

DECLARATION

I, Yolisile Mndubu sincerely and solemnly declare that the work: COMPARATIVE STUDY FOR IRON MEDIATED HYDROLYSIS OF 4-NITROPHENYL PHOSPHATE IN CATIONIC AND ANIONIC MICROEMULSION MEDIA is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

DEDICATION

This booklet is dedicated to all those who share the surname “Mndubu” with me. My family especially my old man (Kwinini), step mom, my little girl (S'novuyo) and my little brother (Sandla). It is also extended to Lentsoane family (Mthobi, his wonderful wife Nomaza and kids Naledi, Itumeleng and Nondoda). This is the family that forms the base of my career, thanks a lot for leading the way for me.

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ABSTRACT

The study of rapid cleavage of organophosphate esters by metal ions is of great interest as it is the most important reaction in both biological and environmental sciences. A good understanding

of organophosphate hydrolysis by metal ions is important as it can be exploited in formulation of useful detoxifying agents for organophosphate contaminants in the environment. The knowledge can also help in developing effective artificial enzymes.

The hydrolysis of 4-NPP in the presence of Ferrous and Ferric ions in o/w microemulsion media was investigated. The reaction was monitored by measuring the absorbance of the 4-nitrophenolate ion produced in the reaction aliquots with time. The order of effectiveness of the ME media towards the hydrolysis of 4-NPP was found to be CME > AME > aqueous in the presence of Fe(II), Fe(III) and Prussian blue at neutral pH. In comparison with individual metal ions used in the investigation, it was found that polymeric Prussian blue showed enhanced rate of hydrolysis. The degree of effectiveness is as follows; Prussian blue (insoluble) > Prussian blue (soluble) > Fe(III) > Fe(II). The result of the present investigation enriches our understanding of the possible roles polymeric ions play in hydrolysis reactions and the effect of different reaction media. The reactions mimic the roles of purple acid phosphatases in the hydrolysis of phosphate esters. The application of the above systems for environmental decontamination of organophosphates is also envisaged.

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LIST OF ABBREVIATIONS

ATP	Adenosine triphosphate
AME	Anionic microemulsion
BNPP	Bis-(4-nitrophenyl) phosphate
BsPAP	Bovine spleen Purple Acid Phosphatase
CME	Cationic microemulsion
CTABr	Cetyltrimethylammonium bromide
CTAC	Cetyltrimethylammonium chloride
DNA	Deoxyribonucleic acid

GMP	Guanosine (2`-3`) cyclic phosphate
KbPAP	Kidney bean Purple Acid Phosphatase
ME	Microemulsion
NDP	Nucleoside 5`-diphosphate
4-NPP	4-nitrophenyl phosphate
4-NP	4-nitrophenol
NTP	Nucleoside 5`-triphosphate
O/W	Oil-in-water
O/W/O	Oil-in-water-in-oil
OPWC	Organisation for the Prohibition of Chemical Weapons
PAP	Purple Acid Phosphatase
RNA	Ribonucleic acid
SDS	Sodium dodecylsulphate
W/O	Water-in-Oil
W/O/W	Water-in-oil-in-water

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