CHAPTER ONE
INTRODUCTION

1.1 General Introduction:

Concrete is a composite product produced by mixing cement, aggregates and water and sometimes admixture if needed, undergoes a number of operations such as handling, placing and curing. Inspection and control at all stages of procurement of raw materials to the development of finish product contributes to the uniformity of concrete.

Concrete has occupied an important place among construction materials and is widely used in all types of civil engineering structures ranging from a small building to heavy structures, ever since concrete has been accepted as a material.

Engineers have been trying to improve its quality, strength, durability, etc, against adverse conditions. The aim of the engineers is to make the concrete not only everlasting but also an economical material of construction in comparison to other materialas such as steel as timber. The 20th century has been truly described as the concrete age since all over the world, concrete, either plain;reinforced or prestressed, has been advancing with tremendous strides, and replacing all the time – honored construction materials.

Concrete consists of four ingredients which can be classified in to two groups: Active group and inactive group. The active group consists of water and cement، while the inactive group consists of fine and coarse aggregates. [1]

Superplasticizers are sometimes described as high range water reducers. The first generation of superplasticizers were commercially launched in the early 1960's and had an effective working life of less than one hour, the current generation of superplasticizers can be effective for periods of up to four hours. Superplasticizers were first used in the United Kingdom in 1973. The original application of superplasticizers was for the production of flowing concrete, they now have far wider applications including the production of high strength

and/or early drying screed mixes. When used as water reducer typical water reductions compared to a control mix can be in the order of 30%. Superplasticizers can be used in the same three ways as a conventional plasticizer:

- To impart extreme workability (beyond that obtainable with a conventional plasticizer).
- To permit a large water reduction to be made beyond the limits of normal plasticizing admixtures.
- To achieve economic and environmental benefits (e.g. reduction of the cement content) whilst maintaining performance.

The mode of action of superplasticizers is similar to conventional plasticizers, the admixture particles are adsorbed onto the cement particles, causing them to become mutually repulsive and thus having a dispersing effect.

The materials used to manufacture superplasticizers include:

- Melamine formaldehyde condensates (introduced in Germany in 1964)
- Naphthalene Formaldehyde (introduced in Japan 1963)
- Modified lignosulfonate
- Synthetic polymers

These admixtures can enormously increase the workability of normal portland cement concrete or greatly reduce its water content. Superplasticizers are more expensive than conventional water- reducing admixtures. The dosage requirements vary between 0.5 and 3 percent by weight of cement, depending on the type of admixture used.

Normally the superplasticizer is added to the truck mixer after it arrives at the jobsite and at the last convenient moment before discharge. Within 5 minutes or less the slump greatly increases and at this time the user can get the most advantage from the high fluidity of the concrete.[2]

In this research, several experiments on concrete using super plasticizer have been conducted aiming to reduce the concrete problems at its fresh and hardened stages.

1.2 Statement of the Research Problem:

High performance concrete (HPC) has recently become very attractive to civil engineers and material scientists. As it exhibits higher workability, greater mechanical properties and better durability, HPC has been increasingly applied in the constructions such as tall building, bridges and off-shore structures. Superplasticizer has been found as the most important chemical admixture in preparing (HPC) for the number of improvements, which can be achieve by its use. For all these reasons, this research aims to study the effect of superplasticizer, when mixed with local materials, on both fresh and hardened concrete to achieve the demands of engineers and contractors.

1.3 Objectives:

The objectives of this research are:

- To study the concrete admixtures in general and Super- Plasticizers in particular on the properties of both fresh and hardened concrete.
- To increase workability without changing the mix composition.
- To develop concrete early age strength.
- To reduce the mixing water and the water/cement ratio (w/c) in order to increase strength and improve durability.
- To select optimum ratio of super-plasticizers and w/c to produce concrete suitable for structural purposes.

1.4 Methodology of the Research:

The following steps were mainly adopted as a methodology to fulfill the aims of the research:

1. Collecting data from different resources.
2. Carrying out an extensive literature review.

3. Designing concrete mixes and carrying out a lot of laboratory experiments using different ratios of super-plasticizers with reduced water contents to evaluate the effect of this admixture on the properties of both fresh and hardened Portland cement concrete.
4. Measuring the values of absorption, workability (slump tests), and compressive strengths for all samples of testing.
5. Analyzing, discussing and comparing the obtained results and drawing conclusion and recommendations.

1.5 Research organization:

This research contains five chapters:

Chapter one: includes a general introduction to research, its research problem, and objectives.

Chapter two: covers the literature review.

Chapter three: contains information about chemical admixtures, air entraining admixtures, superplasticizers and other types and subject matter of the study.

Chapter four: presents and discusses the results of experiments.

Chapter five: covers the conclusion and proposes recommendations.