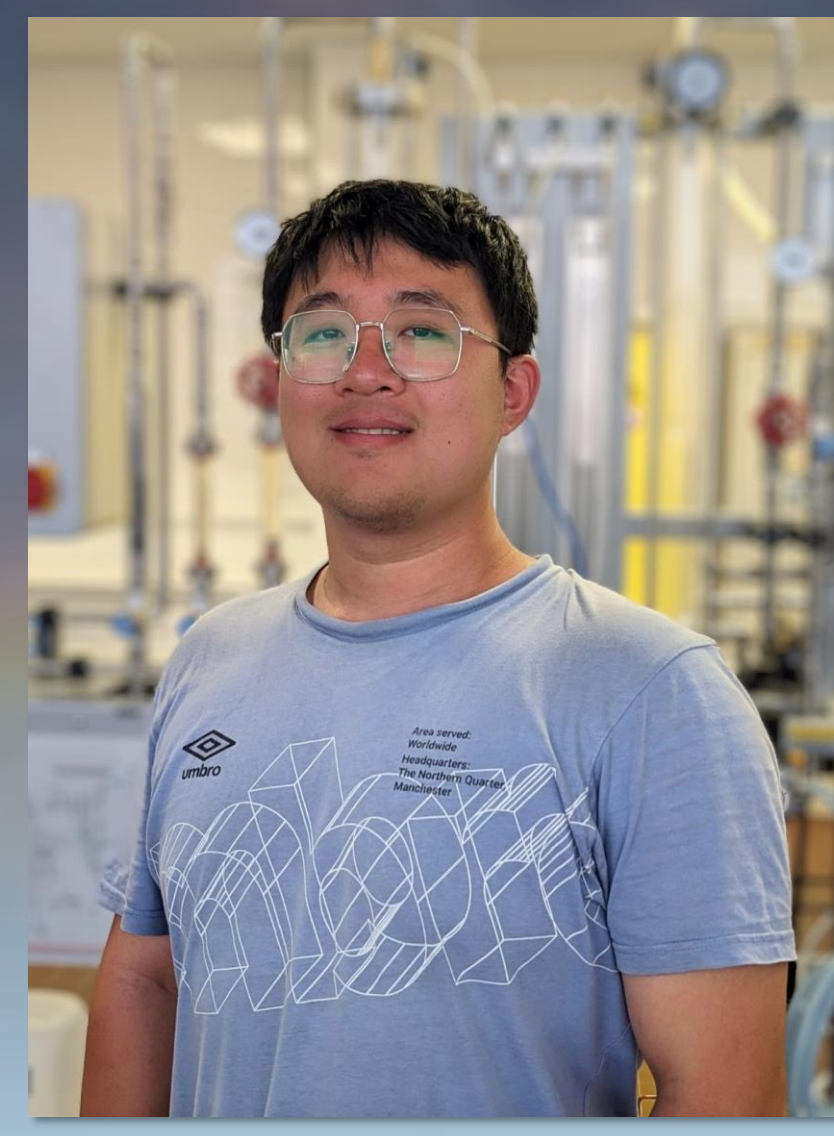


Application of vine-pruning-waste hydrochar for the catalytic ozonation of ibuprofen from water

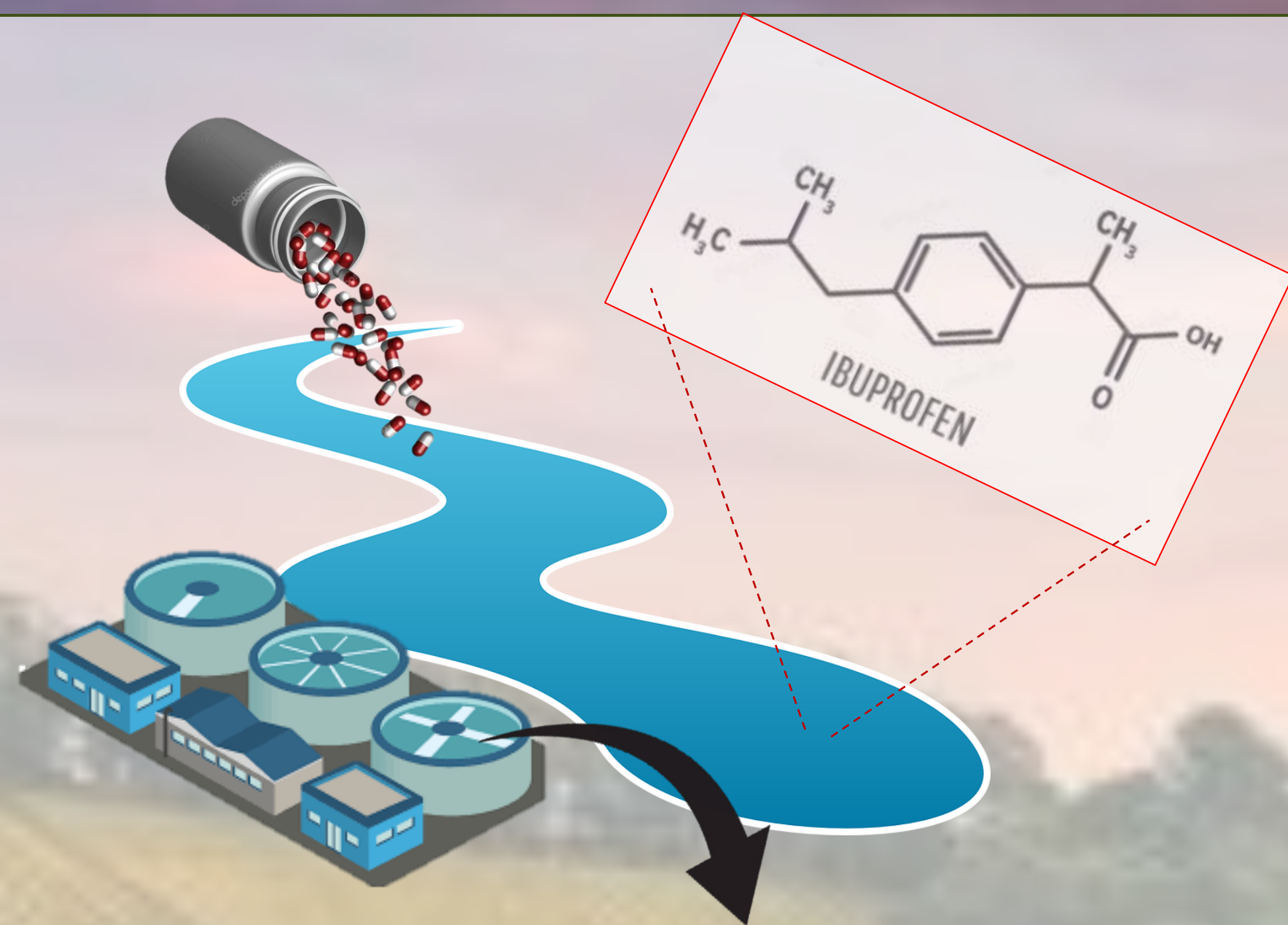
J. Nieto-Sandoval¹, R. P. Cavalcante^{1,2}, B. Bayarri¹, L. Whelan¹, Z. Sun¹, J.A. Malvestiti², R.F. Dantas², C. Sans¹

¹ Dept. of Chemical Engineering and Analytical Chemistry, Universitat de Barcelona, Barcelona, 08028, Spain

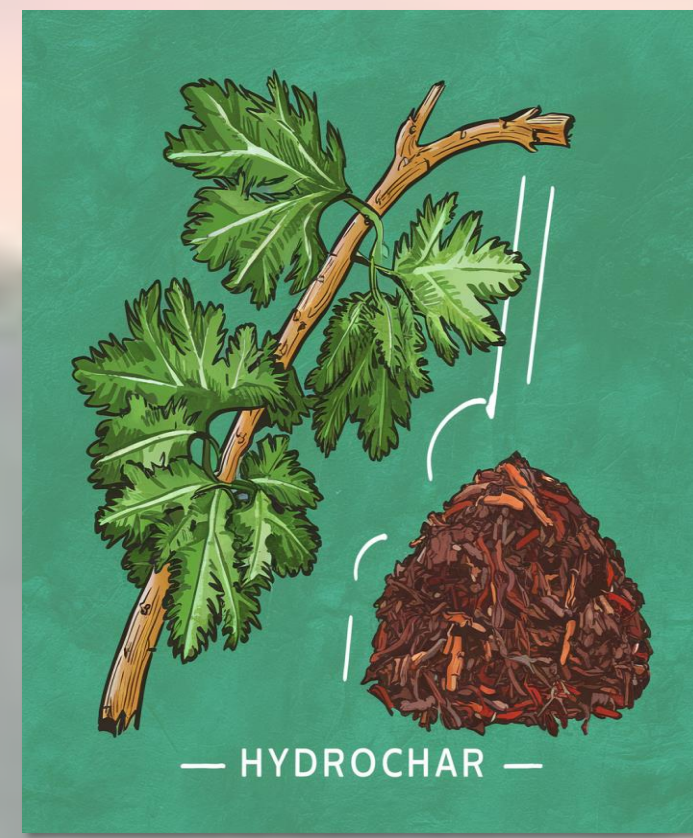
² Faculdade de Tecnologia, Universidade Estadual de Campinas, Limeira, SP, 13484-332, Brazil
(E-mail: samnaphee@gmail.com)



Introduction



Ocurrance of micropollutants such as pharmaceuticals in water courses.



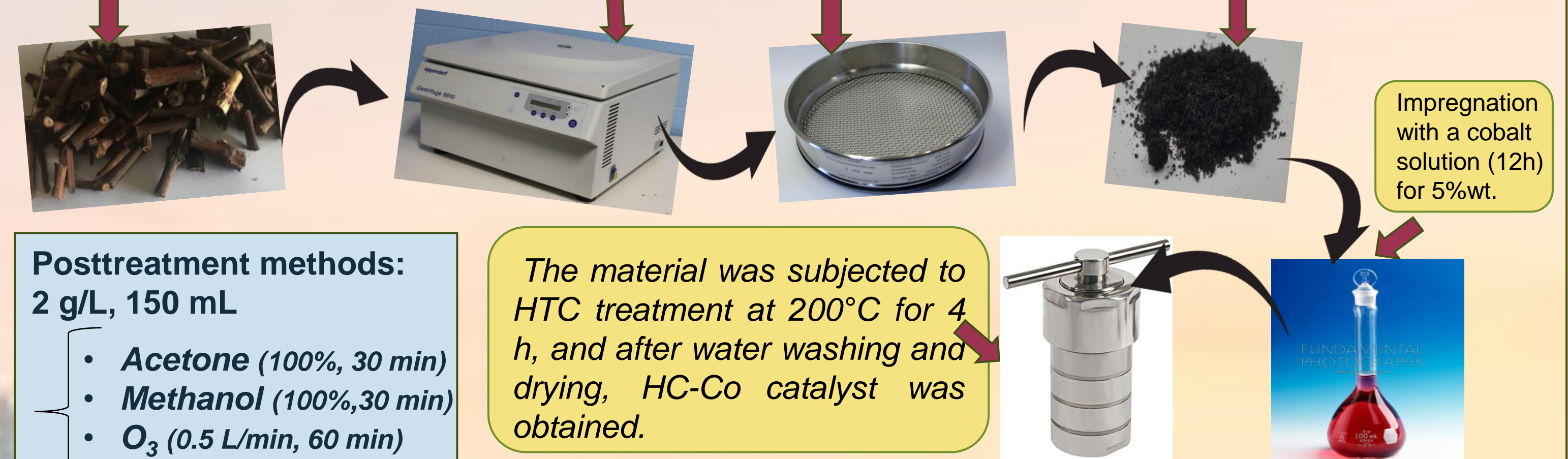
Advanced oxidation processes: Catalytic ozonation

This study explores the use of **hydrochar (HC)** derived from **vineyard pruning waste** as a **catalyst** for the catalytic ozonation of the pharmaceutical pollutant **ibuprofen (IBU)** in water.

Materials and Methods

Hydrochar synthesis

Vineyard pruning waste was cleaned, dried, and milled to a particle size below 250 μm



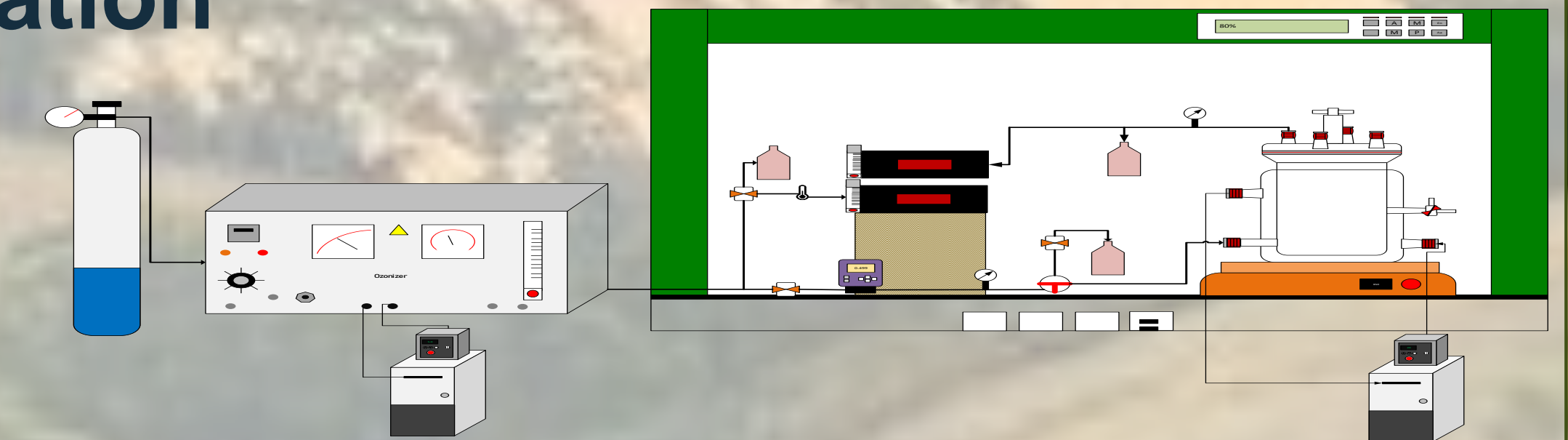
Posttreatment methods:
2 g/L, 150 mL

- Acetone (100%, 30 min)
- Methanol (100%, 30 min)
- O₃ (0.5 L/min, 60 min)
- H₂O₂ (15%, 30 min)

Catalytic ozonation

Operating conditions:

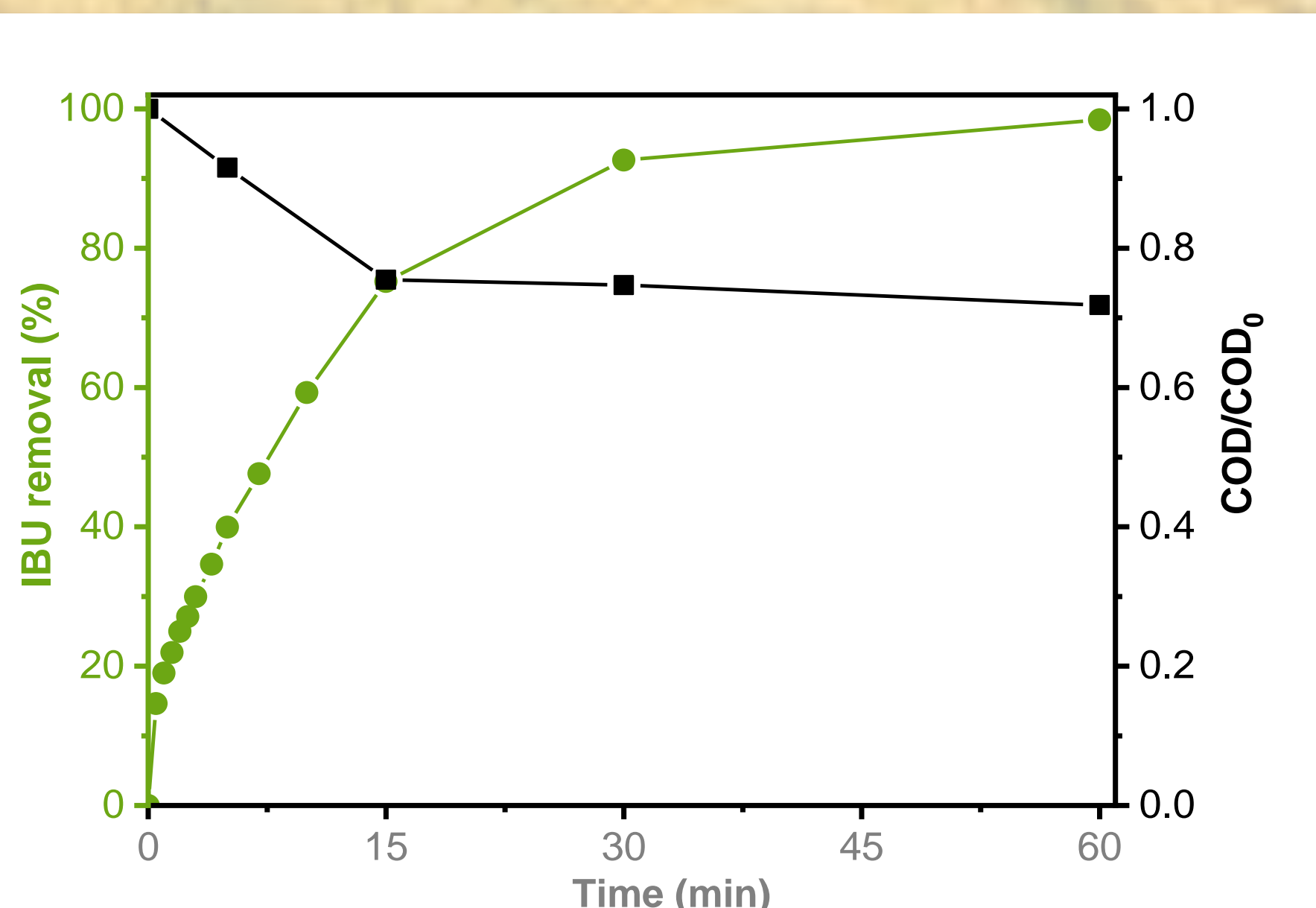
- 600 rpm
- pH₀ = natural (5,2)
- Temperature = 20 °C
- [catalyst]₀ = 0.025 g/L
- Ozone flow= 7.5 mg/min
- [IBU]₀ = 20 mg/L



ANALYSIS → HPLC-UV and COD

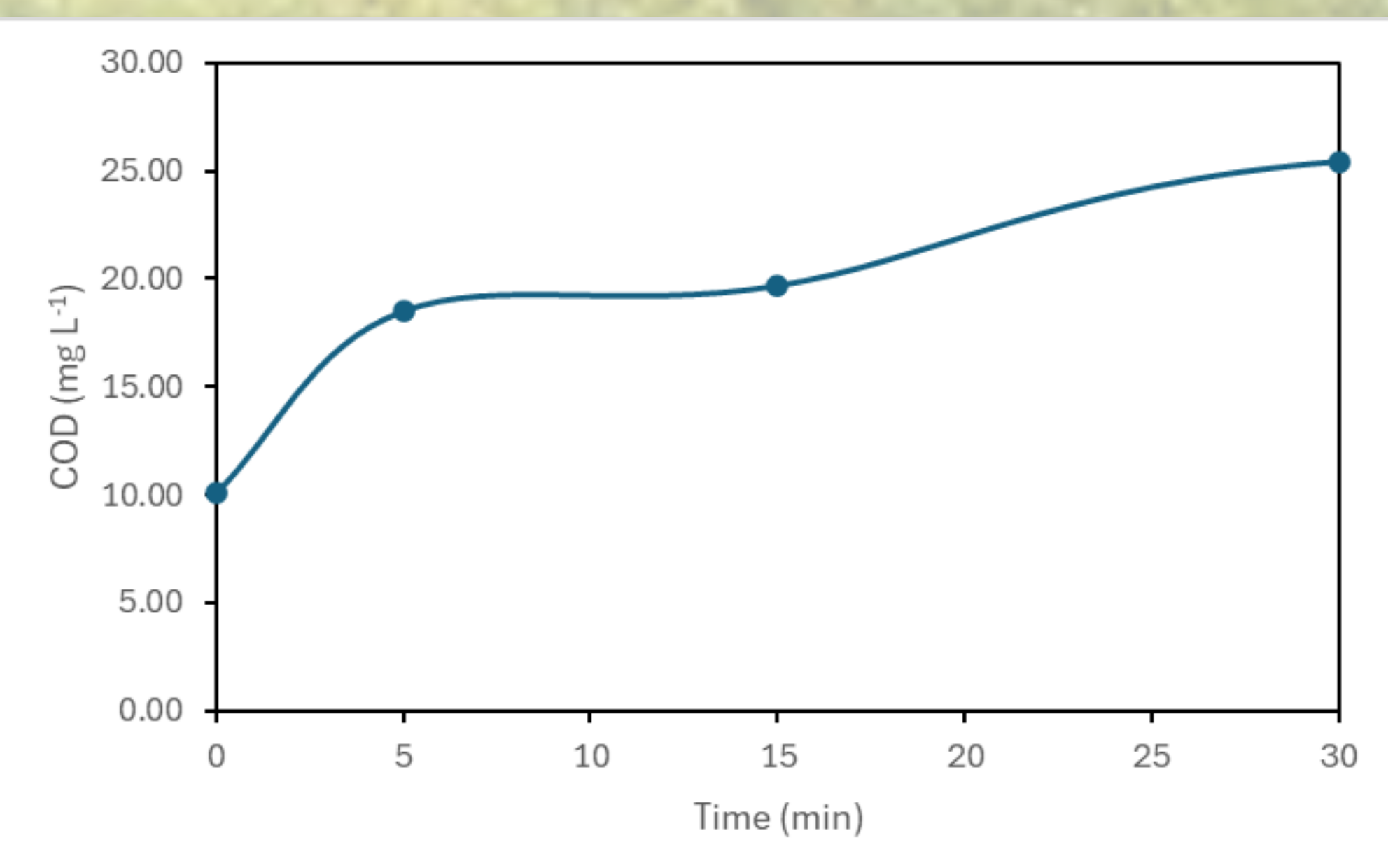
Results and Discussion

Single ozonation



IBU was completely removed through single ozonation in 1 h reaction time. However, **recalcitrant intermediates** were formed since the mineralization yield was close to 30%.

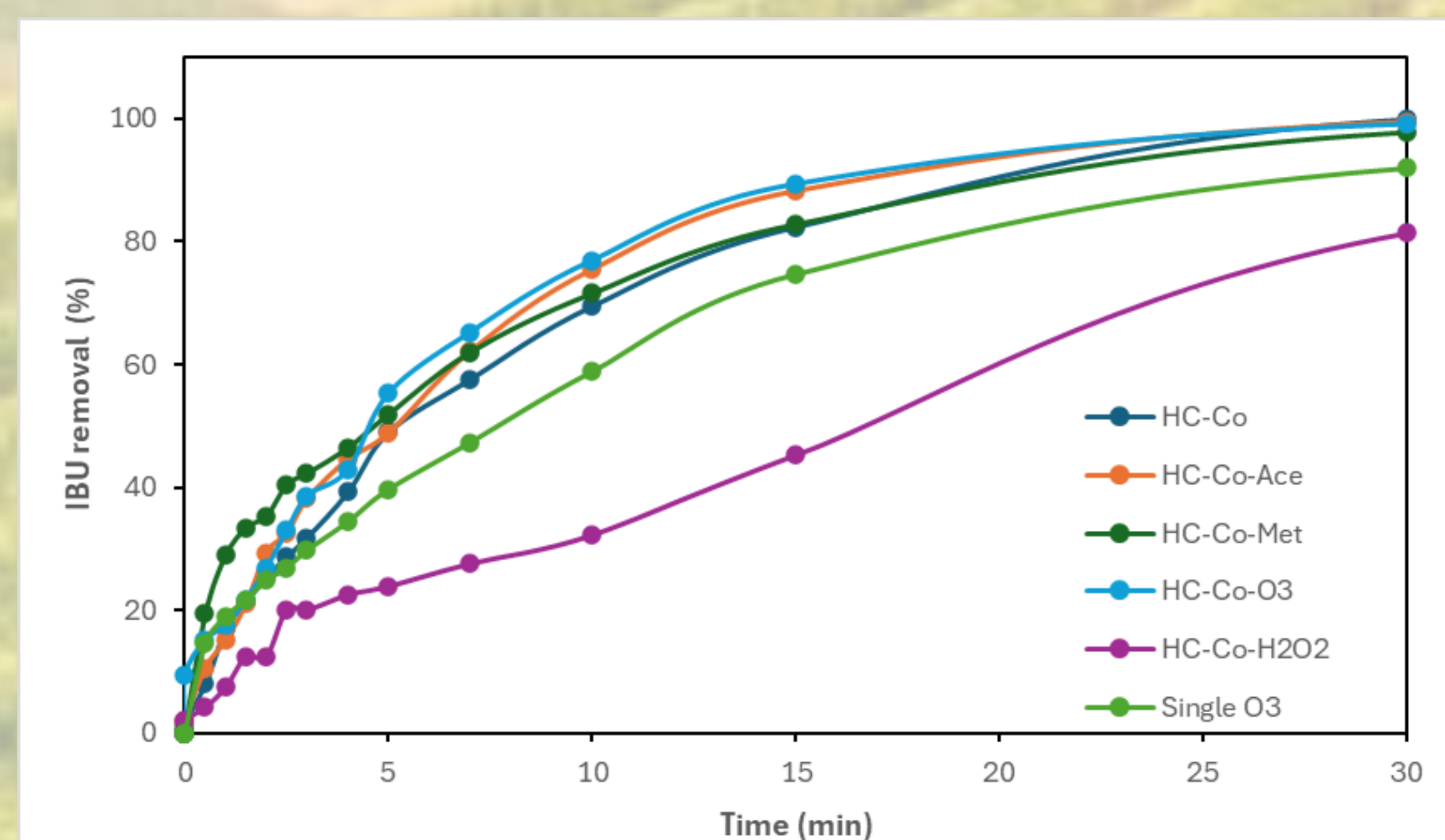
Impact of vineyard-based hydrochar



HC-Co was developed to use as catalyst to improve the removal of IBU and its mineralization. However, **organic matter leached** from the catalyst.

Development of posttreatment methods.

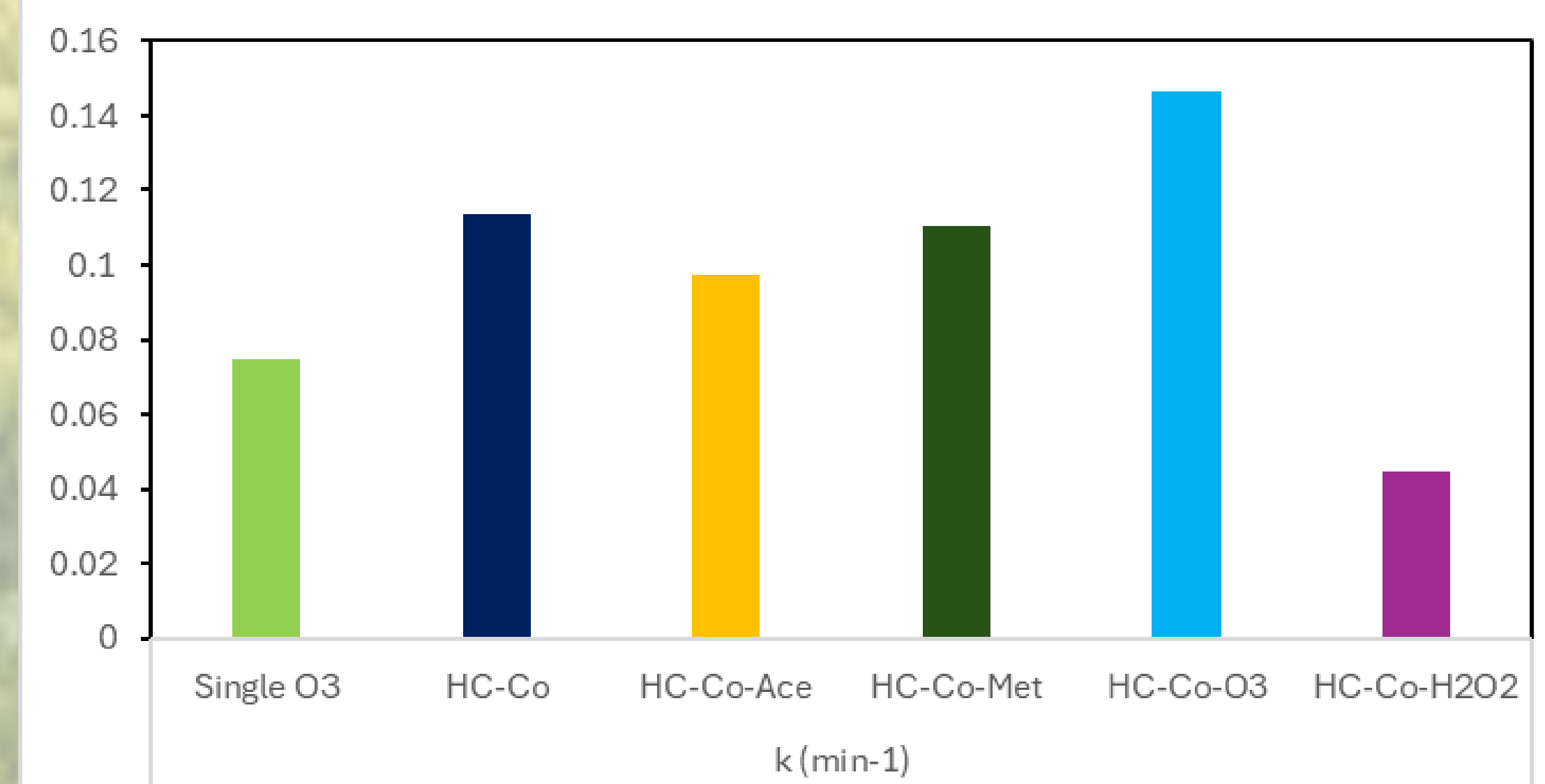
Effect of posttreatment



In the presence of **HC-Co** catalyst, IBU was completely removed in **30 min**.

IBU removal followed a **pseudo-first order kinetic**, and the kinetic constants were calculated.

Kinetic constant



After **posttreatment**, **methanol** showed the most promising results for IBU removal and not leaching organic matter.

Effect of catalyst dose HC-Co-Met



[HC-Co-Met]₀ = 0.025 g/L
→ k = 0.1109 min⁻¹

[HC-Co-Met]₀ = 0.05 g/L
→ k = 0.185 min⁻¹

[HC-Co-Met]₀ = 0.1 g/L
→ k = 0.0256 min⁻¹

Conclusions

- The use of hydrochar derived from vineyard pruning waste shows great potential as a catalyst for the removal of ibuprofen from water.
- The HC-Co catalyst showed organic matter leaching from the material during ozonation reactions.
- Posttreatment methods were explored, and methanol was found to be the most effective post treatment at a catalyst dose of 0.05 g/L.

Authors are grateful to the Ministry of Science and Innovation (projects PID2020-112674RB I00, TED2021-131569B I00, MINECO/FEDER, UE) for funds received to carry out this work.. Whelan thanks to Erasmus@tudublin.ie for supplying a grant to carry out this study.