and clean the delivery line.

9.6 Agitators of all the dosing tanks:

Check the lube oil every seven-day. Apply lube oil if finishes.

9.7 Flash mixing, flocculation and Primary Clarifier (tube settler tank # 1)

The tanks should be cleaned very well in every three months. The tube settler media should also be cleaned.

9.8 Biological Clarifier (Inclined Plate Clarifier)

This tank should be cleaned after every two months time.

9.10 Carbon filters:

It is necessary to backwash the carbon filter every eight hours.

9.12 Painting the plant:

HKF Engineering & Trading Dhaka

All the pipes and M.S tanks should be painted every year. The painting instruction and other details are given in Appendix-III

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর
চট্টগ্রাম বিভাগীয় কার্যালয়
জাকির হোসেন রোড, খুলশী, চট্টগ্রাম –৪২০২।
www.doe-bd.org

স্মারক নং ঃ পঅ/চবি/ফিঃ আদায়/১৩০২৫(৩৬)/১২/ ৪৭০২

০৫/০৯/১৪১৯ বঙ্গাব্দ
তারিখ ঃ ....।
১৯/১২/২০১২খ্রিঃ

বিষয় ঃ নমুনা বিশ্লেষণ ফলাফল প্রেরণ।

সূত্র ঃ Crown Mills (BD) Ltd এর ২২/১১/২০১২ খ্রিঃ তারিখের আবেদন ।

উপরিউক্ত বিষয় ও সূত্রের প্রেক্ষিতে নমুনা সংগ্রহ করে অত্রবিভাগীয় গবেষণাগারে বিশ্লেষণ পূর্বক ফলাফল এতদসংগে প্রেরণ করা হলো।

সংযুক্তি ঃ বর্ণনামতে ০১(এক) পাতা।

(মোঃ জাফির আলম)
পরিচালক
ফোন-৬৫৯৩৭৯

জনাব আব্দুর রাজ্জাক
ক্রাউন মিলস বাংলাদেশ লিঃ
প্লট নং- ১৭-১৯ এবং ৩৬-৩৮, সেক্টর-২
সিইপিজেড, চট্টগ্রাম।

বিতরণ ঃ
১। অফিস কপি।

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Government of The People's Republic of Bangladesh.
Department of Environment
Chittagong Divisional office.
Zakir Hossain Road, Khulshi, Chittagong
www.doe-bd.org

Analysis sheet of Waste water of (Before & After Treatment) Sample of Crown Mills (BD) Ltd. Plot# 17-19, 36-38, Sector # 2, CEPZ, Chittagong.

Sample Location	Lab code	Date	P^H	Color Pt.Co	TDS mg/l	TSS mg/l	Oil & Grese mg/l	DO mg/l	BOD_5 mg/l	COD mg/l	Note
Waste water (B.T) Crown Mills (BD) Ltd, CEPZ, Ctg.	2014	03/12/12	7.9	345	1911	363	6.4	3.6	98	403	ETP Inlet
Waste water (A.T) Crown Mills (BD) Ltd, CEPZ, Ctg.	2015	03/12/12	8.2	62	1996	38	2.2	4.6	36	154	ETP Outlet
Standard as per ECR1997 in Bangladesh.			6.5-8.5	-	Below 2100	Below 100	Below 10	4.5-8.5	Below 50	Below 200	-

18.12.12
Md. Abdus Salam
Lab. Assistant.

18.12.12
Md. Nazrul Islam
Sample Collector.

Jamir Uddin
Sr. Chemist,

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