



# PHA and EPS production by cyanobacteria microbiomes

## Collection, selection and upscaling of natural microbiomes

Beatriz Altamira-Algarra, Eva González-Flo, Joan García

GEMMA-Group of Environmental Engineering and Microbiology, Department Of Civil and Environmental Engineering, Universitat Politècnica de Catalunya

### Introduction

- **Polyhydroxyalkanoates (PHAs)** and **exopolysaccharides (EPSs)** are biopolymers industrially produced using pure culture systems supplied with chemically defined substrates
- **Cyanobacteria** produce both bioproducts through their photoautotrophic metabolism (use of CO<sub>2</sub> and solar energy)
- **Microbiomes** as a production system is currently hindered by fundamental knowledge gaps regarding process control and their composition

### Objectives

Obtaining cyanobacteria consortia from environmental samples for the production of biopolymers (PHA and EPS)

- Collection of environmental samples
- Selection of cyanobacteria vs. other phototrophs
- Upscaling cultures to evaluate their potential of bioproducts synthesis

### Methodology

Environmental samples collection from different sites around Barcelona (Spain) (Fig.1)



Samples were grown under phosphorus limitation to select cyanobacteria



Biomass growth

Microbiome characterization through microscopic observations (Fig. 2) and 16s rRNA analysis

PHA and EPS production evaluation (Fig. 3)

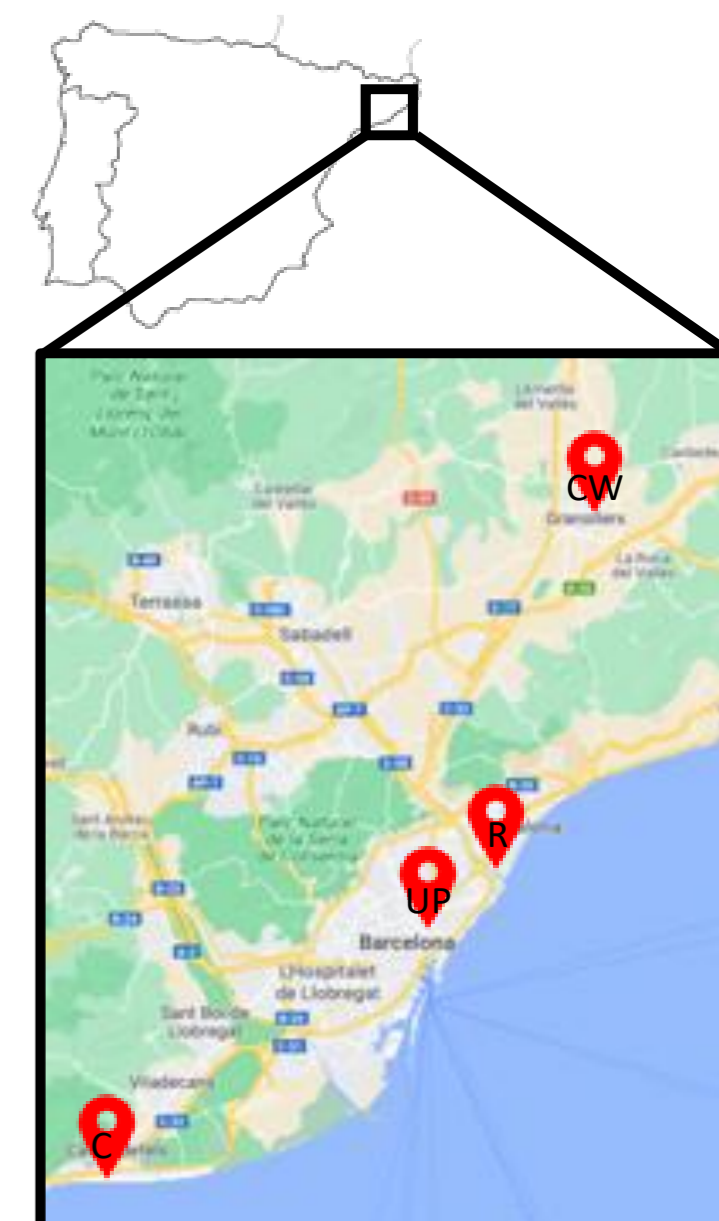


Figure 1. Location of environmental samples for cyanobacteria microbiomes. Red symbols in the map represent the sampling sites. CW: Constructed Wetland; R: River, U.P.: Urban Pond; C: Canal.

### Results

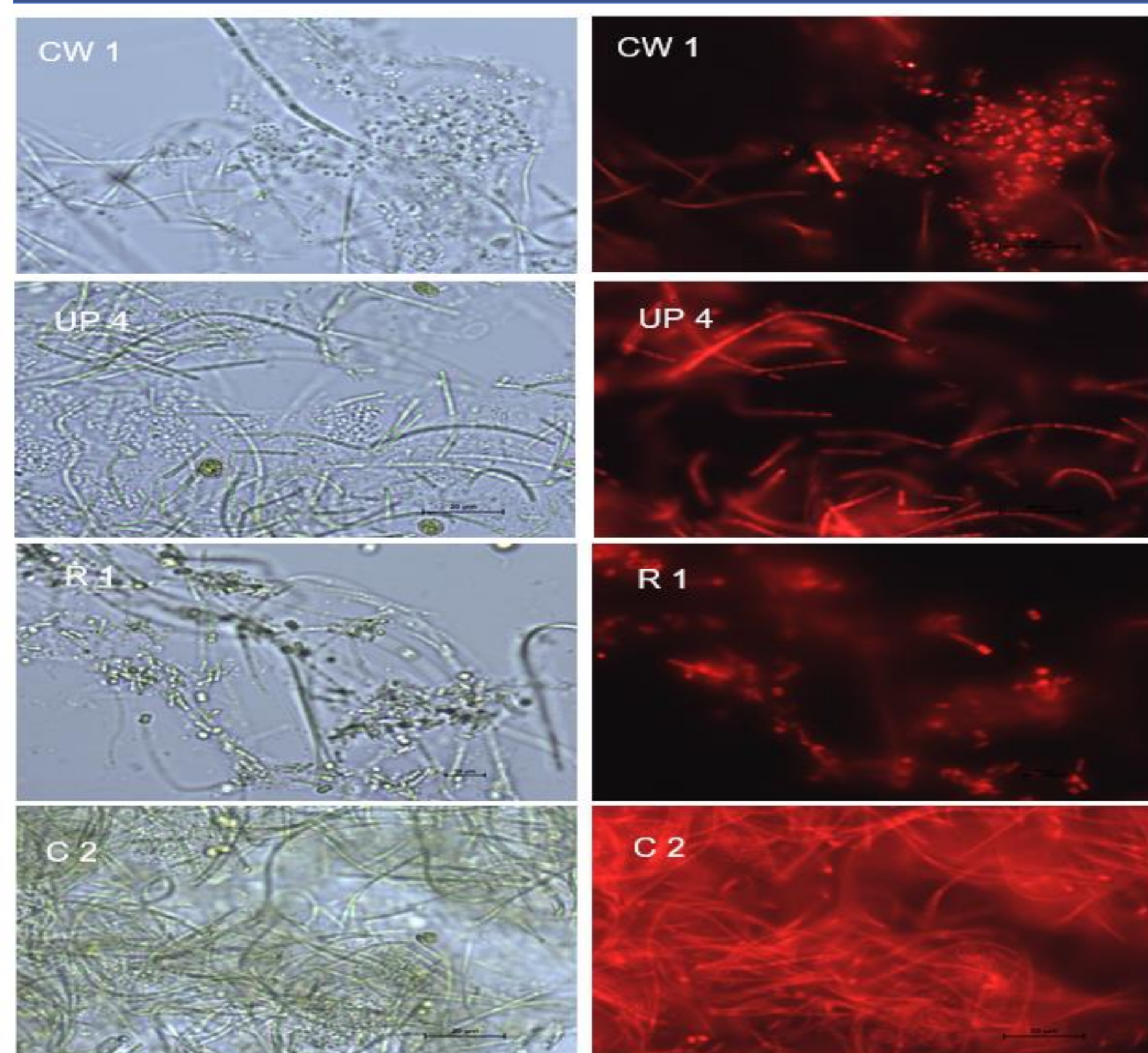


Figure 2. Microscope images of microbiomes observed under bright light and fluorescence microscopy at 400X. Filamentous and punctiform colonial cyanobacteria, *Synechocystis* sp. and cf. *Gloeobacter* were seen.

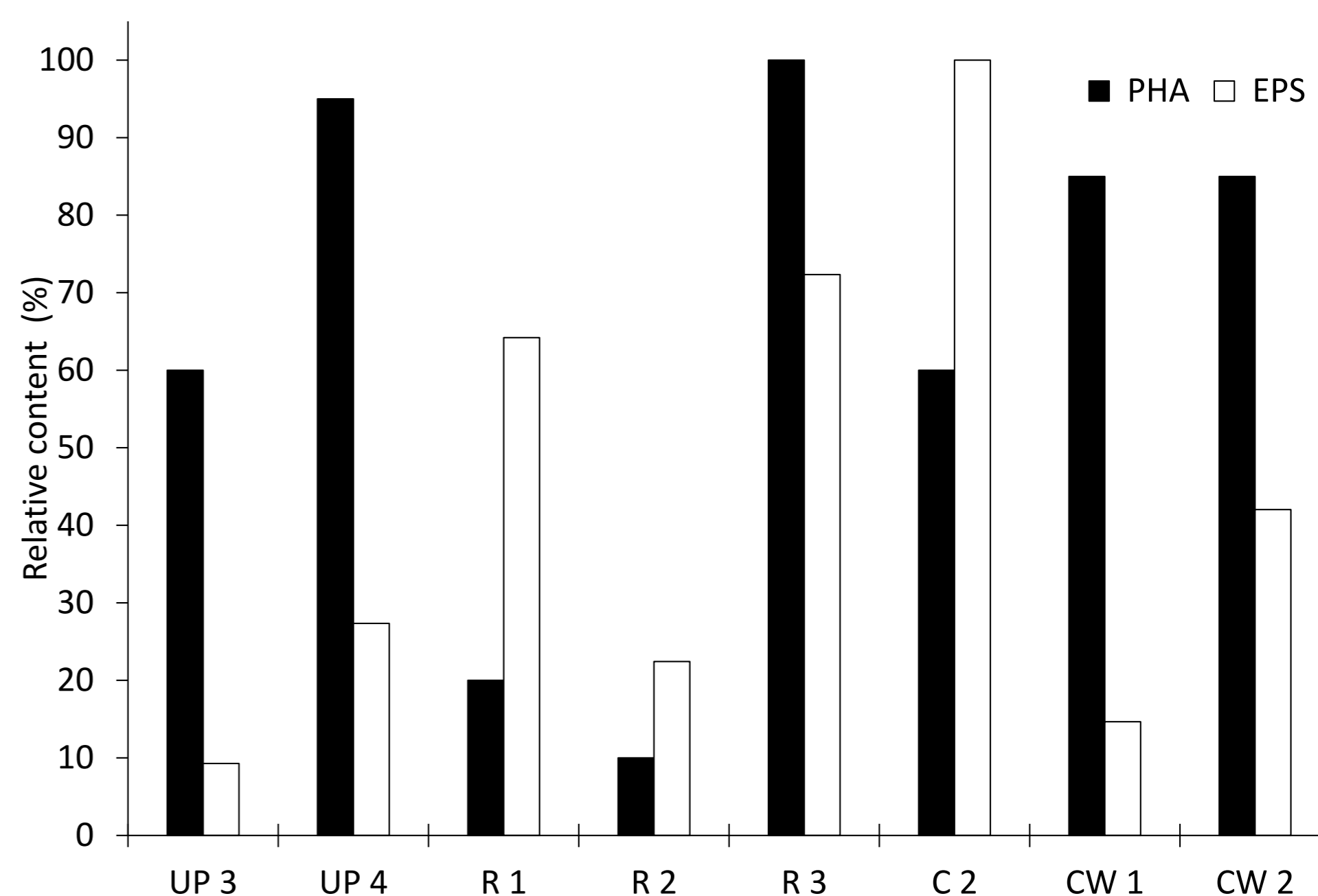


Figure 3. Relative PHA and EPS content of the different microbiomes. Relative content was calculated by normalizing each bioproduct concentration to the microbiome with higher bioproduct content.

### Future work

- Bioproduction by controlled microbiomes in 50 mL test tubes
- Selection of optimal conditions (period of light/darkness, organic and inorganic carbon)
- Upscaling bioproduction to 3 L photobioreactors

