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# Dynamic Sorption Study of Paracetamol on New Sorbent Support Based on Granulated Polyethylene Waste

Turkman Meriem\*<sup>1</sup>, Badaoui. Bouthaina <sup>2</sup>, Mezyane. Rayane <sup>2</sup>, Bouras. Omar<sup>3</sup>

<sup>1</sup> Material and Environmental Laboratory, University of Medea, 26001 Medea, Algeria

<sup>2</sup> Department of Process Engineering, University of Medea, 26001 Medea, Algeria

<sup>3</sup> Water Environment and Sustainable Development Laboratory, University of Blida 1, Blida, Algeria

\*Corresponding author's email: turkmedea@gmail.com

## ABSTRACT

This present research relates to a comparative study of the dynamic sorption of paracetamol in a fixed bed column on a new category of sorbents based on a very available material which is "granulated polyethylene waste (WPEG)" and linear low-density polyethylene. The study is carried out by examining the effects of different parameters such as: pH, bed height and paracetamol concentration. Under the used conditions, all obtained results showed that the highest removal efficiency is obtained under the following optimal parameters ( $C_0=4\text{mg/L}$ ,  $Q=2\text{mL/min}$ ,  $H=7\text{cm}$ ,  $\text{pH}=3$ ). Thomas and Ogata-Bank models were used for modeling the optimal results. It was noticed that the Thomas method predicts the experimental results well with a correlation coefficient considered very satisfactory (0.96). The maximum sorption capacity obtained by the sorbent based on granulated polyethylene waste is approximately 115 mg/g, thus showing the great effectiveness of this sorbent in the elimination of paracetamol.



**Figure1:** Paracetamol dynamic sorption in fixed bed column

**Keywords:** Sorption, Paracetamol, polyethylene, Waste polyethylene granulated.

## 1 Introduction

Recently, many studies have been devoted to the use of microplastics in the sorption of different types of pollutants such as antibiotics, metals ions [1], and emerging pollutants [2]. Numerous studies related to the sorption of emerging pollutants using polyethylene in its different forms have been carried out [3]. In this context, this present study is devoted to the use of linear low-density polyethylene (LLDPE 118WJ), and the waste polyethylene granulated (WPEG) in the dynamic sorption of paracetamol.

## 2 Experimental

### 2.1 Solutions and materials

Paracetamol (P = 99%) kindly donated by Antibiotical SAIDAL, ALGIERS, was used in this research without treatment. Linear low-density polyethylene (LLDPE 118WJ), and the waste polyethylene granulated (WPEG) were supplied by the Soexplast factory, ALGIERS.

### 2.2 Study of the paracetamol dynamic sorption

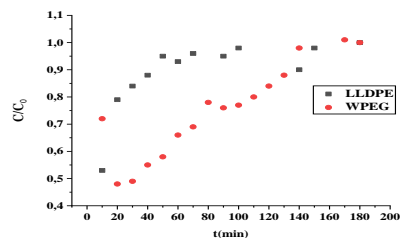
The fixed bed dynamic adsorption experiments were carried out in a simple glass column filled with a fixed quantity of material. Samples are taken at the outlet of the column to measure the absorbances at the wavelength (242 nm) [4].



### 3 Results and Discussion

#### 3.1 Effect of contact time

According to these results (Figure 1), the sorption of paracetamol on WPEG seems to be relatively slow compared to that obtained on LLDPE sorbent. The same shape of curve was obtained previously by Haro et al., 2021 in their research related to the sorption of paracetamol by activated carbon [5].

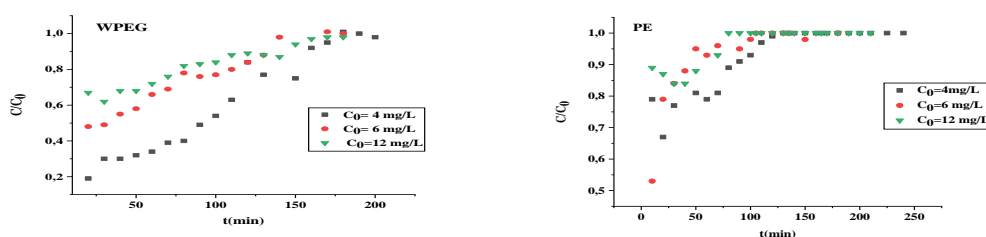


**Figure 1:** Effect of contact time on the kinetics of sorption of paracetamol

#### 3.2 Effect of pH and bed height

The maximum elimination of paracetamol was recorded in a very acidic medium at a pH of approximately 3 for the two sorbents used, LLDPE and WPEG. So a pH of approximately 3 was chosen as the optimal pH. Examination of the results indicates that the optimal height for the two sorbents is around 7 cm.

#### 3.3 Effect of inlet solute concentration



**Figure 2:** Effect of the inlet solute concentration on the sorption of paracetamol ( $H = 7\text{cm}$ ,  $Q = 2\text{mL/min}$ ,  $\text{pH} = 3$ ) As shown in Figure 2, the analysis results reveal that the sorption efficiency decreases as the concentrations increase for both materials (LLDPE and WPEG).

#### Conclusion

The obtained results indicated the effectiveness of used materials as sorbents. The highest removal efficiency was achieved under the optimal parameters ( $C_0 = 4\text{mg/L}$ ,  $Q = 2\text{mL/min}$ ,  $H = 7\text{cm}$ ,  $\text{pH} = 3$ ) for both materials. Thomas model predicted well the experimental breakthrough curves since the correlation coefficients are considered very satisfactory ( $R^2 = 0.96$ ).

#### References

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