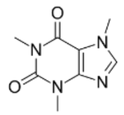
Emerging contaminants adsorption onto fixed-bed columns loaded with commercially available activated carbon

Sub-theme 3: Emerging pollutants and managing wastewater and waste

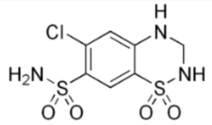
UNESCO-IWRA ONLINE CONFERENCE 17-19 JANUARY 2023 3rd IN THE IWRA ONLINE CONFERENCE SERIES

Introduction

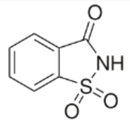
Emerging contaminants (EC) are frequently reported in drinking water treatment plants. Activated carbon (AC) is an exciting material for advanced water treatment. Therefore, this work aimed to compare different fixed-bed column configurations loaded with ACs for removing five ECs that were previously prioritized.



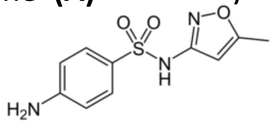
Caffeine **(A)**



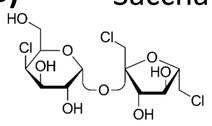
Hydrochlorothiazide **(B)**



Saccharin **(C)**



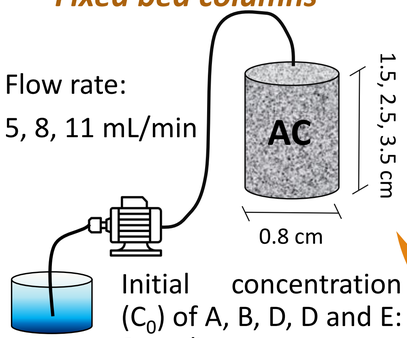
Sulfamethoxazole **(D)**



Sucralose **(E)**

Materials and methods

Fixed bed columns



Modelling equations

$$q_{ads} = \frac{Q * C_0}{m_{ads}} * \int_0^t \left(1 - \frac{C}{C_0}\right) dt$$

$$\frac{C}{C_0} = \frac{1}{1 + \exp(a - b * t_i)}$$

Conclusions

- On the down-flow mode, the particle size directly affected the adsorption of the EC;
- On the up-flow mode, the specific surface area affected most the adsorption of the EC;
- The q_{ads} were higher for all the EC in the adsorption with Reuse water than WWTP effluent;
- Sucralose was the lowest adsorbed EC.

Results

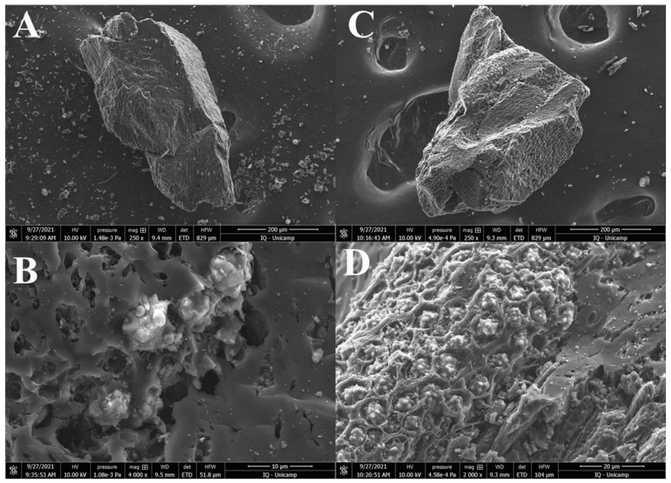


Figure 1: SEM images of AC1 (A and B) and AC2 (C and). Images A and B have 250x magnification. Meanwhile, images C and D have 4000x and 200x magnification, respectively.

- AC2 has a greater particle size than AC1;
- AC2 has a higher specific surface area than AC1;
- Both ACs have similar pH_{pzc} and pore sizes.

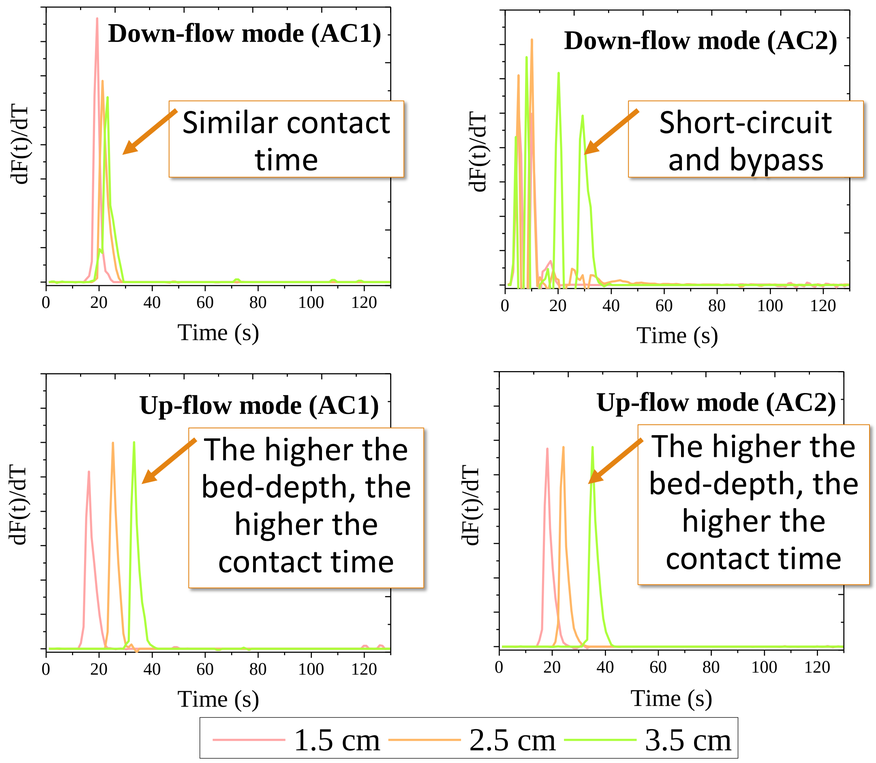


Figure 2: Curve E for different bed-depth on the down-flow and up-flow modes for determining contact time between the EC and the AC.

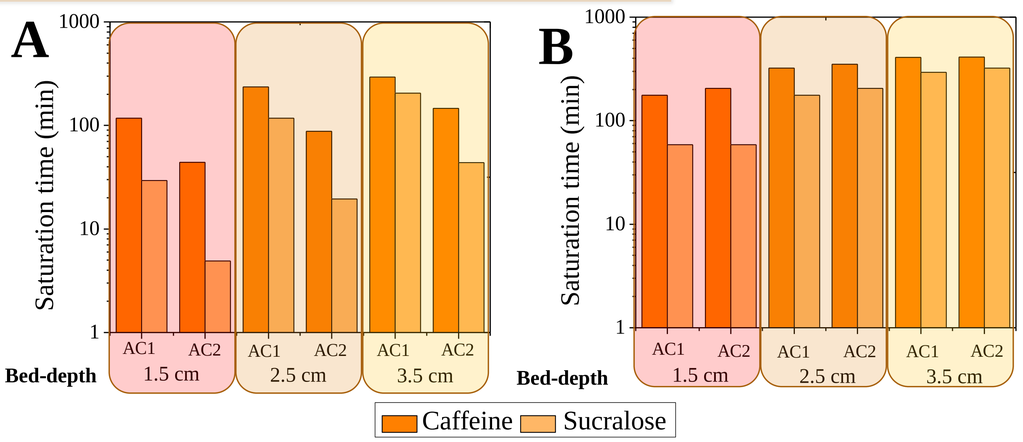


Figure 3: Saturation time for caffeine and sucralose adsorption onto AC1 and AC2 at different bed-depths at down-flow mode (A) and up-flow mode (B) (flow rate = 5 mL min-1, C_0 = 2 mg L^{-1}).

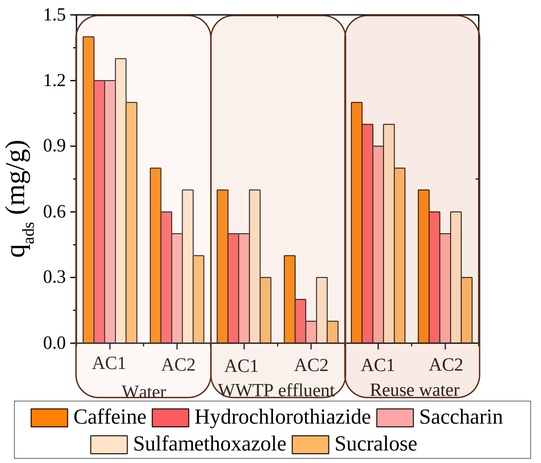


Figure 4: Adsorption capacity (q_{ads}) of the EC in different water matrices (bed-depth = 3.5 cm, flow rate = 5 mL min-1, C_0 = 2 mg L^{-1}). Wastewater treatment plant (WWTP).

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