CONTENTS

CHAPTER - 1

INTRODUCTION 1

1.1 General 1

1.2 Absorption of radiation in water 3

1.3 Radiation Chemistry of water 4

1.3.1 Time scale of events 4

1.3.2 Experimental evidence for the existence of spurs 7

1.4 Primary yields 14

1.4.1 Yields in neutral solution 15

1.4.2 pH dependence of the primary yields 18

1.5 Properties of the primary radicals 20

1.5.1 The hydrated electron 21

1.5.2 The hydrogen atom 24

1.5.3 The hydroxyl radical 26

1.5.4 The perhydroxyl radical 30

1.6 Generation of secondary radicals 32

1.6.1 Reducing conditions 32

1.6.2 Oxidizing conditions 33

1.7 Radiation Chemistry of some oxyanions 35

1.7.1 Bromates 35

1.7.2 Peroxodisulphate 36
1.7.3 Nitrate 37
1.7.4 Alcohols 38
1.8 Scope of the present work 40

CHAPTER - 2

EXPERIMENTAL 42

2.1 Purification of alcohols 42
2.2 Preparation of solutions 42
   2.2.1 Irradiation of samples 43
   2.2.2 60Co-gamma source 43
   2.2.3 Fricke dosimetry 44
2.3 Chemical analysis of the radiolytic products 45
   2.3.1 Spectrophotometric estimation of nitrite 45
   2.3.2 Estimation of hydrogen peroxide 46
   2.3.3 Estimation of aldehydes 47

CHAPTER - 3

RESULTS AND DISCUSSION 48

3.1 Radiolysis of aqueous solutions of sodium nitrate 48
   3.1.1 Results 48
   3.1.2 Discussion 52
      3.1.2.1 The yield of nitrite in oxygen-free solutions 55
      3.1.2.2 Yields of nitrite in aerated solutions 57
3.1.2.3 The $\text{H}_2\text{O}_2$ formation 60
3.2 Radiolysis of aqueous solutions of nitrate-alcohol 61
   3.2.1 Radiolysis of aqueous solutions of nitrate-alcohols in the neutral medium 64
      3.2.1.1 Results 64
      3.2.1.2 Discussion 70
   3.2.2 Radiolysis of nitrate/alcohol systems in basic medium (pH 12) 80
      3.2.2.1 Results 80
      3.2.2.2 Discussion 87
   3.2.3 Radiolysis of nitrate ions containing alcohol in acidic medium (pH 3.5) 96
      3.2.3.1 Results 96
      3.2.3.2 Discussion 103
SUMMARY 110
REFERENCES 116