BIOCHEMICAL STUDIES OF SELECTED PHARMACEUTICAL INDUSTRIAL WASTEWATER COMPOUNDS ON RATS

Submitted By

Ola Ahmed Rashed Rashoud

B.Sc. Science(Biochemistry), Faculty of Science, Ain Shams University, 1999

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Basic Sciences
Institute of Environmental Studies and Research
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APPROVAL SHEET

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ABSTRACT

Widespread occurrence of pharmaceuticals has started to attract attention as aquatic micropollutants that might have been affecting the ecological system in trace amounts. The risks associated with their introduction into wildlife habitats are becoming an important issue for both regulators and the pharmaceutical industry, because of incomplete elimination of pharmaceuticals and their metabolites from wastewater. In this study three different classes of pharmaceuticals i.e. glucocorticosteroid (dexamethasone), analgesics (paracetamol) and stimulant (caffeine) were selected for studying their effects on environmental life. The concentration of them is determined in industrial wastewater using liquid chromatography tandem mass spectrometry (LC-MS-MS) with electrospray ionization (ESI) and each was analyzed by a single multiple reaction monitoring (MRM) transition. The concentration levels of dexamethasone, paracetamol, and caffeine in wastewater were 245 ng/ml, 7216 ng/ml and 9356 ng/ml, respectively. Oral treatments of 0.25 mg/kg b.wt, 7.5 mg/kg b.wt, 9.5 mg/kg b.wt of dexamethasone, paracetamol, and caffeine respectively was studied daily over a period of three months of treatment showed a variable influence on many biochemical and haematological parameters. Dexamethasone showed an effective increase in chronic levels of triglyceride, liver enzymes (ALT, AST, and GGT), total bilirubin, neutrophils and monocytes. Paracetamol showed highly significant increase in serum creatinine, (GGT), total protein, albumin and monocyte counts. But caffeine showed highly significant increase in creatinine, liver enzymes (ALT, GGT), total protein, albumin, total white blood cells, monocyte and eosinophil counts.

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List of abbreviations

ACM	Acetaminophen
ALP	Alkaline phosphatase
ALT	Alanine aminotransferase
APAP	N-acetyl-para aminophenol
API	Atmospheric pressure ionization
APIs	Active pharmaceutical ingredients
AST	Aspartate aminotransferase
AST	Aspartate aminotransferase
COX	Cycloxygenase
DEX	Dexamethasone
ESI	Electrospray ionization
FDA	Food and Drug Administration
GC-MS	Gas chromatography with mass spectrometry
GFR	Glomerular filtration rate
GGT	Gamma-glutamyltransferase
GSH	Glutathione
Hb	Haemoglobin
HDL	High density lipoprotein
HLB	hydrophilic lipophilic balanced

HPLC,	High performance liquid chromatography
LC-MS	Liquid chromatography coupled to mass spectrometry
LDL	Low density lipoprotein
LLE	Liquid lquid extraction
MAX	Mixed mode anion exchange
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
MCV	Mean corpuscular volume
MCX	Mixed mode cation exchange
MRM	Multiple reaction monitoring
MS2	Tandem spectrometry
M-WWTPs	Municipal wastewater treatment plants
NAPQI	N-acetyl-p-benzoquinonimine
NO	Nitrogen oxide
NSAIDs	Non-steroidal anti-inflammatory drugs
PCM	Paracetamol
PCV	Packed cell volume
PFF	Pharmaceutical formulation facilities
PhCs	Pharmaceuticals
PPCPs	Pharmaceuticals and personal care products
PPF	Pharmaceutical production facilities
P-WWTPs	Pharmaceutical manufacture wastewater treatment plants

RBC	Red blood cell
SPE	Solid phase extraction
T.BIL	Total Bilirubin
TNF-a	Tumor necrosis factor a
VLDL	Very low density lipoprotein
WBCs	White blood cells
WWTPs	Wastewater treatment plants