EJERCICIO 1

SE ESTA CONSTRUYENDO UNA DEPURADORA PARA UNA POBLACIÓN CON 15.000 HABITANTES EN LA ACTUALIDAD, QUE TIENE UN CRECIMIENTO ANUAL DE POBLACIÓN DEL 2 %, Y UNA DOTACION DE 250 L/h/d.,

SE DIMENSIONA PARA UNA VIDA UTIL DE 25 AÑOS.

EL SISTEMA SECUNDARIO ES UN CONTACTOR BIOLOGICO ROTATIVO (CBR).

SE PIDE

1. CALCULAR EL CAUDAL MEDIO QUE PUEDE LLEGAR A LA DEPURADORA EN EL AÑO HORIZONTE.

2. CALCULAR CAUDAL PUNTA SEGÚN LA FORMULA QUE SE ADJUNTA

$$Qp = Qm\,x\,(1 + (14/4 + \sqrt{P}))\ \text{EN m3/h}$$

P POBLACION EN MILES DE HABITANTES

Qm CAUDAL MEDIO

3. Determinar el número de etapas necesarias para la eliminación de DBO5 soluble en un contactor biológico rotativo de 60 mg/L a 20 mg/L. El caudal a tratar es de 20.000 m3/d y en cada etapa el área de los discos utilizados suma 20.000 m2.

$$S_n = \frac{-1 + \sqrt{1 + 4 \cdot 0{,}00974 \cdot \left(A/Q\right) \cdot S_{n-1}}}{2 \cdot 0{,}00974 \cdot \left(A/Q\right)}$$

donde S_n: Concentración de DBO_5 soluble en la etapa n, mg/L; A: área superficial de los discos en la etapa n, m^2; Q: caudal, m^3/d.

EJERCICIO 2

Taking into account that Phoenix Project has concluded and based on the documentation provided, please draw up the project sustainability plan to be implemented during a 10 years time period.

OBJECTIVES

LIFE PHOENIX will demonstrate a flexible new tertiary multibarrier water treatment, which is adaptable to different WWTP typologies and water characteristics. This new treatment will be applied in highly water-stressed areas in central and southern Spain, and central Portugal. It will increase removal of organic matter, solids and pathogens using high-efficiency settling, filtration, flotation and biological technologies. These will be coupled with advanced oxidation processes (AOP)/disinfection steps able to go further in reducing the microbiological presence in water.

Specifically, the project aims to:

- Demonstrate and validate the new cost-effective multibarrier treatments in two WWTPs typologies, at large-medium scale in 3 WWTPs in Spain and Portugal and at small scale in 2 WWTPs in Spain, using different combinations of state-of-the-art and innovative technologies;
- Develop a Decision Support System (DSS) and a Sustainability Tool to ensure feasibility for each case;
- Minimise environmental and health effects, by reducingharmful disinfection/oxidation products and eco-toxicity (by >80%), compounds of emerging concern (CECs) and antibiotic resistant bacteria (ARBs) (>90%), microplastics (>97%), and carbon footprint (50%);
- Ensure water quality by online monitoring (e.g. toxins and pathogens) and offline analysis (e.g. eco-toxicity and ARBs);
- Reduce the cost of tertiary treatment;
- Recover >90% of nutrients (nitrogen and phosphorus);
- Test regenerated water and recovered fertilizer on experimental crop fields;
- Promote replication, transferability and market uptake of the new water treatment technologies; and
- Evaluate environmental, social and economic impacts.

LIFE PHOENIX will contribute to maintaining the operation of existing WWTPs, along with the setting up of new WWTPs, as per Regulation (EU) 2020/741 on minimum requirements for water reuse. The Regulation promotes water reuse by harmonising minimum water quality requirements for the safe reuse of treated urban wastewater in agricultural irrigation.

RESULTS

Expected results:

- Obtain reusable water, meeting EU wastewater reuse class A quality standards at 3 demonstration sites for testing large-medium WWTP technologies (El Bobar, Almonte and Fonte Quente WWTPs) and at 2 demonstration and 1 replication sites for small WWTP technologies (El Toyo, Talavera, Pulp WWTPs);

- Validation of indicator microorganisms and performance targets: (1) E. coli for pathogenic bacteria (5.0 log10 reduction), (2) coliphages for pathogenic viruses (6.0 log10 reduction), and (3) Clostridium perfringens spores for protozoa (5.0 log10 reduction);

- Minimised environmental and human health effects of water reuse: reduced eco-toxicity of regenerated water compared to drinking water (<5%), reduced CECs and pesticide levels, less microplastics (lower than 10 particles/m3), 50% reduction in carbon footprint for tertiary treatment due to lower energy consumption, total nitrogen (TN) in reusable water lower than 2 g/m3 and total phosphorus (TP) lower than 0.5 g/m3 (El Toyo and Talavera WWTPs) due to zeolite adsorption;

- Contribution to the protection of Doana National Park, by avoiding the use of 87.6 k m3 of freshwater per yearor the irrigation with lower quality waters (Almonte WWTP);

- 50% lower Operation and Maintenance costs (OPEX) (from 0.23-0.25 euro/m3 of current advanced tertiary), mainly due to lower pre-treatment chemicals consumption, O3 reuse, low membrane fouling, improved oxidation/disinfection steps, and solar-powered technologies;

- Reduced energy consumption (lower than 0.8 kWh/m3) due to the use of UV-LED technologies and solar power;

- Testing of the 900 kg/year of N-P loaded zeolite obtained, together with 125 m3/y reused wastewater, on 500 m2 of crop fields at El Toyo and Talavera WWTPs (250 m2 each);

- Operational PHOENIX DSS and Sustainability Tool;

- Replicability and transferability guides, and a business plan;

- 10 000 visits to projects website, participation in workshops and events of >300 people, and publication of 8 articles;

- Six direct and indirect jobs created as a result of the project;

- Establish a participative Stakeholder Advisory Panel (SAP), involving Public Authorities, Utilities, NGOs and CSOs, and experts and professionals, to ensure replicability and market uptake of the new technologies