Preface

Water pollution is one of the major concerns for human beings due to directly or indirectly discharge of pollutants into water bodies (namely rivers, groundwater, lakes, and oceans). This affects not only plants and organisms living in these waters but also all-natural biomes and biodiversity. Nowadays, advanced oxidation processes (AOPs) have been used to treat wastewater. AOPs are environmentally friendly processes. These AOPs unlike other processes, they not only transfer the pollutants into harmless end product but also mineralize into innocuous substances such as water and carbon dioxide. The process in which light and catalyst are used, known as photocatalytic process. Similarly, when ultrasound and catalyst are used to treat pollutants known as sonocatalysis. Lately, a combination of ultrasound and light in the presence of a suitable catalyst is used to treat water pollutants known as sonophotocatalytic process.

Several photocatalysts have been investigated for AOPs. For decades, there has been emerging interest in ABO_3-type perovskite structure. Among perovskites, $BiFeO_3$ is one of the most studied photocatalysts for advanced oxidation processes (bandgap ~2.2 eV), and it depicts both ferromagnetic and ferroelectric properties at room temperature. Present thesis reports preparation, characterization, and evaluation of photocatalytic properties of graphene-based material supported doped bismuth ferrite heterostructure for the potential applications in sonocatalytic, photocatalytic and sonophotocatalytic degradation of RhB (a pollutant in wastewater). The thesis is divided into five chapters as follows:

Chapter 1 of the dissertation describes the general introduction of advanced oxidation process, ultrasonication.

Chapter 2 includes a brief introduction and reviews of photocatalytic and sonophotocatalytic processes for wastewater treatment. It also includes photocatalyst $BiFeO_3$ properties, synthesis, and its challenges in using. It also includes different modification methods of $BiFeO_3$. Finally, the photocatalytic activity and kinetics studies of pollutant degradation are presented.

Chapter 3 is an experimental section that includes synthesis of supports (graphene oxide and nitrogen-doped graphene oxide), bismuth ferrite, and doped bismuth ferrite. Experimental setup and characterization used in the present study are also described in this chapter.

Chapter 4 includes the result and discussion of the present study. This chapter is divided into three sections as given below:

Section-I: Selection of suitable graphene oxide-based support for bismuth ferrite in photocatalytic degradation process.

Section-II: Synergistic effect of N-rGO supported Gd-doped bismuth ferrite on photocatalytic degradation of Rhodamine B.

Section-III: Sono-photocatalytic degradation of Rhodamine B over N-rGO supported Gd-doped bismuth ferrite heterojunction.

Chapter 5 includes conclusions and suggests possible future work.