# RADIOCHEMICAL STUDY OF MARBLE AND GRANITE FROM LOCAL MARKET

A Dissertation Submitted to the Central Department of Chemistry, Tribhuvan University, Kirtipur, Kathmandu, Nepal

> For Partial Fulfillment of Requirements for the Master's Degree in Chemistry

> > By

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The dissertation entitled

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## FOREWORD

The entire work presented in this thesis has been carried out by Mr. Birendra Thapa under my supervision in the academic year 2006 - 2008. During the research period, he has performed his work sincerely and satisfactorily. No part of this thesis has been submitted for any other degrees.

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### ABSTRACT

A sensitive method is used for the extraction and determination of soluble uranium in marble and granite using Isobutyl Methyl Ketone (IBMK) as extractant and 0.02 % (w/v) Arsenazo (III) as a chromogenic reagent. The present study assesses the gross radioactivity and extractable uranium in marble and granite samples. A Multichannel Analyzer (MCA) coupled with NaI (Tl) crystal detector was used for the measurement of gross radioactivity where as spectrophotometer was used to estimate the uranium contained in sample with the help of Arsenazo (III). The extraction involved the adjustment of pH at 0.9.The efficient extraction was achieved by the addition of at least 10 gms of Al (NO<sub>3</sub>)<sub>3</sub>. This method involved the reduction of  $UO_2^{(+2)}$  to U (IV) by using granulated Zinc in concentrated hydrochloric acid. The physical measurements showed the presence of gross radioactivity in the range 266.19 Bq/kg to 644.268 Bq/Kg in marble and 871.63 Bq/kg to 1127.32 Bq/Kg in granite while the chemical analysis showed the marble sample analyzed had the uranium concentration in the range of 0.02ppm to 0.06 ppm and the granite sample had the range of 0.08 ppm to 0.12 ppm.

Key Words: Arsenazo (III), IBMK, Multichannel Analyzer, Spectrophotometer, Uranium.

Contents	Page No.
Foreword	i
Acknowledgement	ii
Abstract	iii
List of Abbreviations Used	iv
1. Introduction	1-9
1.1 General Introduction	1
1.2 Historic and Present Uses of Uranium	2
1.3 Natural Abundance	2
1.4 Mineralogy	4
1.5 Natural Radioactivity in Building Materials	6
1.6 Geochemistry	7
1.7 Uranium cycle	8
1.8 Public Health Statement of Uranium	9
1.9 Behavior of uranium in the body	9
1.10. Quantitative Analysis	10
1.10.1 Spectrophotometric Methods	10
1.10.2 Spectrophotometer	11
1.10.3 Theoretical basis of Spectrophotometric Analysis	11
1.11. Literature Survey	13-16
2. Objective of Work	17
3. Experimentation	18-19
3.1 Preparation of Reagents	18
3.2 Experimental Instruments	19
3.3 Procedure	19-21
3.3.1 Collection of Samples	19
3.3.2 Absorption Spectra of Uranium (IV)	
Arsenazo (III) complex and Adherence to Lambert – Beer law	, 19
3.3.3 Preparation of Calibration Curve for the	
determination of Uranium	20
3.3.4 Determination of Uranium in collected sample	20

3.3.5 Gross Radioactivity Measurement by MCA	21
4. Results and Discussion	22-32
4.1 Adherence to Beer's Law and Stability	22
4.2 Calibration Curve for the determination of Uranium	23
4.3 Effect of amount of Aluminium nitrate on Extraction	24
4.4 Effect of pH on Extraction	26
4.5 Extraction of Uranium	27
4.6 Efficiency of Ortec – Norland – 5600 – MCA	28
4.7 Sample Analysis	30-32
5. Conclusion	33
6. Suggestions for further Work	34
7. References	35-39
8. Appendices	40-45

# LISTS OF ABBREVIATIONS USED

А	Absorbance
AES	Atomic Emission Spectroscopy
Arsenazo (III)	2,2-(1,8-Dihydroxy-3,6-disulphonapthalene -
	2,7 – diazo) dibenzenearsenic acid
BEIR	Biological Effects of Ionizing Radiation
Bq/Kg	Becquerel Per Kilogram
С	Concentration
C <sub>n</sub>	Net Count
Cps	Counts per second
Cs	Caesium
CTMAC	Cetyltrimethyl ammonium chloride
E <sub>f</sub>	Efficiency
Eh	Redox Potential
EPA	Environmental Protection Agency
FTA	Fission Tract Analysis
g	Gram
GR	Gross Radioactivity
I <sub>0</sub>	Intensity of the incident light
IAEA	International Atomic Energy Agency
IBMK	Isobutyl Methyl Ketone
ICP	Inductively Coupled Plasma
ICRP	International Commission on Radiological Protection
INAA	Instrumental Neutron Activation Analysis
It	Intensity of the transmitted Light
KJ	Kilo Joule
L	Liter
LED	Light Emitting Diodes
Max	Maximum
NaI (Tl)	Sodium Iodide (Thallium)
NCRP	National Council on Radiation Protection

NIOSH	National Institute for Occupational Safety and Health
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
pCi	Picocurie
PEL	Permissible Exposure Limit
pH	Hydrogen ion Concentration
ppb	Parts Per Billion
ppm	Parts Per Million
REL	Recommended Exposure Limit
RNNA	Radiochemical Neutron Activation Analysis
ROI	Region of Interest
Sec	Second
SF	Spontaneous Fission
TBP	Tributyl Phosphate
Th	Thorium
U	Uranium
UV	Ultra Violet
WPPA	Wet process phosphoric acid
Symbols Used	
%	Percentage
<sup>0</sup> C	Degree Centigrade
	Alpha
	Beta
	Gamma
	Molar Absorptivity
	Lambda
μg	Microgram
nm	Nanometer
mg	Milligram