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❖ المؤهـــلات العلمية والشـــهـادات الحـــاصل علـــيهـا :

م	المـــؤهـــل	تاريخه	الجامعة \ المعهد	المركز	التخصص
	بكلوريوس هندسة كيمياوية	٢٠٠٩	الجامعة التكنولوجية	بغداد /العراق	هندسة الوحدات الصناعية
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❖ ***الدورات التدريبية والندوات***:

م	البرنامج	تاريخه	المركز	محتويات البرنامج
١	**Software & Hardware**	٢٠١٠	مركز المعلوماتية /جامعة بغداد	**Internet ,Windows** –
٢	**Microsoft office**	٢٠١٢	الجامعة التكنولوجية	**Word , Excel & Access , Power & Point**
٣	**WinQSB & STATISTICA)**	٢٠١٣	الجامعة التكنولوجية	
	TOEFL	٢٠١٣	مركز المعلوماتية /جامعة بغداد	
	IC3	٢٠١٣	الجامعة التكنولوجية	

❖ ***البحوث والمنشورات*** :

عنوان البحث	الجهة الناشرة
Characterization of nano-silica prepared from local silica sand And its application in cement mortar using optimization technique.	**Advanced Powder Technology**
Optimization Process for Using Prepared Nano Silica in Concrete.	**2nd International Conference on Buildings, Construction, and Environmental Engineering**

→ Education

Details		Research title
B.Sc. **2004-2008**	Chemical Engineering /Chemical Processing Engineering From University Of Technology.	*Sepration process of N_2 from air.*
M.Sc. **2011-2014**	Chemical Engineering /Chemical Processing Engineering From University Of Technology.	*Study The Effect Of Nano-Silica Prepared From Iraqi Silica Sand On Some Mechanical Properties Of cement mortar Composites.*

→ Language

Arabic Native language

English Very good written & spoken.

→ Technical Proficiency

Platforms Windows XP/Vista/7

Applications Microsoft Office, WinQSB & STATISTICA.

→ Certificates

- Successfully completed courses in **TOEFL.** And successfully passed the exam Grade : 520

- Successfully completed the **IC3** at University Of Technology. And successfully passed the exam Grade : Excellent

→ The Publication

Organization	Research title
Advanced Powder Technology	Characterization Of Nano-Silica Prepared From Local Silica Sand And Its Application In Cement Mortar Using Optimization Technique.
2nd International Conference on Buildings, Construction, and Environmental Engineering	Optimization Process For Using Prepared Nano Silica In Concrete.

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Original Research Paper

Characterization of nano-silica prepared from local silica sand and its application in cement mortar using optimization technique

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ABSTRACT

The objective of this work is to prepare, and characterize silica nanoparticles (NS) for the first time from Ardma silica sand, which is obtained from Anbar province in the west of Iraq. The procedure suggests using a combination of ball milling and heating process, then evaluating the influence of (NS) addition on mechanical properties (compressive strength and splitting tensile strength) of mortar mixture to improve its characteristics. Optimization of the operating variables (nanosilica particle size, and percentage of addition) involved using (WinQSB) and (Statistica) software to predict the optimum conditions. Samples have good SiO_2 value of about 99.2% increased up to 99.83% after leaching with sulfuric acid. The high purity silica sand was milled for 30–50 h to produce nanoparticle silica with average particle size of 50 nm. By means of TEM, SEM, AFM, and PSA characterization, these nanoparticles look like spherical particles and have irregular shapes with clusters, the range of their external diameters is (30–100) nm. These nanoparticles silica have a good possibility to be applied as an additive material to produce ultra high performance concrete. According to our knowledge, there is no previous work focusing on preparing of silica nanoparticles from Ardama silica sand, and used to improve mechanical properties of cement mortar using optimization technique. Optimization results proved that an improvement in compressive strength of 29.889% occurred under optimum conditions (6% adding percent and 50 nm particle size), while tensile strength was 22.863% under optimum conditions (8% adding percent and 50 nm particle size) at 28 day age.

1. Introduction

Nanoparticles of silica sand have been researched progressively and produced due to their unique features as a result of size reduction. Silica sand nanoparticles have proved to be a very effective additive to concrete by improving durability, mechanical properties and workability to produce high performance concretes. Nano-silica is also used as effective additive to polymers to improve durability, strength, and flexibility. Nano-silica particles are widely produced by chemical processes. However, chemical synthesis of NS produces high contamination in the final products. As the demand is increasing for higher NS purity, contamination is expected at the minimum level. Other than chemical synthesis, other processes such as precipitation, vaporization at high temperature, sol–gel process, high speed vertical rotating mill, and planetary ball mill are among the most commonly used methods to produce silica sand nanoparticles. It is expected that the technique will be able to produce high purity silica sand nanoparticles of less than 100 nm consistently. In the last decades, the employment of NS in concrete has changed it to have better mechanical properties, initializing a great vision to the concrete erections [1]. Nano-scale substances have a great impact on concrete mixtures in order to their higher surface area. A lot of research used various nano materials to show their effect on the concrete. One of the main interest is on NS, this has been attributed to its Pozzolanic characteristics [2].

For NS, the Pozzolanic reaction is more apparent than in silica fume. NS has the ability to react with calcium hydroxide $Ca(OH)_2$ crystals, which are ordered in the interfacial transition zone (ITZ) is among consolidated cement confection and aggregates, and generates a C–S–H gel. Consequently, the volume and quantity of calcium hydroxide are characterized by reduction, and the strength of the reinforced cement developed [3]. Ball milling is one of the wide spread process to produce a fine powder in micro or nano scales [4]. It is useful for grinding whole types of materials [5,6]. It has showed to be unsophisticated and prosperous procedure to get huge amounts of nanoscale materials [7]. Thus, this study focuses on preparation of silica sand nanoparticles from Ardama

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Date: August 16, 2015

Dear Prof. Dr. Najat J. Saleh, Asst. Prof. Dr. Raheek I. Ibrahim and Ali D. Salman ,

Your paper titled:

Optimization process for using prepared Nanosilica in concrete

has now been accepted for presentation in BEEC2 which will be held in Beirut, Lebanon in October 17 – 18, 2015.. The paper will be published in the conference proceedings.

Thank you very much for the submission.

Prof. Dr. Shakir A. Salih
Conference Scientific Committee Chairman

Prof. Dr. Riyad H. Al-Anbari
Organizing Committee Chairman

University OF Technology
BUILDING & CONSTRUCTION
ENGINEERING DEPT.

Optimization Process for Using Prepared Nano Silica in Concrete

Najat J. Saleh[1], Raheek I. Ibrahim[*2], Ali D. Salman[1]

Abstract— This study has been devoted to apply the optimization technique involving central composite rotatable design to seek on the optimum conditions for using novel nanosilica (NS) in concrete; this nano silica has been previously prepared from Iraqi sand. Nano silica sand has been shown to improve workability and strength. This research presents the compressive strengths and the microstructure photographs (SEM) of concrete containing nanosilica particles with various sizes of 50, 80 and 100 nm, then compared it with those for control mixture (without nanosilica). Tested results indicated that nanosilica sand significantly improved compressive strength of concrete. The strength improvement was also dependent on the particle size and concentration of nanosilica particles (replacement content). Concrete containing (NS) with 50 nm gave higher compressive strength compared with (NS) of 80 nm and 100 nm. The optimization results proved that the enhancement in compressive strength is 30.149% at optimum conditions. By varying the replacement contents of NS as 2%, 6%, and 10% by weight of cement, the optimum replacement content was shown to be 8% for all nanosilica particle sizes used.

Keywords: Silica nanoparticle, Silica sand, Optimization, Portland cement.

INTRODUCTION

Nanotechnology has been defined by Drexler et al. as ‘‘the control of the structure of matter based on molecule-by-molecule control of products and by-products’’. Nanotechnology can be considered as the most modern aspect in the fields of science and technology **[1].** Because nanotechnology has great market potential and economic impact, the need for research and exploration in this field and of its applications has been growing significantly during the last few decades **[2].**

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Nanoparticles of silica sand have been researched progressively and produced due to the unique features as a result of size reduction. Silica sand nanoparticles have proved to be a very effective additive to concrete by improving durability, mechanical properties and workability to produce high performance concretes **[3].**Nano-scale substances have a great impact on concrete mixtures in order to their higher surface area. A lot of researches used various nanomaterial's to show its effect on the concrete. One of the farthest interests is the nanosilica (NS), this has been attributed to its Pozzolanic characteristics **[4].** The aim of this research is to gain better understanding of the behavior of materials on the nano-scale level as well as determine how to improve the microstructure of cementations materials. Incorporation of nanomaterial's into the matrix to improve concrete mechanical properties has emerged as a promising research field. Because there is no present work concentrated along with this silica sand nanoparticles conduct inside the concrete, this study optimized the operating parameters like NS particle size and percentage of addition to the concrete, using experimental design procedure utilize a second order polynomial model equations, the optimization technique employed **[WinQSB]** and **[Statistica]** software to analyze the developed model equation and predicate the optimum conditions, furthermore, the experimental validation of proposed model was also involved.

2. Materials and Method

The prepared nanosilica specifications and characterization are available in our previous work **[5]**.

2.1. Mix Proportions

Thirty Concrete mixtures was made for compressive strength test were included in the study, there are ten experiments to be carried out for every curing age in sequence according to experimental design. All the concrete specimens had a water-to-cementations ratio