demEAUmed Technologies

Electrocoagulation-flotation technology

Eight categories of innovative technologies together with a monitoring, control and decision support system are integrated and demonstrated in real life situation within the European project demEAUmed "demonstrating integrated innovative technologies for an optimal and safe closed water cycle in Mediterranean tourist facilities." This factsheet presents one of these eight technologies; the **Electrocoagulation-flotation (EC-EFl)** technology.

Description

Electrocoagulation-flotation (EC-EFl) is an electrochemical process used as an alternative to conventional coagulation/flotation processes. In this advanced technology, coagulum agents are generated through electrochemical oxidation of sacrificial metallic plates (e.g. iron or aluminium) used as anodic material (Equation 1). Obtained Fe(II)/Fe(III) (Equation 2) or Al(III) precipitate with hydroxide ions (Equations 3 and 4) generating coagulum particles which destabilize and adsorb water pollutants by surface complexation or electrostatic attraction. Pollutants are removed by sedimentation or electro-flotation producing bubbles of hydrogen gas at cathode surface (Equation 5).

$$Fe_{(s)} \rightarrow Fe^{2+}_{(aq)} + 2e^- \quad (1)$$
$$Fe^{2+}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + 1e^- \quad (2)$$
$$Fe^{2+} + 2OH^-_{(aq)} \rightarrow Fe(OH)_{2(s)} \quad (3)$$
$$Fe^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Fe(OH)_{3(s)} \quad (4)$$
$$2H_2O_{(l)} + 2e^- \rightarrow H_{2(g)} + 2OH^-_{(aq)} \quad (5)$$

The innovation of EC-EFl lies behind the polarity inversion which performs several times per minute in order to combine the electrocoagulation process with flotation due to hydrogen and oxygen generation in the electrodes (Equation 6 and 7):

$$H_2O_{(l)} \rightarrow \tfrac{1}{2}\, O_{2(g)} + 2H^+_{(aq)} + 2e^- \quad (6)$$
$$H_2O_{(l)} + e^- \rightarrow \tfrac{1}{2}\, H_{2(g)} + OH^-_{(aq)} \quad (7)$$

Applicability

Electrocoagulation-flotation process is used as primary treatments for wastewater treatment in order to remove suspended solids, oils, fats and slightly reduce the turbidity and the organic matter content. If needed, it could be also applied for kitchen effluent treatment.
EC-EFl is used for other effluents such as industrial pollutants which have high suspended solids, metal and organic matter content.

Design Criteria for demEAUmed

Size

The dimensions of the pilot plant are expected to be around 2m x 2m x 2m.

Location

As EC-EFl will be used as primary treatment, thus it has to be located close to both wastewater catchment and secondary treatments.

The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-20) under grant agreement nº 619116

Flows
From approximately 0.1m^3/h to 1m^3/h.

Operation and Maintenance

- Acidic cleaning systems in order to remove the fouling on electrodes and in the inner part of the CPC borosilicate.
- Changing the electrodes periodically.

Advantages of EC-EFI

- It is a compact system.
- Minimization of the use of chemicals externally added.
- Possibility of water reuse.
- Removal of toxic/recalcitrant emergent pollutants.
- Possibility to be fed by solar PV panels.

Costs issues (or additional value)

- Generation of in-situ coagulants that avoid the use of external chemicals.
- Solar light could be used as an energy resource.

Contact:
Electrocoagulation-flotation Supplier:

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Please find further information and updates on demEAUmed project, its technologies and DSS at: www.demeaumed.eu

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