

# Removal of analgesic pharmaceutical by adsorption onto biocarbons

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## Introduction

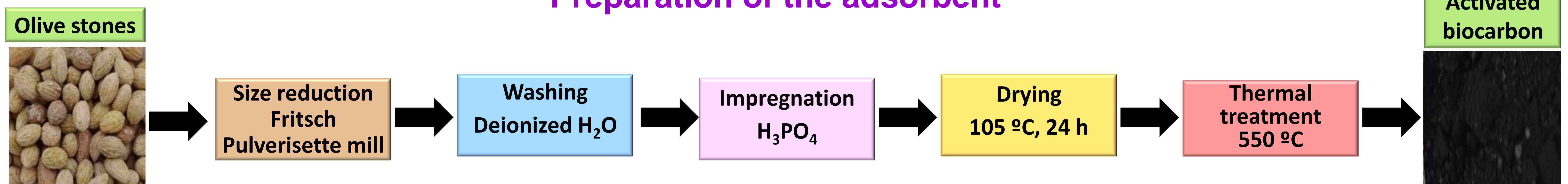
- ✓ The increasing consumption of pharmaceuticals constitutes an environmental problem due to the growing presence of unaltered pharmaceuticals and their metabolites in urban and industrial wastewater (Fraiha et al., 2024). The European Union has set a 2035 deadline for removing a wide spectrum of micropollutants, including pharmaceuticals that are deemed detrimental to human health. The standard processes currently used in wastewater treatment plants (WWTP) only allow to remove a portion of these pollutants (Patel et al., 2019).
- ✓ The adsorption process has been shown to be a successful way to remove diluted pollutants from wastewater (Varsha et al., 2022). However, the use of conventional adsorbents at industrial scale is limited by their high cost.

## Objective

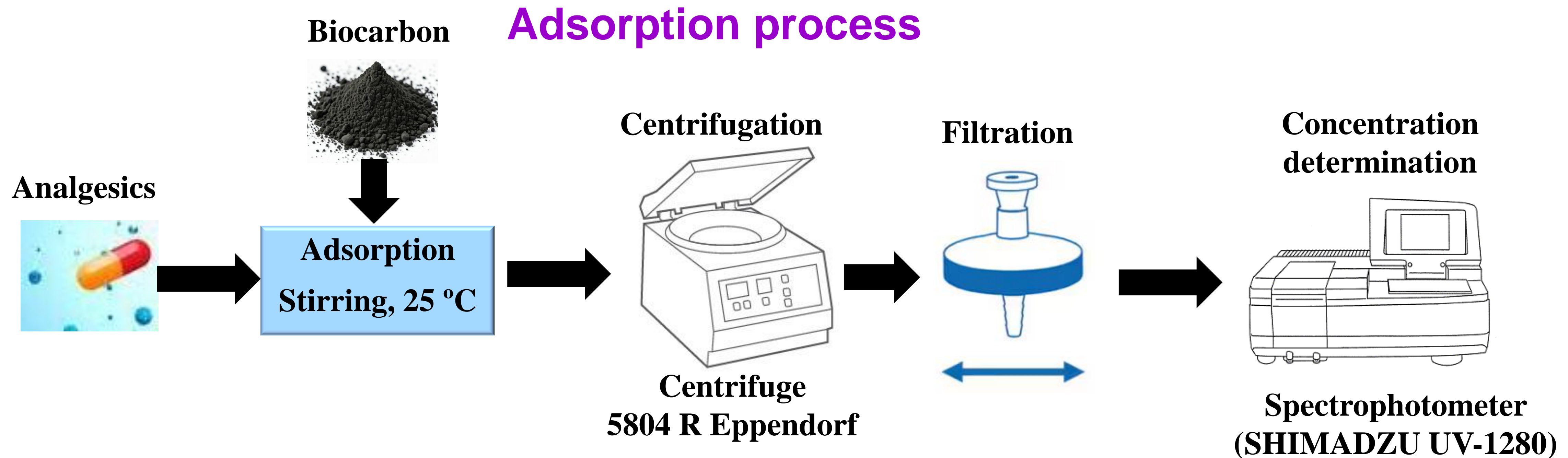
- ✓ The removal of an analgesic pharmaceutical, paracetamol, from wastewater was conducted by adsorption onto a non-conventional biocarbon.
- ✓ The process would allow achieving zero net waste, according to the New Action Plan for the Circular Economy (European Commission, 2020), on the path towards a competitive and climate-neutral economy.

## Methods and Equipment

### Preparation of the adsorbent

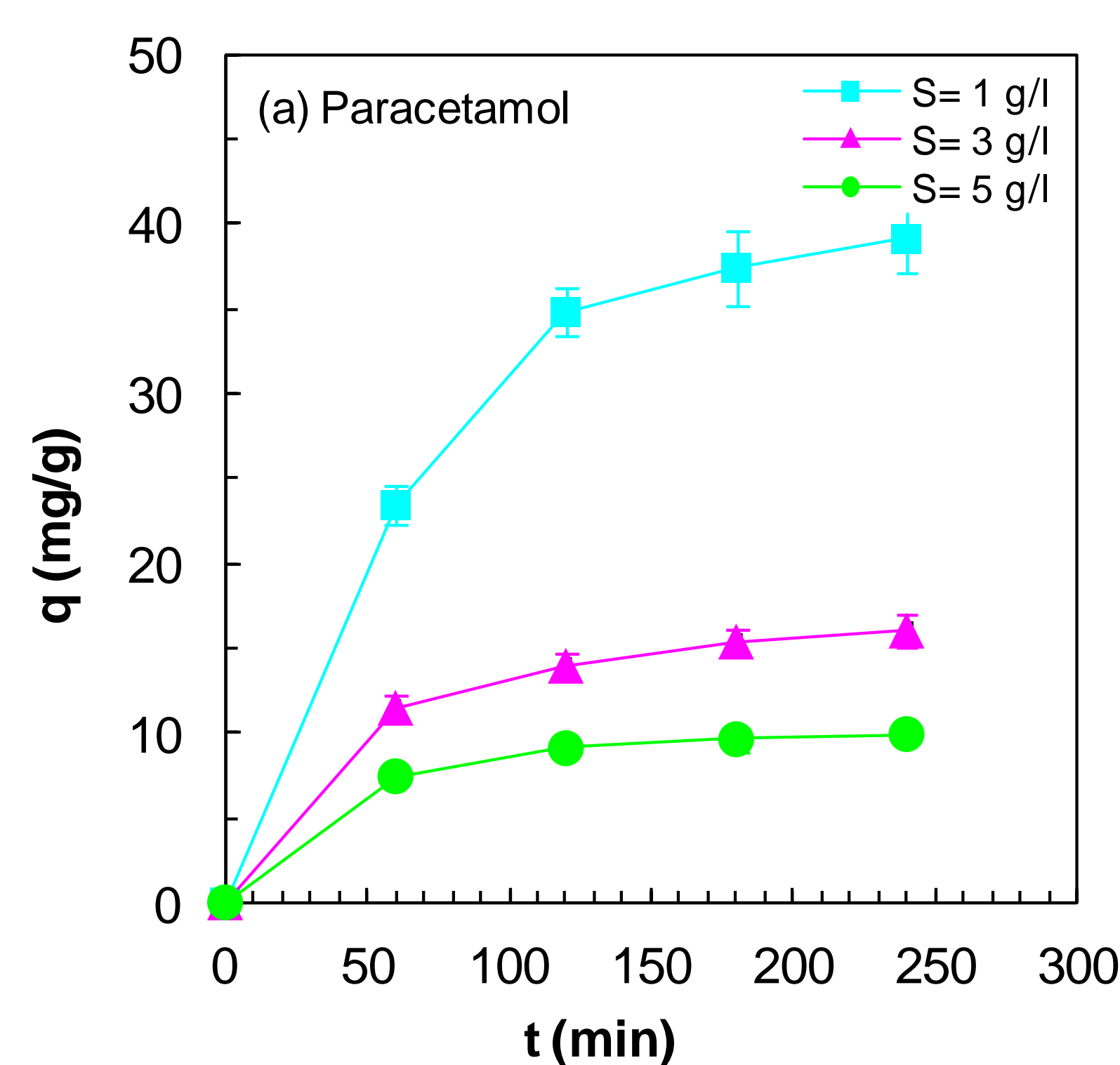


### Adsorption process

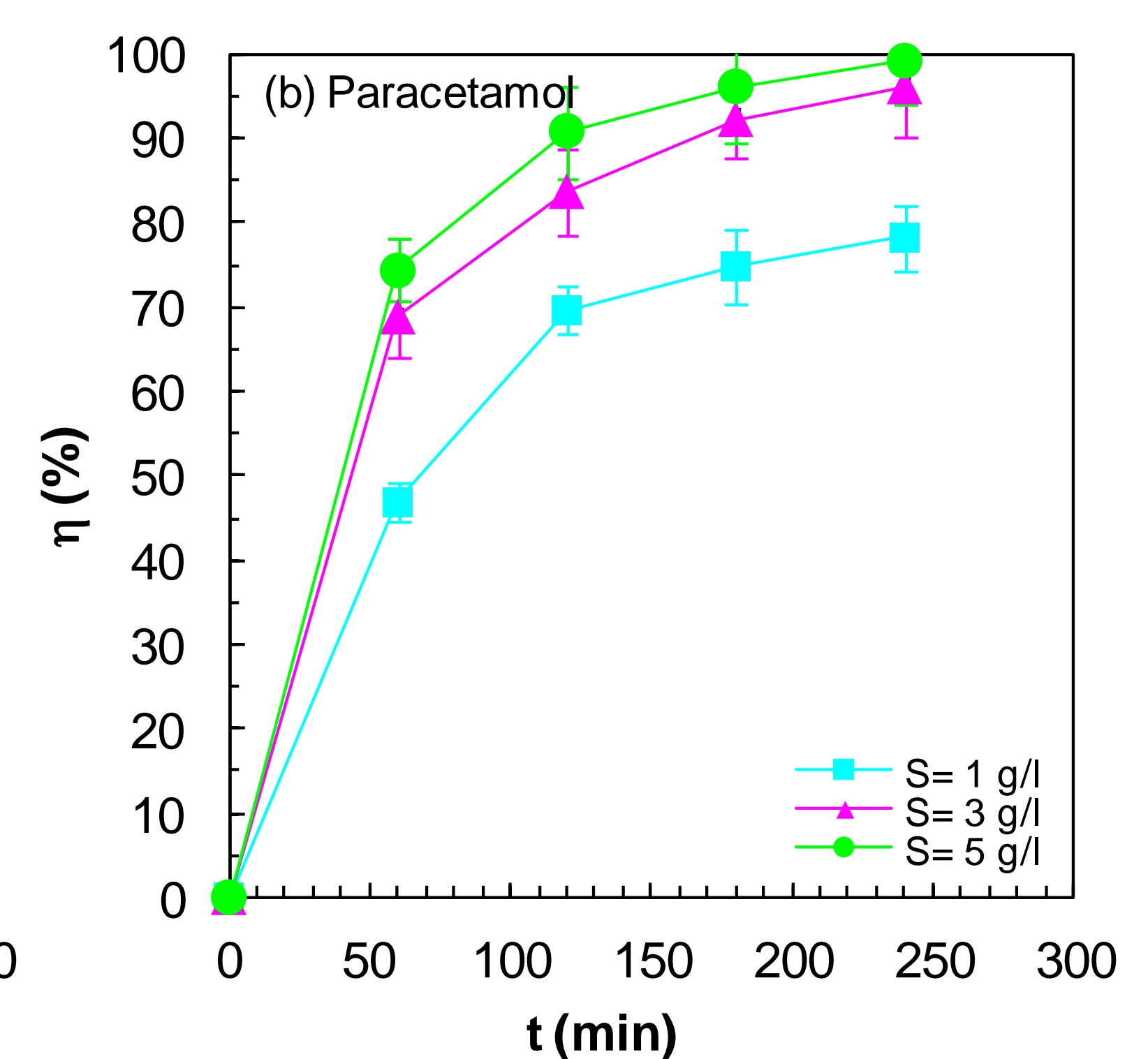


## Results and Conclusions

- ✓ The textural characteristics of the adsorbent, BET surface, the morphological structure, and the surface functional groups were determined, before and after paracetamol adsorption, confirming interaction between the analgesic and the biocarbon surface.
- ✓ The adsorption capacity of paracetamol on the olive stone biocarbon increased as the concentration of the adsorbent was decreased; mainly from 3 to 5 g/L.
- ✓ The adsorption efficiency was over 80% using a concentration olive stone biocarbon of 3 and 5 g/l.
- ✓ The adsorption capacity and efficiency data accomplished with the biocarbon were comparable with those obtained using commercial activated charcoal, although with this charcoal the equilibrium was obtained in a quarter of the time.
- ✓ The good performance of the activated biocarbon from the olive stones waste for removal of paracetamol from wastewater was confirmed by the high adsorption capacity and efficiency obtained in accordance with the European regulation on wastewater treatment (Directive EU 2024/3019) and national law on waste (Law 7/2022).



Time evolution of adsorption capacity of paracetamol on olive stone based biocarbon.  $C_o = 50$  mg/L and  $S = 1, 3,$  and  $5$  g/L.



Time evolution of adsorption efficiency of paracetamol on olive stone based biocarbon.  $C_o = 50$  mg/L and  $S = 1, 3,$  and  $5$  g/L.

## References

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