UNEP MAP

Horizon 2020

INESCOP
INSTITUTO TECNOLÓGICO DEL CALZADO Y CONEXAS

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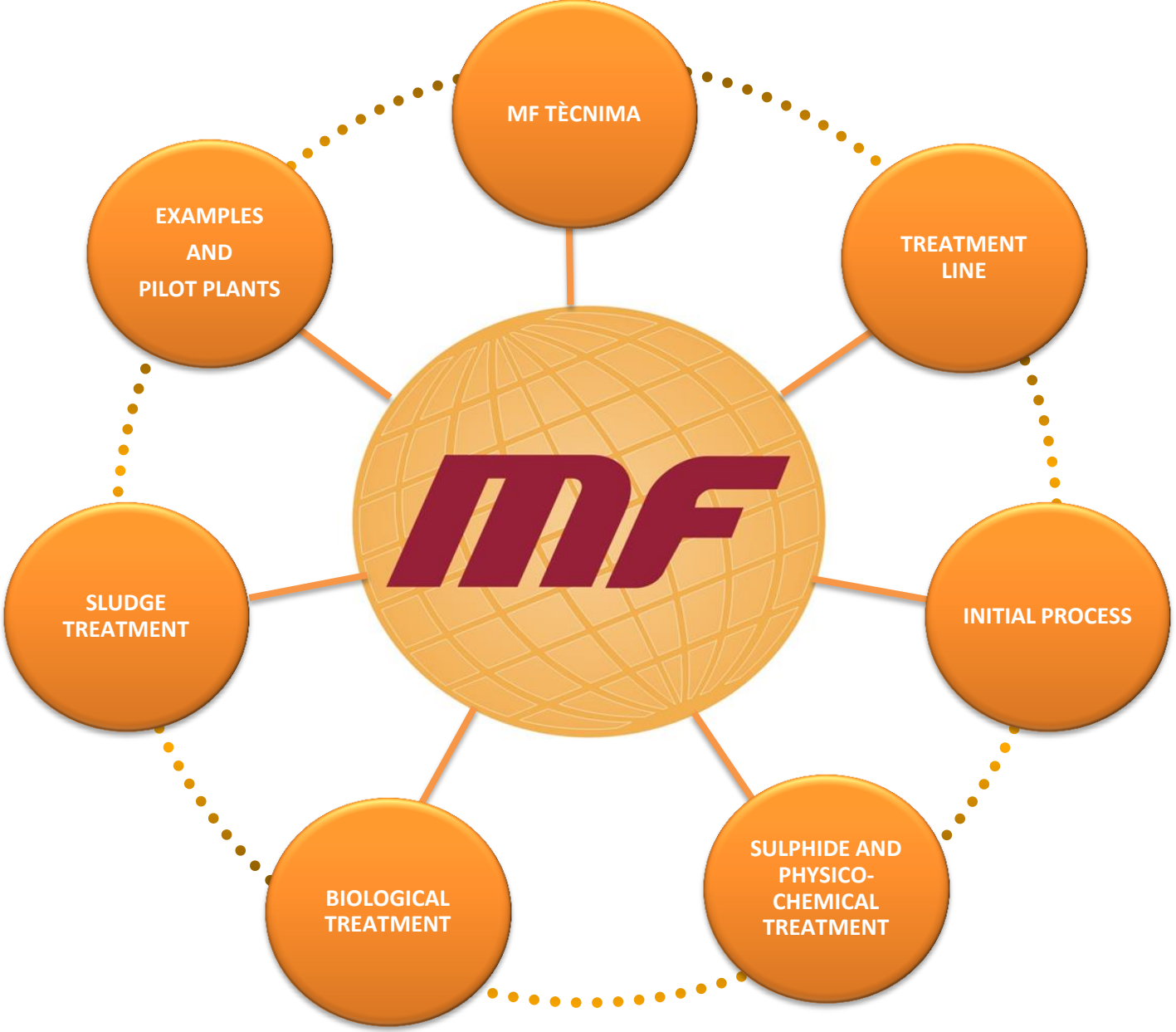
WASTEWATER TREATMENT:

MECHANICAL AND PHYSICO-CHEMICAL TREATMENT


MF TÈCNIMA
TREATMENT LINE
INITIAL PROCESS
SULPHIDE AND PHYSICO-CHEMICAL TREATMENT
BIOLOGICAL TREATMENT
SLUDGE TREATMENT
EXAMPLES AND PILOT PLANTS
MF

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MF TÈCNIMA

MF Tècnima

MF Tècnica Industrial i Mediambiental, S.L. (MF TÈCNIMA), Engineers - Consultancy specializing in the environmental sector, founded in 1997 with a clear objective: to provide companies with an integral and customized service to effectively and professionally solve the problems deriving from their activity and provide technical and legal advice in aspects relating to the environment.

We offer a wide range of services, which include the design, installation, laboratory, start-up, operation and maintenance of waste water treatment plants.

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ENGINEERING

MF Tècnima has an important engineering department that designs waste water treatment plants, applying the most appropriate solutions to problems that are characteristic of each type of company. Among the activities of the engineering department, the following deserve special mention:

-Design and construction of treatment plants. (Physicochemical, Biological and special treatments).

-Design and construction of drinking water plants and water recovery (for reusability and/or irrigation).

-Design and assessment of sludge treatment plants.

-Diagnostics for the reduction of water consumption and evaluations of the opportunities to reduce and recycle at the source, together with other ways of minimizing source contamination.

-Studies at pilot level (FQ, active sludge, BRM, SBR).

MANAGEMENT

MF Tècnima has a legal and technical assessment service department which deals with the administrative side of the business. This department manages and handles all the paperwork needed to be sent to public administration authorities as well as the paperwork related to grants and industrial waste management. Among these services we can find:

-Management and handling of paperwork for Local, Autonomous, National and European administration authorities.

-Dumping authorizations.

-Legalization of underground and surface water capture.

-Legalization of businesses.

-Management and handling of grants.

-Environmental evaluations.

LABORATORY

ESTABLIMENT TÈCNIC AUXILIAR DE L'AGÈNCIA CATALANA DE L'AIGUA

Our laboratory is fitted with the most up-to-date technologies and waste water analysing techniques, in order to be able to offer our clients a vast range of services, all of which are adapted to the individual needs of each company, with the aim of designing and optimising the treatment processes specific to each industry. Some of the activities that are carried out are:

-Waste water sampling.

-Water analysis.

-Counter analysis of the "Agència Catalana de l'Aigua" and assigned organisms.

-Coagulation - Floculation studies (Jar - Test).

-Respirometric tests.

-Water studies.

OPERATION

A fundamental part of the treatment process is the maintenance of the installations, controlling the contaminating parameters, being able to offer technical assistance in case of emergency, controlling and managing the treatment plants, etc. It is for this reason that MF Tècnima has at its disposal an operation and maintenance team that offers the following services:

-Management of waste water treatment plants.

-Comprehensive follow-up of the functioning of the plant.

-Technical assistance.

-Preventive - Corrective maintenance.

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TREATMENT LINE

Treatment line

Treatment stages for a treatment line:

INITIAL PROCESS (common in all treatment line):

- Filtration
- Mixing tank
- Initial settling tank

SULPHIDES STAGE

WATER LINE:

- Catalytic oxidation
- Physicochemical treatment
- Settling tank

Sulphides

CHROME STAGE

WATER LINE:

- Specific Physico-chemical treatment for precipitation of chrome
- Settling tank

Chrome

SLUDGE LINE:

- Thickening
- Sludge preparation
- Dehydration: press filter

PHYSICO-CHEMICAL STAGE

WATER LINE:

- Physico-chemical treatment
- Settling tank

COD/Chrome

SLUDGE LINE:

- Thickening
- Sludge preparation
- Dehydration: press filter

BIOLOGICAL STAGE

WATER LINE:

- (Physico-chemical treatment)
- Biological treatment: aerobic/anoxic tank
- Settling tank

COD/NKT

SLUDGE LINE:

- Thickening
- Sludge preparation
- Dehydration: press filter / decanter centrifuge

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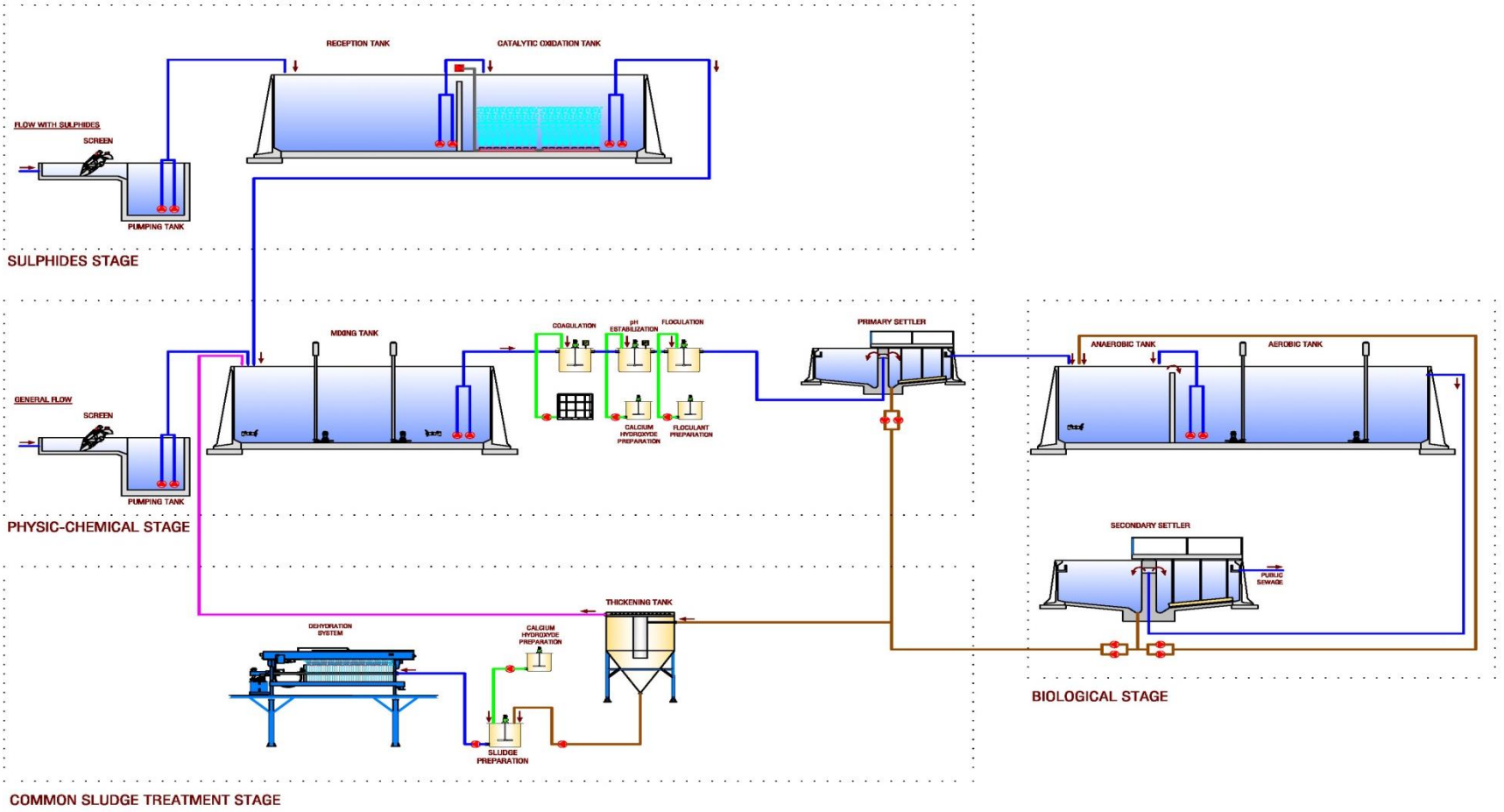
Treatment line



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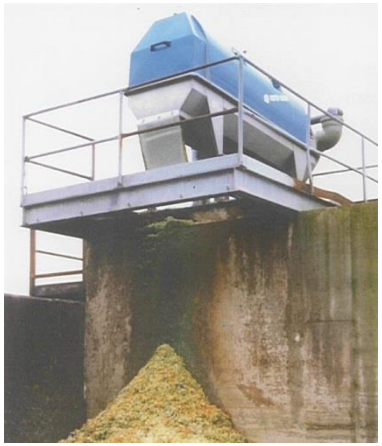
INITIAL PROCESS

Initial process

FILTRATION:

Waste water passes through a filter installed in the water collecting channel before going to pumping tank, before the mixer. This filter separates the fragments of hides and large particles that could damage the pumping system.

Filtered water is pumped to the mixing tank by means of pumps located in the pumping tank, after having passed through the channel where the filter will be fitted.



Initial process

MIXING TANK:

The mixing tank has a mission to homogenize and prepare all wastewater pollution and particles for further processing.

All wastewater that enter in the decontamination process must have physicochemical conditions very similar to make easier the post treatment.

Initial process

INITIAL SETTLING TANK:

The initial settling tank permit to separate the solid particles which they have the property of settle.

The main advantage is avoid the entrance of solids in the rest of the treatment process.

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SULPHIDE TREATMENT

Sulphide Treatment

The sulphides removal system is done through a catalytic oxidation by following unit operations:

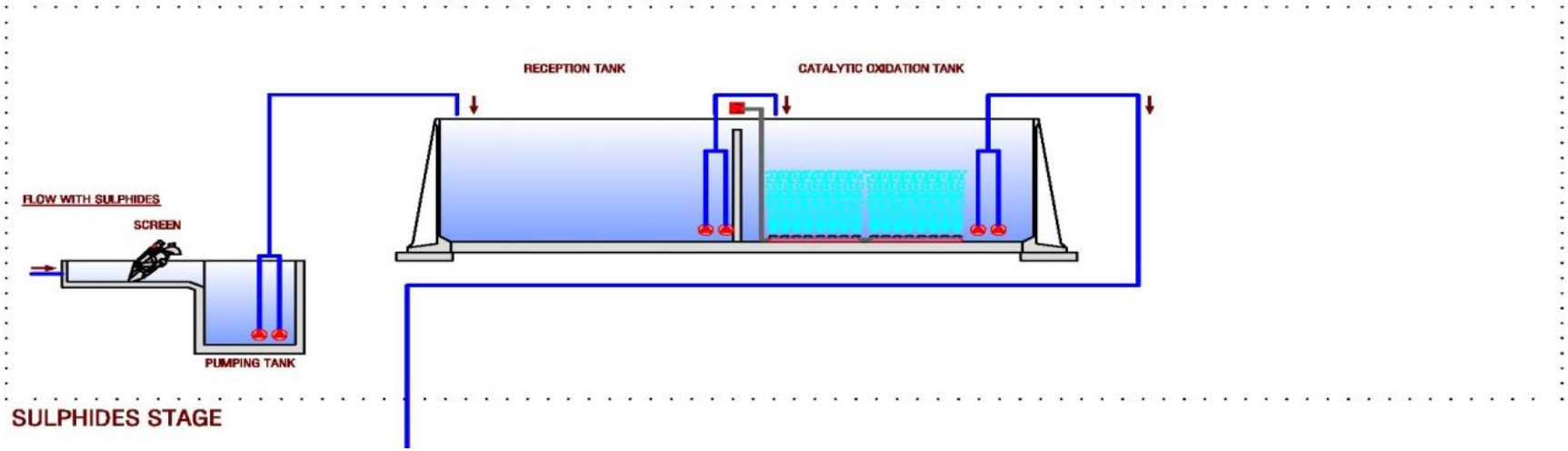
1) Filtration before reception tank for eliminate remnants of hair and bits of skin.

2) Reception tank of waste water with sulphides. This is a mixing tank that acts as a storage tank because the catalytic oxidation is in discontinuous (batch).

3) Catalytic oxidation of sulphides:

$$2Na_2S + 2O_2 + H_2O \xrightarrow{MnSO_4} Na_2S_2O_3 + 2NaOH$$

Sulphide Treatment



PHYSICO – CHEMICAL TREATMENT

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PHYSICO - CHEMICAL TREATMENT

Physico - chemical Treatment

The physico-chemical treatment has the function to destabilize the pollution in water with the addition of chemical products. Basically it can be divide in three steps:

- Coagulation
- Neutralization
- Flocculation

In each process there are different types of chemical products.

Physico - chemical Treatment

This process can be done continuously (in different tanks) or by "batch“ (in discontinuous mode)

DIFFERENT TANKS SYSTEM

BATCH SYSTEM

After that, a clarifier is necessary to obtain for one hand a clarified water and for the other hand the sludge

Physico - chemical Treatment

There are different ways to clarifier the water – sludge, the main are:

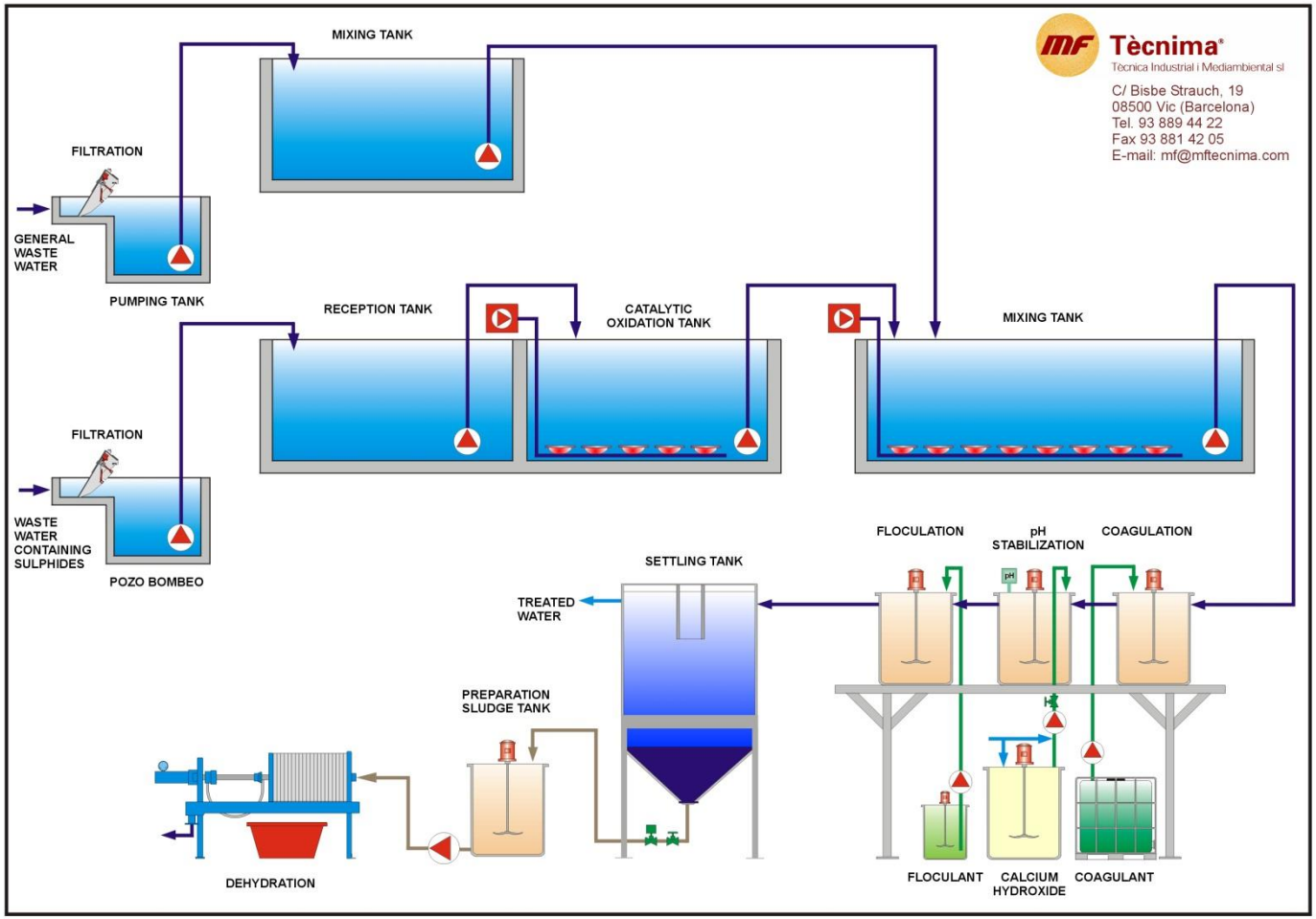
SETTLING TANK:

To clarifier for sedimentation. The effects of gravity will permit to settle the particles at the bottom of the tank. It exists 2 kinds of settling tank.

FLOTATION UNIT:

To clarifier with air. It needs an extra air giving to float the sludge. In this case the water it will extract in the middle of the tank.

Physico - chemical Treatment



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BIOLOGICAL TREATMENT

Biological Treatment

After the mixer (or physical-chemical process) waste water is pumped to the biological treatment, where pollution is eliminated using activated sludge processes.

The biologic treatment consists in an anoxic tank, where the nitrogen compounds are eliminate, followed by an aerobic tank where the carbon particles are removed using oxygen.

Throughout the time the water remains in the tanks it is constantly aerated (aerobic tank) and mixed (anoxic tank) in such a way that the entire mass of liquid is in constant movement and it is also ensured that no sediments are present in the tank.

Biological Treatment

ANOXIC PROCESS

The anoxic process consist in the biological reduction of nitrate to nitrogen gas and its elimination of the system.

The chemical reaction that takes place is:

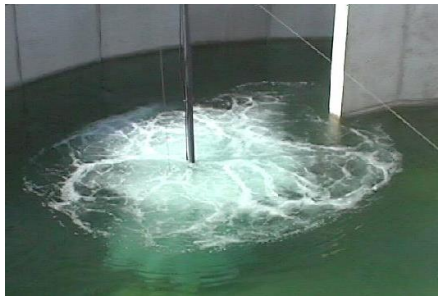
$$NO_3^- \rightarrow N_2\,(g)$$

It's important to mix the water to ensure that no sediments are present in the tank. That is why agitators are needed in this tank.

Biological Treatment

AEROBIC PROCESS

The nitrification is the process that takes place in the aerobic tank. This reaction consists in the biochemical oxidation of the nitrogen from the ammonium through nitrobacter and oxygen.

$$NH_4^+ + O_2 \rightarrow NO_2^- + H^+$$
$$NO_2^- + O_2 \rightarrow NO_3^-$$

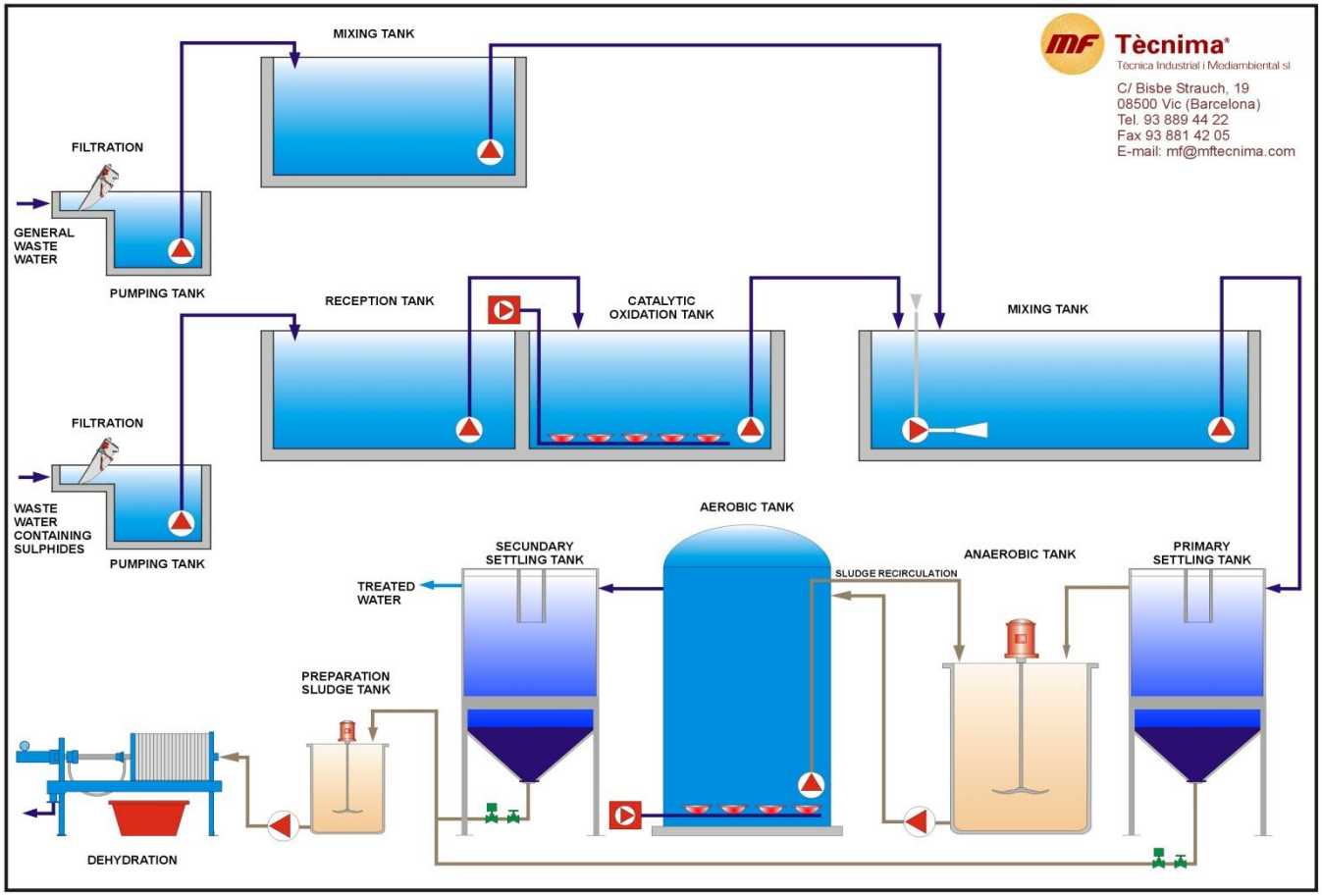
Oxygen is introduced in the system by aerators, mixers, blowers or venturi systems. It has a double function, to oxidize the organic matter and to mix the water to ensure that no sediments are present in the tank.

Biological Treatment

SETTLING TANK:

The activated sludge liquor is sent to the settling tank where the sludge settles down and the outing water is the final treated water.

Biological Treatment



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SLUDGE TREATMENT

Sludge Treatment

SLUDGE PREPARATION FOR PRESS FILTER:

Before the sludge is introduced into the press filter, it must be prepared by adding calcium hydroxide. After this the sludge can be dehydrated.

The outing water is returned to the mixing tank.

Sludge Treatment

PRESS FILTER:

Press filters are used to eliminate excess water from the sludge. This system is based on forcing the excess water out of the sludge by means of high pressure. In this way, dryness above 35% can be obtained.

This dehydration system has the following advantages:

- Low humidity in dehydrated sludge.
- Outing water with high transparency.
- High solid retention.
- Low consumption of chemical products.

Sludge Treatment

DECANTER CENTRIFUGE:

Another option to dehydrate the sludge is a centrifuge, based on the forced elimination of water present in sludge by means centrifugal force. In this way, a 20% of sludge dryness can be reached.

The sludge is prepared using flocculants and then it's pumped to the centrifuge. The mixing of the sludge and the flocculant is done in a special mixer located in the entrance of the machine. The outing water is returned to the beginning of the treatment, to the mixing tank.

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EXAMPLES OF CUSTOMERS PLANTS

EXAMPLE: Tannery - I

DESIGN & OPERATING DATA	
TREATMENT	Biological
ANOXIC TANK	450 m^3
AEROBIC TANK	1320 m^3
SETTLING TANK	8,6 m Ø

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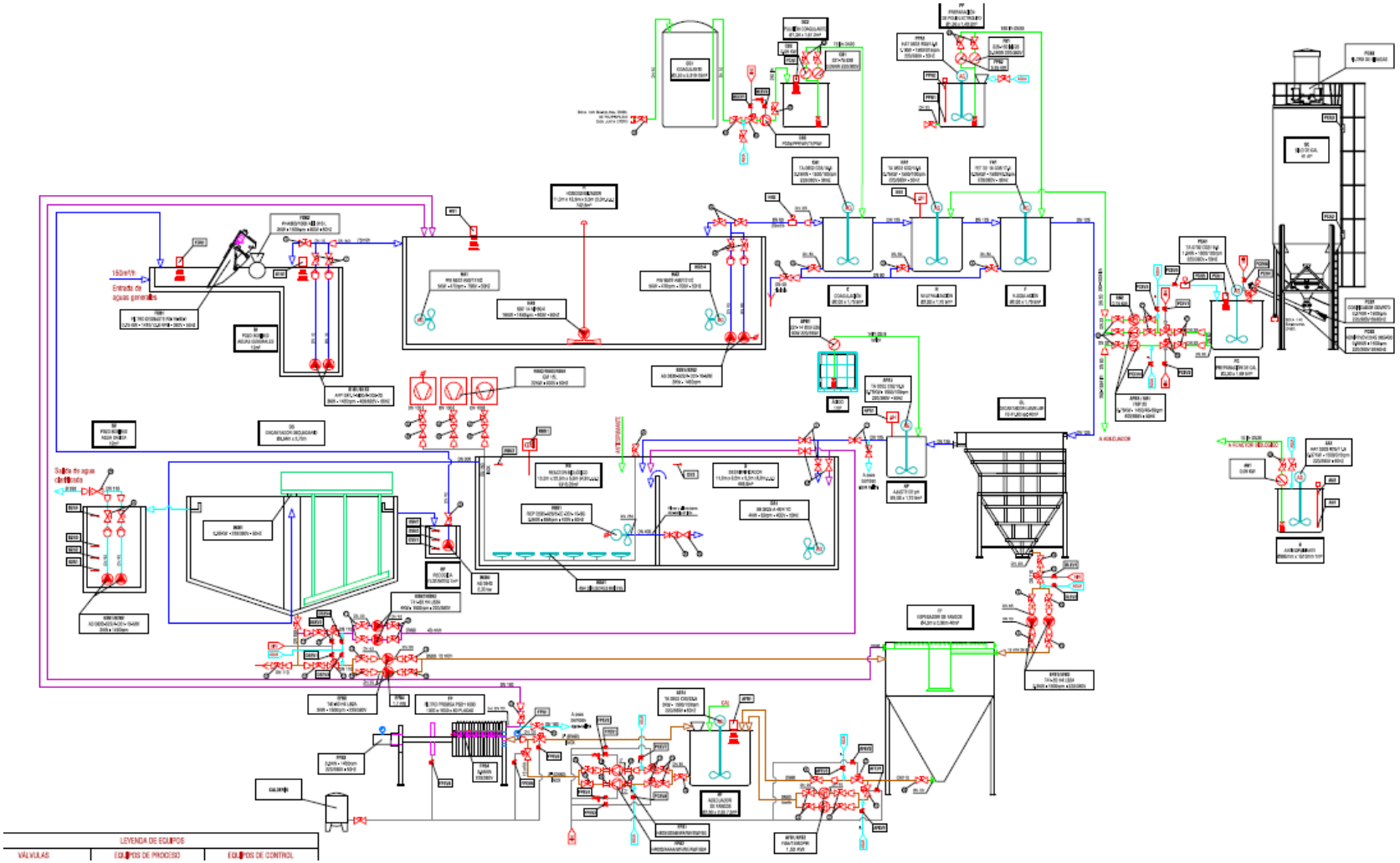
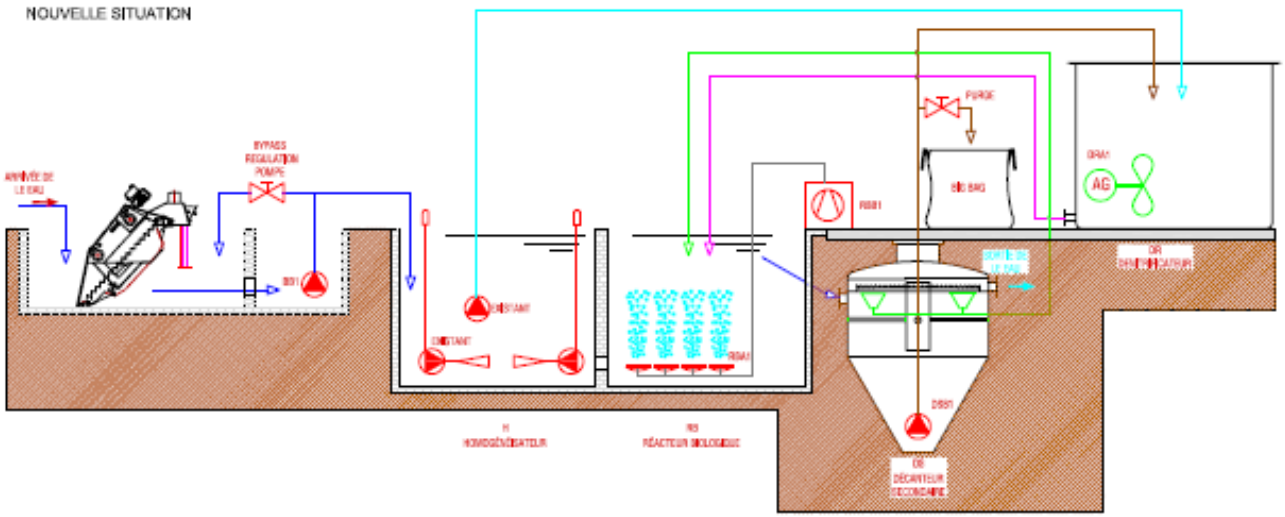
EXAMPLE: Tannery - I



EXAMPLE: Tannery - II

DESIGN & OPERATING DATA	
TREATMENT	Biological
ANOXIC TANK	86 m^3
AEROBIC TANK	198 m^3
SETTLING TANK	5 m Ø
Inhabitants Equivalent	1.607 IE

EXAMPLE: Tannery - II



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PILOT PLANTS

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PILOT PLANTS

Physico-chemical pilot plant

PILOT PLANTS

Biological pilot plant

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PILOT PLANTS

BRM pilot plant

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