Organic reactions in water are now having great interest because water is a beautiful solvent in many aspects: it is cheap, safe, and clean. Among the various solvents used in organic synthesis, water is no doubt the most inexpensive. Its lack of inflammable, explosive, mutagenic, and carcinogenic properties makes the use of water favourable not only in laboratories but also in industries. Furthermore, from the environmental point of view, water is now regarded as one of the most beneficial solvents.

In addition to these advantages, several synthetic utilities are expected using water as a solvent. Firstly, simple operating systems are possible by the use of water. Phase separation is easy because most organic compounds are lipophilic and are easily separated from the aqueous phase. In addition, control of the reaction temperature is easy because the heat capacity of water is extremely high compared with most organic solvents. Secondly, no protective groups for amino acids or carbohydrates are needed in water, and other water soluble materials are employed directly in aqueous media. Thirdly, the hydrophobic effect and solvation are expected to control the course of reactions in water.

*Water as solvent (Why water?)*

Until recently, the use of water as solvent for organic reactions was mainly restricted to simple hydrolysis reactions. Accordingly, most reagents and catalysts in organic synthesis have been imperiously developed for use in anhydrous, organic reaction media.

Why should we now spend time "rediscovering" reactions for use in water that already work well in familiar organic solvents such as THF, toluene, or methylene chloride? Because there are potential advantages of replacing these and other unnatural solvents with water. The most obvious are the following. (1) *Cost.* It does not get any cheaper than water! (2) *Safety.* Most of the organic solvents used in the lab today are associated with risks: Flammables, explosives, carcinogens, etc. (3) *Environmental concerns.* The chemical industry is a major contributor to environmental pollution. With increasing regulatory pressure focusing on organic solvents, the development of nonhazardous alternatives is of great importance.

Considering these advantages, the present work entitled "**ORGANIC SYNTHESIS IN AQUEOUS MEDIA**" describes the synthesis of a series of Suzuki coupling
reaction, Heck coupling reaction, Aza-Michael Addition, 2-arylbenzimidazole, 2-arylbenzothiazole, 2-arylbenzaxazole, 1,5-Benzodiazepine, and Benzilic Bromide.

The present work is broadly divided into four Chapters.

Chapter 1: Palladium Catalyzed Suzuki and Heck coupling reaction in aqueous media

It is divided into three sections.

Section I:

This section deals with palladium-catalyzed Suzuki reaction by using sodium 2-(2-pyridin-3-ylethylamino) sulfonate, an efficient ligand and base in aqueous media.

\[
\begin{align*}
\text{aryl} & \quad \text{X} \quad \text{B(OH)}_2 \quad \text{aryl} \\
R & \quad \text{R}_1 \\
X = \text{I, Br} & \quad \text{PdCl}_2, \text{N-donor ligand (1)} \\
& \quad 3-4 \text{ h, rt, H}_2\text{O} \\
\text{N-donor ligand} & \quad \text{SO}_2\text{Na} \\
\end{align*}
\]

Section II:

This section deals with ligand promoted palladium (II)-catalyzed Suzuki coupling of aryl iodides and bromides with arylboronic acid in aqueous media.

\[
\begin{align*}
\text{aryl} & \quad \text{X} \quad \text{B(OH)}_2 \\
R & \quad \text{R}_1 \\
X = \text{I, Br} & \quad \text{PdCl}_2(\text{PPh}_3)_2, \text{K}_2\text{CO}_3 \\
& \quad 4-5 \text{ h, rt, H}_2\text{O-CH}_3\text{CN} \\
\end{align*}
\]

Section III:

This section deals with palladium-catalyzed Heck Reaction by using sodium 2-(2-pyridin-3-ylethylamino) sulfonate, an efficient ligand and base in aqueous media.

\[
\begin{align*}
\text{aryl} & \quad \text{X} \\
R & \quad \text{Y} \\
X = \text{I, Br} & \quad \text{Pd(OAc)}_2, \text{ligand (1)} \\
& \quad \text{water, 3-4 h, rt} \\
\text{N - donor ligand} & \quad \text{SO}_2\text{Na} \\
\end{align*}
\]

Y = COOMe, COOEt
Chapter 2: Synthesis of 1,5-benzodiazepines, 2-arylbenzothiazoles, and 2-arylbenzoxazoles in aqueous media.

*It is divided into three sections.*

**Section I:**

This section describes the novel, efficient and green procedure for the synthesis of 1,5-benzodiazepines catalyzed by MgBr₂·OEt₂ in water.

![Chemical Reaction](image)

**Section II:**

This section describes the selective synthesis of 2-arylbenzothiazoles using alum (KAl(SO₄)₂·12H₂O) as catalyst in aqueous media.

![Chemical Reaction](image)

**Section III:**

This section describes the selective synthesis of 2-arylbenzoxazoles using alum (KAl(SO₄)₂·12H₂O) as catalyst in aqueous media.

![Chemical Reaction](image)

Chapter 3: Synthesis of benzimidazoles and Aza-Michael addition reaction in aqueous media.

*It is divided into three sections.*

**Section I:**

This section describes selective synthesis of 1,2-disubstituted benzimidazoles using glyoxylic acid as catalyst in aqueous media.

![Chemical Reaction](image)

\( R = H, \text{Cl, F, OCH}_3 \)
Section II:
This section describes the phosphomolybdic acid promoted synthesis of 2-substituted benzimidazoles in aqueous media.

\[
\begin{align*}
\text{NH}_2 & \quad \text{Ar} \quad \text{H} \\
\text{NH}_2 & \quad \text{Ar} \\
\text{R} & = \text{H, Cl, F, OCH}_3
\end{align*}
\]

Section III:
This section describes Aza-Michael addition reaction using N-donor ligand as catalyst in aqueous media.

\[
\begin{align*}
\text{NH} & \quad \text{X} \\
\text{N-donor Ligand} & (1) \\
\text{rt, 20-40 min, water} & \quad \text{90-95%} \\
\text{Where X} & = \text{COOMe, COOEt, CN, COMe.}
\end{align*}
\]

N-donor Ligand = ![Image]

Chapter 4: Synthesis of 1,5-benzodiazepines and benzylic bromide in aqueous media.

*It is divided into two sections.*

Section I:
This section describes a practical and green approach towards synthesis of 1,5-benzodiazepines using cesium fluoride as efficient catalyst.

\[
\begin{align*}
\text{NH}_2 & \quad \text{R} \\
\text{NH}_2 & \quad \text{R}_1 \\
\text{R} & = \text{benzylic}
\end{align*}
\]

Section II:
This section describes convenient and efficient method for the bromination of benzylic alcohols by using KBr/(COOH)$_2$ in aqueous media.

\[
\begin{align*}
\text{R-OH} & \quad \text{KBr/(COOH)$_2$} \\
\text{H}_2\text{O-MeOH, rt-60 °C, 1-2h} & \quad \text{R-Br}
\end{align*}
\]