Introduction

- The occurrence of pharmaceuticals in the aquatic environment is a rising problem.
- The threefold increase in drug consumption in the next 22 years will make it even more critical.
- Considering the potential impacts of pharmaceutical products, it is highly important to remove them from wastewater before discharge.

Goals:
- Determination of adsorption isotherms of levodopa from aqueous solution onto three activated carbons.
- Evaluation of five models to fit the experimental data.
- Relationships between chemical composition of carbon’s surface and adsorption

Experimental

Adsorption conditions:
- Temperature: 25°C (thermostated bath).
- Time: 18 h.
- 100 mL of solution (initial concentration between 0.031 g/L and 1.281 g/L)
- Three activated carbons (ACs) from different source materials:
  - Coconut shell carbon: S23 (0.05 g)
  - Wood carbon: L27 (0.1 g)
  - Casuarina carbon: C1 (0.05 g)

Analysis:
- HPLC-UV (wavelength 278 nm), C18 reverse phase column (ProtonSIL C18 AQ), eluent: water-acetonitrile (90:10), 0.25 mL/min

Activated Carbons characterization:
- Nitrogen sorptometry (ASAP 2010 analyzer).
- Thermogravimetric analysis (TGA): N2, T: 20-700°C/min

Activated Carbons properties:
- Specific surface area
- Microporous volume
- Mesoporous volume
- Total surface groups

Optimization: non linear regression (method of least squares)

Results and Discussion

Adsorption isotherms models:
- Freundlich
- Redlich-Peterson
- Khan

Levodopa adsorption isotherms for the three carbons

Conclusions

The adsorption of levodopa is clearly disfavored by the presence of acidic groups as lower levodopa uptake is found with L27 AC despite a higher surface area. Comparing C1 and S23 ACs which have similar specific surface area (and low amounts of acidic surface groups), it is observed that the adsorption capacity is positively influenced by the presence of basic surface groups. While the surface of L27 may be essentially in the neutral form (pH > pHPZC), the surface of S23 and C1 carbons is positively charged (pH < pHPZC), which contributes to enhance adsorption of levodopa which has a 1st pKa value equal to 2.3 (corresponding to COOH function) and is partially dissolved in the solution (pH > pKa).

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