Sedimentation, Precipitation and Flocculation Unit

SPFB

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION
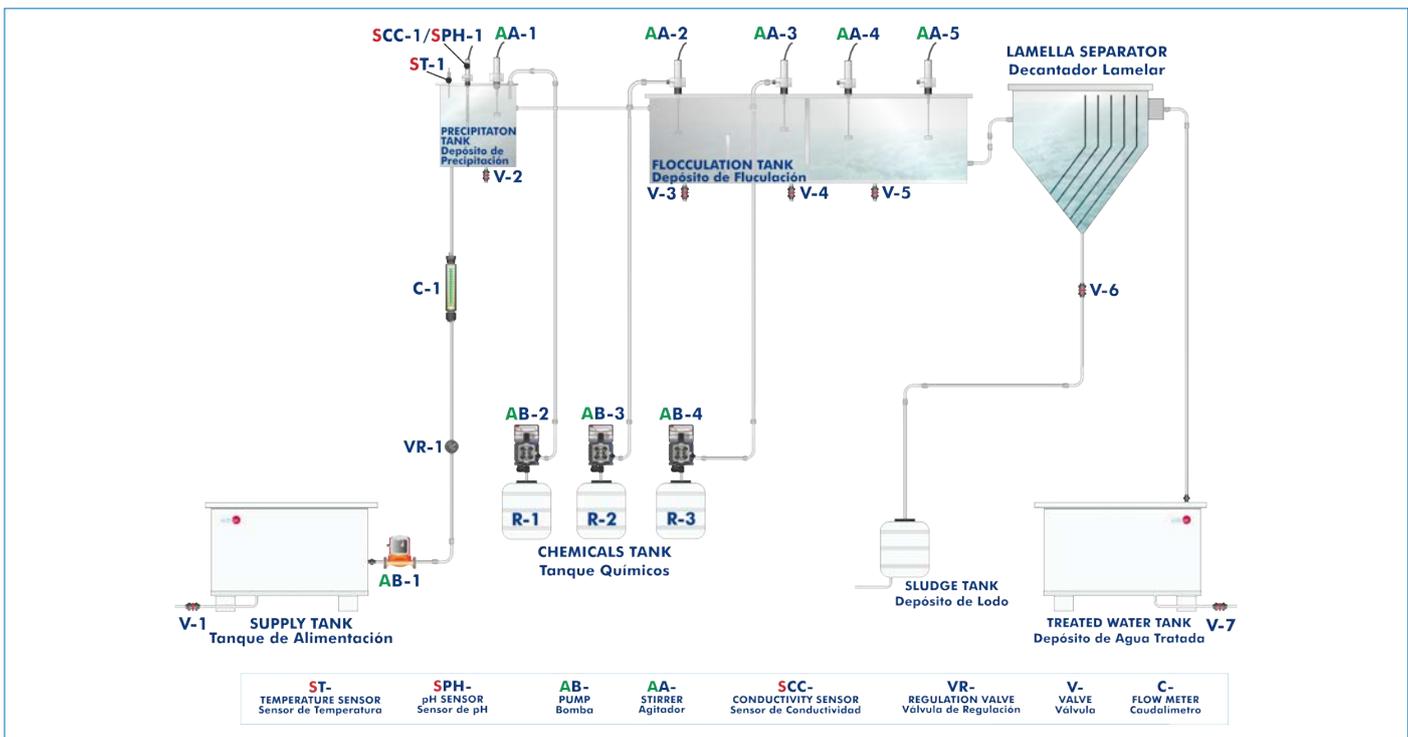
SCC-1/SPH-1 AA-1   AA-2   AA-3   AA-4   AA-5

ST-1

LAMELLA SEPARATOR
Decantador Lamelar

PRECIPITATON TANK
Depósito de Precipitación

V-2

FLOCCULATION TANK
Depósito de Fluculación

V-3   V-4   V-5

C-1

V-6

VR-1

AB-2   AB-3   AB-4

R-1   R-2   R-3

CHEMICALS TANK
Tanque Químicos

AB-1

SLUDGE TANK
Depósito de Lodo

V-1   SUPPLY TANK
Tanque de Alimentación

TREATED WATER TANK
Depósito de Agua Tratada   V-7

| ST-
TEMPERATURE SENSOR
Sensor de Temperatura | SPH-
pH SENSOR
Sensor de pH | AB-
PUMP
Bomba | AA-
STIRRER
Agitador | SCC-
CONDUCTIVITY SENSOR
Sensor de Conductividad | VR-
REGULATION VALVE
Válvula de Regulación | V-
VALVE
Válvula | C-
FLOW METER
Caudalímetro |
|---|---|---|---|---|---|---|---|

INTRODUCTION

Nowadays, water pollution is a global problem of great social importance. Therefore, factors affecting water treatment must be established.

Physicochemical treatments may be used as a single stage in wastewater treatments or be interposed as an extra purification process between the pre-treatment and the biological treatment. Its high use in industry resides in its high efficiency to remove non-settable suspended matter and/or colloidal matter.

The objective of the Sedimentation, Precipitation and Flocculation Unit, "SPFB", designed by EDIBON, is to study the physicochemical treatments used in wastewater purification.

GENERAL DESCRIPTION

The Sedimentation, Precipitation and Flocculation Unit, "SPFB", has been designed by EDIBON to study the parameters that affect the physicochemical treatment of wastewater for purification. The objective of the unit is to reduce colloidal and suspended matter by studying the precipitation, coagulation, flocculation and sedimentation stages.

The process starts with the supply of water to be treated to the unit, using the raw water an adjustable speed supply pump for that purpose. The supply flow is obtained with the flow meter. The raw water is introduced into the precipitation tank, where an adjustable speed pump adds dissolved caustic soda to neutralize that water. Besides, there is an adjustable speed stirrer that facilitates the mixture of the reagents associated to the neutralization reaction. It also includes a temperature sensor and a pH-conductivity sensor to control the key variables of the precipitation process.

Then, water overflows onto the flocculation tank, which is divided into two parts: the coagulation tank and the flocculation tank. Water overflows from one tank to the other. The difference between them is the type of compound added for the colloids breakdown and the formation of flocs.

Coagulation takes place in the first tank by adding coagulant with an adjustable speed pump. The coagulation tank includes an adjustable stirrer to break the colloids down. Thus, the mixing will be intense to obtain a uniform and quick distribution of the coagulant before the chemical reaction is generated.

Different sections are observed in the second tank. The first one is delimited by baffle walls to help the mixing process and the others are delimited by stirrers. A flocculant is added to the first section through an adjustable speed pump to help in the generation of flocs. The size of those flocs grows in the other sections in order to increase the efficiency of the settling process. For that purpose, the fluid is quietened, preventing turbulences. There is an adjustable speed stirrer in each section to encourage the bond of the particles and their agglomeration as flocs.

Finally, water goes to a lamella separator, where the flocs are separated from the treated water by a settling process. The clarified water leaves through the top and is driven to the treated water tank, while sludge is accumulated in a hopper at the bottom of the unit. As a final result, treated water is stored in the purified water tank, while sludge is extracted from the separator in the sludge tank.

The unit has sampling points in each tank of the process, including the different sections of the flocculation tank. Besides, it has a conductivity meter to analyze the conductivity variation along the process and associate it with the evolution of the dissolved solids.

Anodized aluminum frame and panels made of painted steel.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

All elements of this unit are chemically resistant.

<u>Supply unit</u>:

Storage tank for raw water, volume: 400 l.

<u>Process unit</u>:

Peristaltic pump to supply raw water:

Max. flow: 240 l/h.

Max. head: 8 bar.

Transparent precipitation tank. Volume: 10 l. It includes:

Adjustable speed stirrer with display for rpm (0 – 2200 rpm).

"J" type temperature sensor.

Transparent coagulation-flocculation tank made of PETG. Total volume: 45 l.

It is divided into two main tanks, coagulation and flocculation.

It includes four adjustable speed stirrers with display for rpm (0 – 2200 rpm).

Transparent lamella separator made of PETG. Volume: 100 l.

21 removable lamelas made of PMMA with a preset angle of inclination of 60°.

The number and inclination of the lamellas can be changed.

Sludge tank made of HDPE. Volume: 20 l.

Treated water tank made of HDPE. Volume: 400 l.

Three tanks for the addition of chemicals made of HDPE. Volume: 20 l.

Three adjustable speed pumps for the addition of reagents:

Maximum flow: 2.1 l/h.

Maximum pressure: 5 bar.

Double regulation range: 0 – 100% and 0 – 20%.

Flow meter to measure the raw water flow, range: 15 – 160 l/h.

pH/conductivity and total dissolved solids sensor:

pH range: 0 – 14.

Conductivity range: 0 – 1990 μS/cm.

Total dissolved solids range: 0 – 1990 ppm.

Inclined seat valve to regulate the raw water flow.

Flushing and cleaning valve for the separator.

Six sample collection points distributed in different tanks of the unit.

LEDs for the coagulation-flocculation process visualization.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

SPFB detail

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Familiarization with precipitation, flocculation and sedimentation processes.

2.- Analysis of the pH influence on precipitation.

3.- Analysis of the stirring influence on precipitation, coagulation and flocculation.

4.- Study of the operation of a lamella separator and influence of the number of lamellas.

5.- Quantitative analysis of the amount of precipitant, coagulant and flocculant in the water treatment process.

6.- Determination of a steady operating state.

Additional practical possibilities:

7.- Treating wastewaters with different characteristics.

8.- Choosing the most appropriate reagents for each type of raw water thanks to the results of the gravimetric analysis.

9.- Comparing possible methods to determine the efficiency of the coagulation, flocculation and settling processes.

REQUIRED SERVICES

- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.

REQUIRED ACCESSORIES (Not included)

- Instrumentation for the analytical method (gravimetry to analyze total solids).

REQUIRED CONSUMABLES (Not included)

- Raw water.
- Neutralizer.
- Flocculant.
- Coagulant.

DIMENSIONS AND WEIGHTS

SPFB:
  Supply unit:
      -Dimensions: 1100 x 800 x 800 mm approx.
                (43.30 x 31.49 x 31.49 inches approx.)
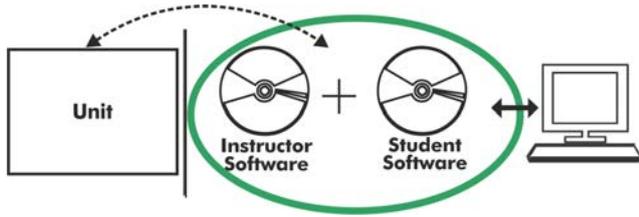   -Weight: 50 Kg approx.
                (110 pounds approx.)
  Process unit:
      -Dimensions: 1900 x 950 x 1810 mm approx.
                (74.80 x 37.40 x 74.25 inches approx.)
      -Weight: 350 Kg approx.
                (771 pounds approx.)
  Electronic console:
      -Dimensions: 490 x 330 x 310 mm approx.
                (19.29 x 12.99 x 12.20 inches approx.)
      -Weight: 10 Kg approx.
                (22 pounds approx.)

SPFB/ICAI. Interactive Computer Aided Instruction Software System:

With no physical connection between unit and computer (PC), **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.
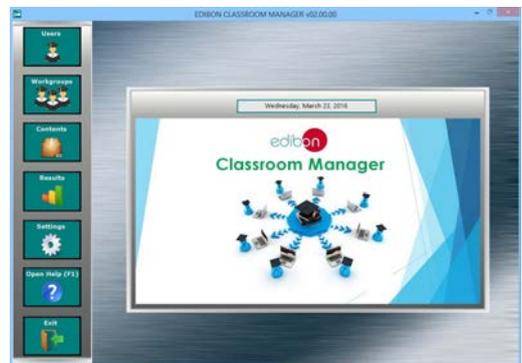
<u>Instructor Software</u>

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

• User Data Base Management.

• Administration and assignment of Workgroup, Task and Training sessions.

• Creation and Integration of Practical Exercises and Multimedia Resources.

• Custom Design of Evaluation Methods.

• Creation and assignment of Formulas & Equations.

• Equation System Solver Engine.

• Updatable Contents.

• Report generation, User Progression Monitoring and Statistics.
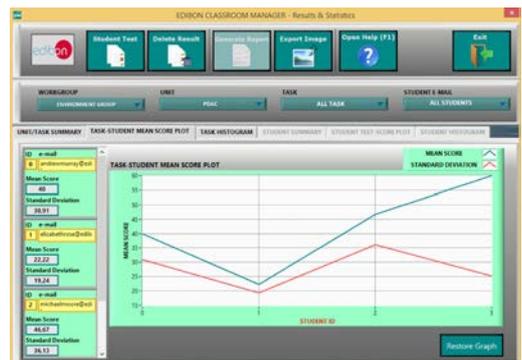

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen

ECAL. EDIBON Calculations Program Package - Formula Editor Screen
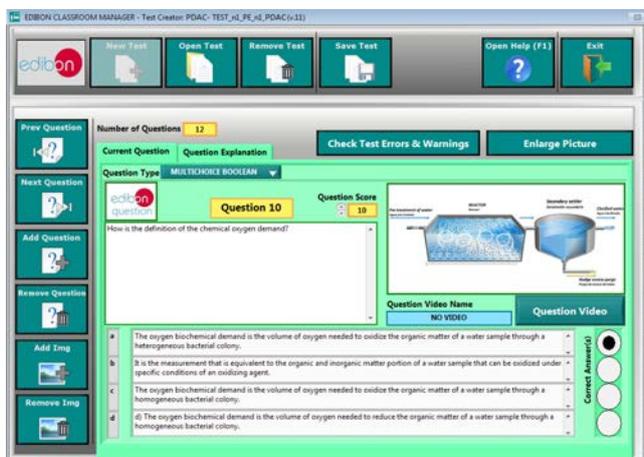
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

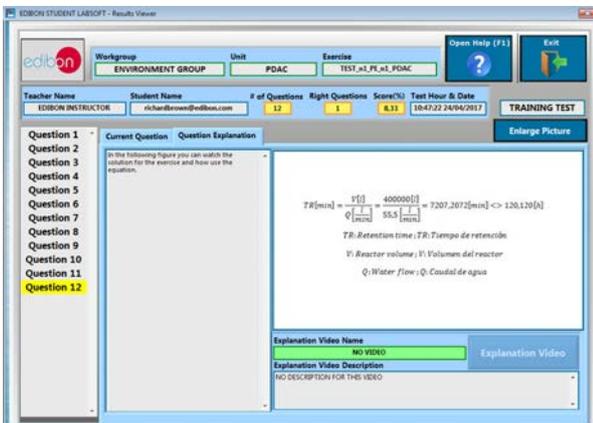For more information see ICAI catalogue. Click on the following link:
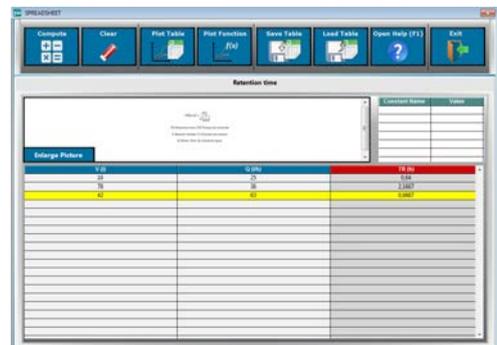www.edibon.com/en/files/expansion/ICAI/catalog

ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen
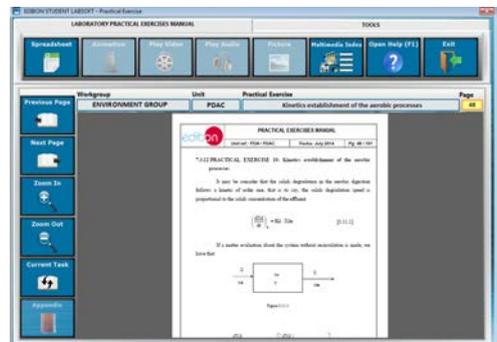
EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product.

REPRESENTATIVE: