

**EFFECT OF ADDITION OF THE SOLID WASTE OF  
GLASS REINFORCED PLASTIC (GRP) INDUSTRY  
ON THE COMPRESSIVE STRENGTH OF THE  
HARDENED CEMENT MORTARS**

**Submitted By**

**Abdel Fattah Mahmoud Abdel Fattah Gharieb**

B.Sc. Science ( Chemistry – Botany), Faculty of Science, Ain Shams University, 2003

A thesis submitted in Partial Fulfillment  
Of  
The Requirement for the Master Degree  
In  
Environmental Sciences

Department of Environmental Basic Sciences  
Institute of Environmental Studies and Research  
Ain Shams University

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## **ABSTRACT**

In this study the effect of incorporation of recycled glass reinforced polymer (GRP) waste materials, obtained by means of milling processes, on mechanical behavior of polyester polymer mortars was assessed. For this purpose, different contents of recycled GRP waste powder, with distinct size grading, were incorporated into cement based mortars as solid admixture and filler replacements.

GRP is a composite material made of glass fibers dispersed in a resin, usually polyester, which is widely used in several fields from buildings to furniture to boats. Worldwide, there is a growing use of GRP due to its lightness, high mechanical performance, possibility of production in any shape and ease of installation and good durability.

In fact, most of the glass-reinforced plastics industry solid waste (GRP) have negative effects on the environment and the need for additional costs to remove them or safe disposal. With the progress in the knowledge of environmental science and the use of recycling by recycling waste with high costs for disposal to the products can take advantage environmental protection and environmental development techniques.

According to modern uses of some solid waste has the idea has grown to the use of waste steel output for reinforced plastics industry glass in improving physical and mechanical properties of slurries of cement, mortar and concrete hardened, in order to protect

the environment from the accumulation of this waste and also take advantage of it when it is used in the production of products to build its yield and economic affairs in order to environmental development.

In this study, it adds different proportions of GRP is at 0.5, 1, 2.3, 4, 5, 6% of the cement weight of mortar which made by 1: 3 of cement and sand with using the ratio by weight ,40 from the water to cement weight. The mortar samples cured for 24 hours (from mixing with the water time) when the relative humidity of 100% then submerged under water for various times of a 3, 7, 28 and 90 Days conducted compressive strength measurements and total porosity of the hardened pastes at different times of the cement interaction, and so for the control mortar samples (without the addition of GRP) and samples containing different ratios of residue GRP

The viability of improving some durability aspects of mortars through the addition of dosages of very fine Glass Reinforced Plastic by-product was investigated if was found that GRP dust increases the compressive strength performance of the hardened mortars up to a certain limit (4 – 5% addition); 6% GRP addition leads to a negative effect on compressive strength where GRP act as a filler .

The extent of improvement in compressive strength is higher at early ages of hydration and to a less extent at the late ages of



hydration. The results of scanning electron microscopy (SEM) indicate the densification of structure of the hardened mortar pastes.

the study concluded that the optimal ratio to add GRP to cement mortar is 5% for the weight of the cement, and representing the highest improvement in physical and mechanical properties of hardened mortar slurries containing waste GRP.

GRP waste materials as efficient and sustainable reinforcement and admixture for concrete and cement mortars composites, constituting an emergent waste management solution.

Keywords: GRP waste, Mechanical behaviour, mortars, Recyclability



## CONTENTS

Title	Page
Acknowledgments.....	i
Abstract.....	ii
List of tables.....	Viii
List of figures.....	Ix
List of abbreviations.....	Xii
<b>1-INTRODUCTION</b> .....	1
IA. Introduction.....	1
IA.1 Background.....	2
IA.2 Problem Statement.....	3
IA.3 Scope of the Study.....	3
IB. Object of investigation .....	4
IB.1 Optimization of the paste mixes.....	4
IB.2 Further testing of the mixes which possessed acceptable results in preliminary tests.....	5
IB.3 Methodology .....	5
<b>2-LITERATURE REVIEW</b> .....	7
IIA. Introductory remarks .....	7
IIB.Cement.....	8
IIB.1 Portland Cement .....	10
IIB.2 Manufacturing Process of Portland Cement .....	14
IIB.3 Raw mix preparation and blending .....	14
IIB.4 Formation and grinding of clinker .....	17
IIB.5 Environmental Concerns in Cement Production.....	19
IIB.6 Properties of Portland cement .....	20
IIB.6.1 Chemical properties .....	20
IIB.6.2 Physical properties .....	23
IIC.Construction Materials.....	32
IID.An Overview of Solid Waste and Waste Management.....	34
IID.1 Reduce, Re-use and Recycle.....	40
IID.2 Classification of Wastes.....	44
IID.3 Previous Use of Wastes in Construction Industry.....	44
IIE.Historical background of Glass Reinforced Plastic .....	45

IIE.1 Applications of Glass Reinforced Plastic in construction..	52
<b>3-MATERIALS AND METHODS</b> .....	57
GENERAL.....	57
IIIA.MATERIALS.....	57
IIIA.1 Portland cement.....	57
IIIA.2 Fine aggregate.....	59
IIIA.3 Water.....	60
IIIA.4 GRP waste dust.....	63
IIIB TESTING PROCEDURE.....	63
IIIB.1 Preparation of mortar pastes .....	65
IIIB.2 Compressive strength test.....	66
IIIC Determination of porosity.....	67
IIID Scanning Electron Microscopy (SEM).....	67
<b>4-RESULTS AND DISCUSSION</b> .....	69
IV.A .Compressive strength.....	70
IV.A.1. Percent of compressive strength  increasing.....	78
IVA.2. Effect of age on compressive strength results.....	81
IV.A.3. Effect of GRP dust content on compressive strength..	84
IVB. Total Porosity .....	87
IVC. Morphology and microstructure .....	96
IVC.1 Control cement mortar made of the neat OPC.....	97
IVC.2 Cement mortar mixture with 2 % of GRP dust.....	101
IVC.3 Mortar mixture with 3 % of GRP dust .....	104
IVC.4 Mortar mixture with 4 % of GRP dust .....	106
IVC.5 Mortar mixture with 5 % of GRP dust .....	110
IVC.6 Mortar mixture with 6 % of GRP dust .....	113
<b>5-CONCLUSIONS</b> .....	119
V.A. Conclusions And Major Findings .....	119
V.B. Recommendations .....	120
<b>6-SUMMARY</b> .....	122
<b>REFERENCES</b> .....	123

## LIST OF TABLES

Title	Page
Table (2-1): Main Compound of Portland cement.....	12
Table (3.1) Chemical composition and physical properties of ordinary Portland cement.....	58
Table (3.2) : Particle size distribution of standard sand .....	60
Table (3.3): Chemical oxide composition of GRP dust.....	62
Table (3.4): Mix proportions for all dry mixtures and their designations.....	64
Table (4.1): Compressive strength results at the different ages of hydration.....	72
Table (4.2): Percent increase in compressive strength from control mix.....	79
Table (4.3): total porosity values obtained for the various OPC- GRP dust mortars after 7,28 and 90 days of hydration.....	90



## LIST OF FIGURES

Title	Page
Fig.(3.1): SEM micrograph of GRP dust .....	61
Fig. (3.2): GRP dust .....	62
Fig. (3.3) : The mixer used in the study.....	65
Fig. (3.4): Compressive strength machine.....	66
Fig. (3.5): Scanning Electron Microscope (SEM).....	68
Fig.(4.1): Compressive strength results of the hardened OPC-GRP mortar having different GRP contents after 3 days of duration .....	73
Fig. (4.2): Compressive strength results of the hardened OPC-GRP mortar having different GRP contents after 7 days of duration .....	74
Fig. (4.3): Compressive strength results of the hardened OPC-GRP mortar having different GRP contents after 28 days of duration .....	75
Fig. (4.4): Compressive strength results of the hardened OPC-GRP mortar having different GRP contents after 90 days of duration .....	76
Fig. (4.5): Compressive strength results of the hardened OPC-GRP mortars made with different GRP contents at the various ages of hydration .....	77