ADSORPTION-DESORPTION BEHAVIOUR AND MECHANISMS OF PYRIMETHAMINE AND METRONIDAZOLE BENZOATE ON POLYSTYRENE, POLYETHYLENE AND POLYETHYLENE TEREPHTHALATE MICROPLASTICS

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(19PCC01975)

SEPTEMBER, 2021

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE (M.Sc) DEGREE IN INDUSTRIAL CHEMISTRY IN THE DEPARTMENT OF CHEMISTRY, COLLEGE OF SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY.

SEPTEMBER, 2021

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the Degree of Master of Sciences in Industrial Chemistry in the Department of Chemistry, College of Science, Covenant University, Ota, Nigeria.

Mr. John A. Philip **…….**

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Prof. Akan B. Williams **……**

(Dean, School of Postgraduate Studies) Signature and Date

DECLARATION

I, **AGBOOLA, OMOWUMI DARLINGTON (19PCC01975)**) declares that this research was carried out by me under the supervision of Prof. Nsikak U. Benson of the Department of Industrial Chemistry, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

AGBOOLA, OMOWUMI DARLINGTON **……..**

Signature and Date

CERTIFICATION

We certify that this dissertation titled "**ADSORPTION-DESORPTION BEHAVIOUR AND MECHANISMS OF PYRIMETHAMINE AND METRONIDAZOLE BENZOATE ON POLYSTYRENE, POLYETHYLENE AND POLYETHYLENE TEREPHTHALATE MICROPLASTICS**" is an original research work carried out by **AGBOOLA, OMOWUMI DARLINGTON (19PCC01975)** in the Department of Industrial Chemistry, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Prof. Nsikak U. Benson. We have examined and found this work acceptable as part of the requirements for the award of Master of Science in Industrial Chemistry.

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(Head of Department) **Signature and Date**

Prof. Olayinka P. Asekun **……**
(External Examiner) **Signature and Date**

Prof. Akan B. Williams **……**
(Dean, School of Postgraduate Studies) **Signature and Date**

DEDICATION

To God Almighty, the one who has been good and will always be.

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LIST OF ABBREVIATIONS

4-MBC	4-Methyl benzylidene camphor
5-FU	5- Fluorouracil
AMX	Amoxicillin
ATR-FTIR	Attenuated Total Reflectance Fourier-Transform Infrared Spectrophotometer
CBZ	Carbamazepine
CEP-C	Cephalosporin C
CIP	Ciprofloxacin
DOM	Dissolved organic matter
EE2	17α-Ethinyl estradiol
ENR	Enrofloxacin
FEN	Fenbendazole
FLU	Flubendazole
HDPE	High density polyethylene
HNO_3	Nitric acid
HPLC/MS	High-performance liquid chromatography-mass spectrometer
LDPE	Low density polyethylene
MET	Methotrexate
MNZ	Metronidazole
NaOH	Sodium hydroxide
NOD	Nadolol
NOR	Norfloxacin
PA	Polyamide
PA	Polymers polyamide
PE	Polyethylene
PLA	Polylactic acid
PP	Polypropylene
PPCPs	Pharmaceuticals and Personal Care Products
PRO	Propranolol
PS	Polystyrene

PVC	Polyvinyl chloride
PYM	Pyrimethamine
SDZ	Sulfadiazine
SMT	Sulfamethazine
SMX	Sulfamethoxazole
TC	Tetracycline
TCS	Triclosan
TH	Tetracycline hydrochloride
TMP	Trimethoprim

ABSTRACT

Research studies over the years have shown the presence of contaminated plastic debris in the organs of marine organisms. In addition to the problems presented by improper disposal of plasticsgiving rise to presence of microplastics in the environment, is the sorption of pharmaceuticals on plastic polymers and their persistence which contributes to their long-range transport into the marine environment. Numerous studies have been done to investigate adsorption of different types of antibiotics. However, very little has been done on antimalarial drugs commonly used to treat prevalent malarial disease in Nigeria. This research work aims to investigate the adsorption behaviour of pyrimethamine and metronidazole benzoate on 3 types of plastic polymers which include polystyrene, polyethylene, and polyethylene terephthalate through batch adsorption experiment. Contributing factors like pH, concentration of drug standards, and contact time, were varied to study points of optimal sorption. The pH of aquatic media was varied between 4 and 8 using NaOH and HCl, initial concentration was varied between 20 mg/L and 100 mg/L, while contact time was varied between 0hour and 48hours. The identity of the plastic polymers was confirmed using an FTIR, while HPLC was used to confirm the concentration of the analytes before and after adsorption. Results showed that adsorption increased from 20% to 69% with increase in initial concentration between 20 mg/L and 100 mg/L, adsorption isotherm showed that adsorption best fit into the Langmuir adsorption with a correlation coefficient (R^2) of 0.9938, pyrimethamine drug standards led to a slight increase in pH of aquatic media, however, metronidazole benzoate slightly increased pH between 4.0 to 6.0, but led to a reduction in pH of 7.0 down to 6.5 and pH of 8.0 to 7.5 was observed for metronidazole benzoate owing to the pH of MNZ being 4.3. The observed change in pH introduced by pyrimethamine and metronidazole benzoate shows that aquatic life can be influenced adversely on exposure to these drugs.

Keywords: Adsorption, microplastics, pharmaceuticals, environment.