

**INVESTIGATION OF THE METAL COMPLEXES OF
ISOMERIC NAPHTHOIC ACID WITH BASE: SYNTHESIS,
CRYSTAL STRUCTURE, AND ITS ENERGY APPLICATIONS**

THESIS

Submitted to Bharathiar University

in partial fulfillment of the requirements for the award of the Degree of

DOCTOR OF PHILOSOPHY

IN

CHEMISTRY

Submitted by

M.SWATHIKA

Under the guidance of

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SEPTEMBER 2023

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This is to certify that the thesis, entitled “**INVESTIGATION OF THE METAL COMPLEXES OF ISOMERIC NAPHTHOIC ACID WITH BASE: SYNTHESIS, CRYSTAL STRUCTURE, AND ITS ENERGY APPLICATIONS**” submitted to the **BHARATHIAR UNIVERSITY**, in partial fulfillment of the requirements for the award of the Degree of **DOCTOR OF PHILOSOPHY IN CHEMISTRY** is a record of original research work done by **Mrs. M. SWATHIKA** during the period **2019 - 2023** of her research in the Department of Chemistry at **PSGR KRISHNAMMAL COLLEGE FOR WOMEN, COIMBATORE**, under my supervision and guidance and the thesis has not formed the basis for the award of any Degree / Diploma / Associateship / Fellowship or other similar title of any candidate of any University.

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The contents of the publication incorporate a part of the results presented in her thesis.



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CHAPTER I INTRODUCTION Nanotechnology refers to the utilization of technology on a minuscule scale, ranging from 1 to 100 nanometers, enabling the manipulation of matter at this level to create innovative materials and devices with exceptional properties. These advancements find practical applications in various fields, including medicine, electronics, energy, and the environment, leading to significant benefits for society. This rapidly emerging megatrend empowers scientists and engineers to employ individual atoms and molecules, forming functional structures that have the potential to revolutionize numerous industries. 1.1 HISTORY OF NANOTECHNOLOGY

During an international conference on industrial production held in Tokyo in 1974, N. Taniguchi introduced the term "nanotechnology." This term described the precise manipulation of materials with nanometer precision and the study of nano-sized mechanisms. Subsequent to that period, from the late 1980s to the early 1990s, several significant publications on the subject and an expansion of practical applications. Consequently, there was significant increase in project financing and numerous organizations and countries became involved.

In 1991, the United States launched its inaugural nanotechnological program under the National Scientific Fund. Later, in 2001, the National Nanotechnological Initiative (NNI) was established with the primary goal of fostering collaboration among federal departments to prioritize nanotechnology development. The objective was to make nanotechnology the foundation for the USA's economy and national security in the first half of the 21st century.

The term "nanometer" was first introduced by Richard Zsigmondy. He used a microscope ingeniously to measure the size of particles like gold colloids, coining the term "nanometer" for particle size characterization. In the 20th century, Richard Feynman, the Nobel Prize Laureate in physics in 1965, emerged as a visionary force. During the 1959 American Physical Society conference at Caltech, Feynman delivered a groundbreaking speech. In this speech, he presented the idea of manipulating matter at the atomic level, which laid the foundation for modern nanotechnology and opened up possibilities for technological advancements at the nanoscale.

1.2 PROPERTIES OF NANOMATERIALS

Nanomaterials, also known as materials containing nanostructures, exist in various dimensions for their structural components. All these variations fall within the size range of 1-100 nm. When combined with polymers, biomolecules, or other nanostructured materials, these nanomaterials create nanocomposites, often leading to particle sizes larger than 100 nm. The exceptional physical and chemical characteristics of nanomaterials, arise from their high surface-to-volume ratio.

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M.SWATHIKA

Abbreviations Used

ABBREVIATIONS USED

<i>mol</i>	---	<i>mole</i>
<i>g</i>	---	<i>gram</i>
<i>GUA</i>	---	<i>Guanidine</i>
<i>AMG</i>	---	<i>Aminoguanidine</i>
<i>NA</i>	---	<i>Napthoic acid</i>
<i>M.Pt</i>	---	<i>Melting</i>
<i>bp.</i>	---	<i>Boiling point</i>
<i>M.wt</i>	---	<i>Molecular weight</i>
<i>Temp.</i>	---	<i>Temperature</i>
<i>Asym.</i>	---	<i>Asymmetric stretching</i>
<i>Sym.</i>	---	<i>Symmetric stretching</i>
<i>Obsd.</i>	---	<i>Observed</i>
<i>Calcd.</i>	---	<i>Calculated</i>
<i>DTA</i>	---	<i>Differential thermal analysis</i>
<i>TG</i>	---	<i>Thermogravimetry</i>
<i>(+)</i>	---	<i>Endothermic transformation</i>
<i>(-)</i>	---	<i>Exothermic transformation</i>
<i>XRD</i>	---	<i>X-ray diffraction</i>
<i>DFT</i>	---	<i>Density Functional Theory</i>
<i>HOMO</i>	---	<i>Higher Occupied Molecular Orbit</i>
<i>LUMO</i>	---	<i>Lower Occupied Molecular Orbit</i>