

## Introduction

- Wineries produce **high-strength** organic wastewater (COD > 5 000 mg/L)
- Anaerobic** wastewater treatment is a commonly used treatment option
- Most systems are **mesophilic** ( $\pm 37^\circ\text{C}$ )
- Mesophilic systems have **high operating costs** to maintain temperature making them inaccessible to small-scale wineries
- An upflow Anaerobic Filter (AF) is a **packed, biofilm, high-rate** implementation of anaerobic wastewater treatment
- Upflow AFs are **robust** systems which are **simple** to operate

## Aim and Objectives

**Aim:** Investigate the effectiveness of a simple and low-cost upflow AF in treating representative synthetic winery wastewater (WWW) at ambient temperatures (20 - 25 °C), as well as the effect of hydraulic conditions on performance.

**Objectives:**

- Design and build a suitable experimental set-up
- Investigate the effects of hydraulic retention time (HRT) and upflow velocity on COD reduction
- Monitor the health/performance of the system

## Experimental set-up

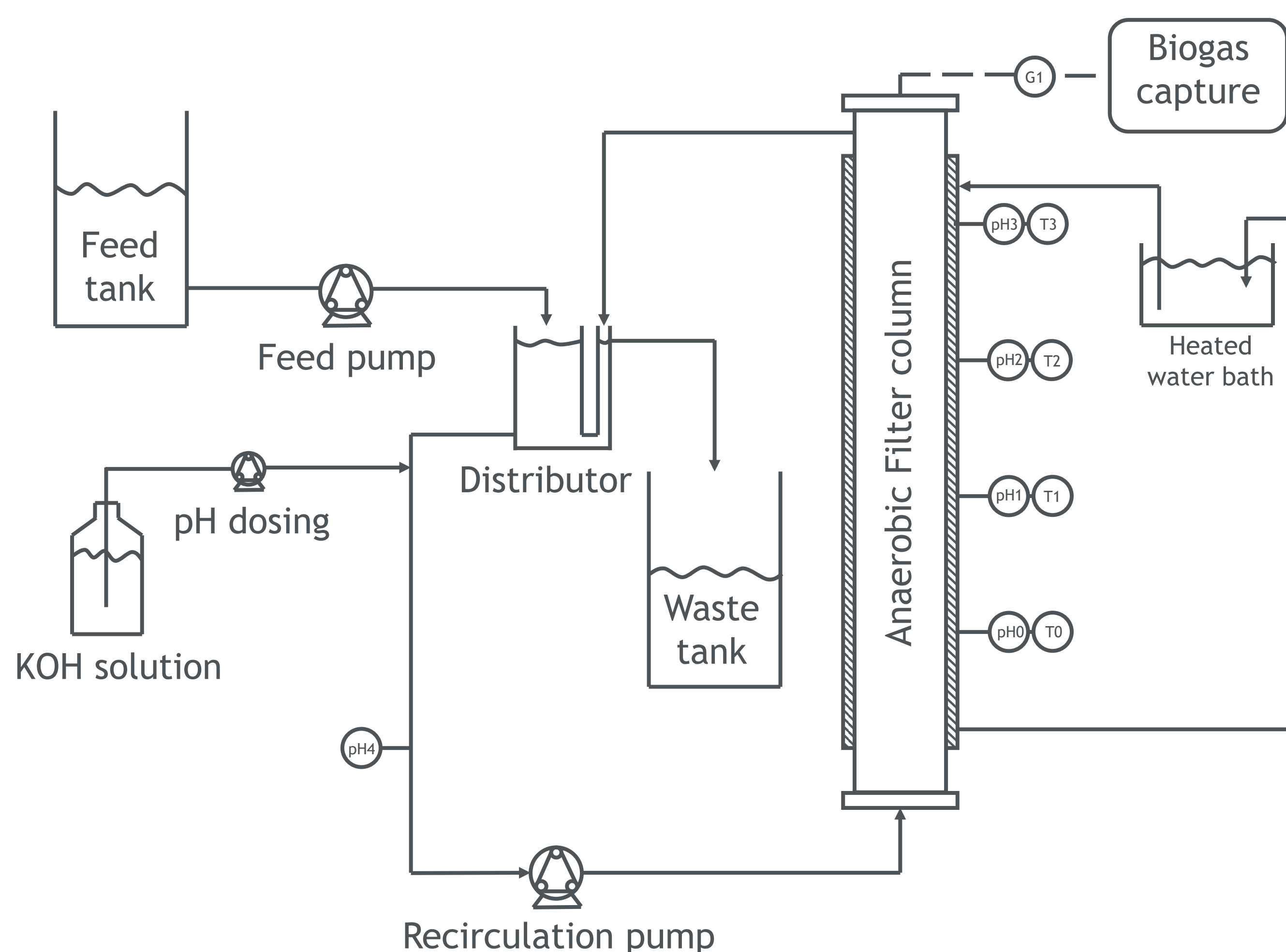


Figure 1: Schematic of experimental set-up

Table 1: Summary of key experimental design and operating parameters

Parameter	Specification	Units
Column height	3	[m]
Column diameter	110	[mm]
Working system volume	25.7	[L]
Upflow velocity	31 - 48	[m/day]
HRT	24 - 60	[hours]
Temperature	20 - 25	[°C]
Feed set-point pH	7.2	[-]
Packing	Plastic Pall rings	25 mm

## Results

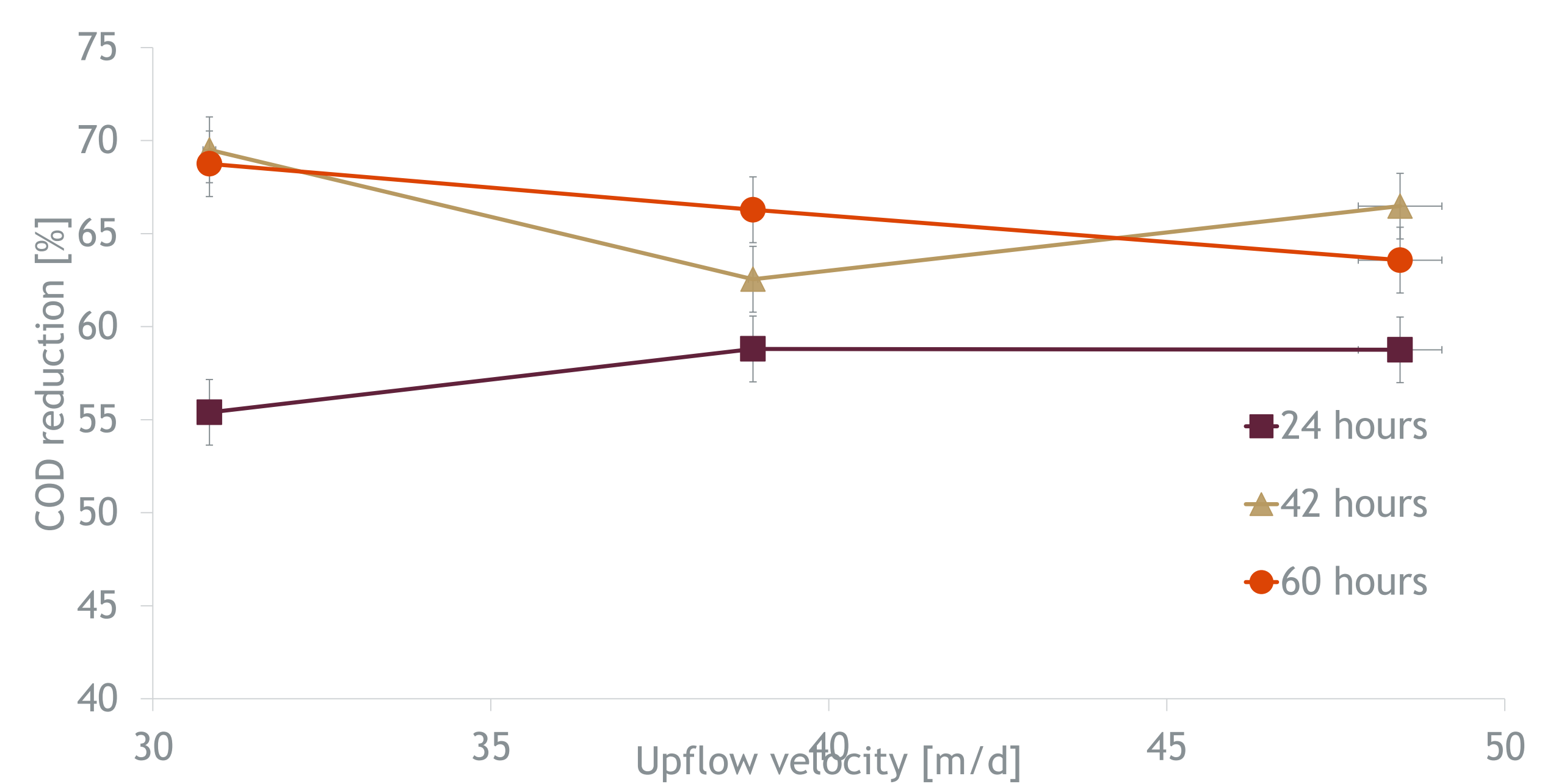


Figure 2: COD reduction of the system at various upflow velocities and HRTs

- As expected, 24 hours HRT showed the poorest performance at all upflow velocities
- Highest COD reduction of 69.5% seen at an upflow velocity of 31 m/day and HRT of 42 hours

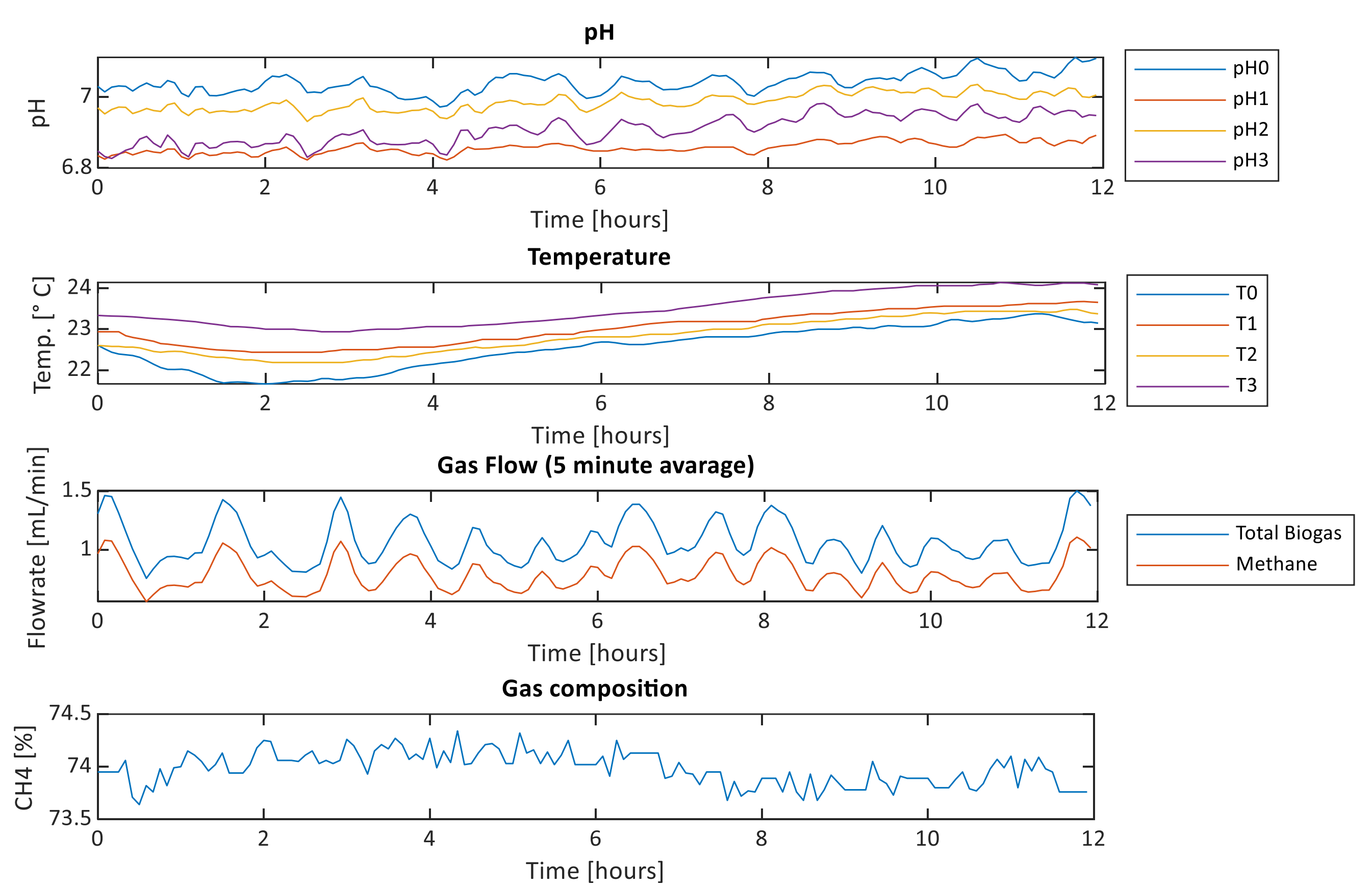


Figure 3: Example of system parameters logs during an experimental run

- Stable steady-state operation observed at higher upflow velocities
- Higher velocities result in better mixing within the column

## Conclusions

- The system showed good resilience and response to adverse and sub-optimal conditions
- The system met the minimum legal requirements for water reuse for irrigation at wineries
- The most stable system performance was seen at upflow velocities higher than 31 m/day
- Scope for future work in investigating the effect of different packing media on solids retention and performance