International Journal of Science and Technology

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Study the Effect of Absorption Solution for Same Composite Polymeric Material

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ABSTRACT

In this paper concerns an investigation of absorption solution in materials of polymeric composite were prepared two types of the matrix material were used (PE,PVC). Also two types of fiber were used (woven and short glass fiber).with volume fraction 20%.

The sample were immersed in different solution ($NaCO_3$-KOH –HCL , Normality 0.5 N) for equal time at constant temperature (room temperature ±20C) . The result show that the relative mass gain increased with increasing the immersion time till they tend saturation moisture mass after that the relative mass gain decreased .

The result show that sample in (KOH)solution had higher mass gain while the sample immersed in (HCL) had lower mass gain .Also the results show that the sample immersed in ($NaCO_3$) has maximum diffusion coefficient which means minimum absorption resistance, while the sample immersed in (HCL) has minimum diffusion coefficient which means maximum absorption resistance.

Keyword: *Absorption Solution, PE,PVC*

I. INTRODUCTION

As result of scientific and technological on large world needed to find a new alterative materials for metals and alloys so be light weight and with high mechanical specifications in additions to resistance to various environmental conditions and their uses in industrial products so been manufacturing the so called composite materials .[1],[2]

Different polymeric composite materials for metallic and ceramic materials susceptibility to absorb water and chemical solution . the permeability of chemical solution to composite materials are made by a major mechanical diffusion include deployment of solvent molecules in material foundation and reinforcement material .[3]

Due to the above mentioned reasons has made many researchers under the guidance of their ideas and effects to study the material composite , especially foundation alpolymeric and that because of its good features .

The researcher (Gardiner 1997) studied the case of weathering on the sheet of materials PVC used in civil engineering applications concluded that UV , oxygen moisture and solution working on biodegradable polymer more than UV work alone .[4]

The researcher (sheelan 2008) diffusivity behavior and diffusion coefficient was investigated in this paper for epoxy composite reinforced with glass fiber (woven roving and random direction) to gather as a sandwich with volume fraction 44% .the result show that the relative mass gain increased with increasing the immersion time . the result show that the sample immersed in (kerosene) solution had higher mass gain while the samples immersed in distill water had lower mass gain .[5]

The researcher (asraa 2009) A composite material from the epoxy resin reinforced with silica and hybrid composite material from epoxy resin reinforced with silica and glass . Also absorption test was carried out for the prepared samples to study the diffusivity after immersion in different chemical solutions including at room temperature . the results show that the binary blend reinforced with silica particles had superior values of properties .[6]

The researcher(awham 2011) the current study concerns an investigation of diffusion mechanism of different kinds of water into thermoplastic material (UPVC) . after comparing the obtained results from these tests ,it is found that the distilled water has the higher value of (D_X) into the (UPVC) material ,it is followed by the sea water and then the rainwater ,while each of river and tap water record the lowest values [7].

II. THEORETICAL PART

Absorption ,is the influence of process liquid into solid material over a given time . that has been affected composite materials with water and solutions represents one of the factors analyzed and breaks the bonds between molecules ,

particulate in the region interfaces and also effect the material basis and make them more plasticity.

The presence of crack inherent in interlaced material (during manufacturing – transportation –use) will help in the ingress of water and fluids inside the composite material in addition to moving along the fiber reinforcement . particularly in the region interfaces and thus influence the properties of the material composite .[8] in general the effect of solutions in polymer and composite take different form .[9]

1- Osmosis solution of various kinds during the polymer leading to the phenomenon swelling .
2- Dissolution of the polymer in different circles .

The fluid permeability through the material to not depend on the absorption coefficient of the material , but also depend on the difference in the concentrations of material scattered from one point to anther within the material and the material thickness. When concentrations do not change on the other side of the material over time ,it can be expressed Fick's first law, states that the prevalence of the atoms in the material can be measured by flux , which is defined as the number of atoms scattered across unit area per unit time . [10],[11]

---------- (1)

$$J = -D\frac{ds}{dx} \quad --$$

J represent flux units **(atoms/cm^2 . sec)**

D: diffusion coefficient (cm^2 / sec)

$\frac{ds}{dx}$ include a concentration **(atoms/cm^3 .cm)**

III. EXPERIMENTAL PART

The materials used in the search:

Matrix material is of two types (PVC and PE) .

Reinforcement materials is of two types (short fiber glass and woven roving fiber glass) .

After that was manufactured four types of materials composite a

[PE+F.G , PE+F.G(W.R),PVC+F.G , PVC+F.G(W.R)] . That was to prepare chemical solutions (KOH, $NaCO_3$,HCL) and put in bottles special than immersion all well sample and by immersion was calculated masses samples using electronics balance sensitive fumbles reading to four dec imal place and after ten days immersions samples extracted from solution and weighed and repeated this process for six months .

Using the relationship (2) is calculated percentages of change in mass of the samples developed in solutions

$$\text{weight gain} = \frac{M_2 - M_1}{M1} \times 100\% \quad \text{.....(2)}$$

M_1mass of the sample before immersion(gm).

M_2 mass of the sample after immersion(gm) .

It then calculate the diffusion coefficient using the equation (2) .

IV. RESULTS AND DISCUSSION

That forms (1,2,3,4,5,6,7,8) refers to the charge percentages of absorption with the square root of the time , and we note way that the ratios of absorption materials composite solutions increases with time and varying degrees of immersion , and the reason for this is due to the entry chemical solutions in the composite material leads to poor connectivity between reinforcement material and material matrix and this in turn , works to increase the porosity and thus increasing the absorption material to chemical solution. [12]

The absorption process taking place for all types of polymers and composite material when immersed in chemical solution follow ficks law in proliferation and does this mean that the mass of water or chemical solutions absorbed increases linearly with the square root of time gradually and slowly until reaching the saturation [13] and this has demonstrated in practical results.

The results also showed when immersing the sample in chemical solution which are all same concentration (0.5N) and for a period of up to six months to see that the solution (KOH) has a greater effect from the solution ($NaCO_3$) and the solution (HCL) .The solution (KOH) had a larger its effect in the material because of the ratio of impurities is corrosive solutions [14],[15] . The results also showed that the highest value for the solution ($NaCO_3$) followed by solution (KOH) followed by solution (HCL).

The influence of solution inside composite exhibits multiple ways ;

1- Interface between the matrix material and reinforcement materials .

2- Cracks inherent with in the material and poor regions interdependence between the matrix material and reinforcement materials.

V. CONCLUSIONS

1. Mass increases for samples with increasing time of immersion in chemical solutions.
2. Given sample[PE+F.G(W.R)] immersed in ($NaCO_3$) the highest value for the diffusion coefficient , while given sample(PE+F.G) immersed in (HCL) less the value of the diffusion coefficient.
3. The study proved that immersion composite materials in chemical solutions does not alter the dimensions of material and color , but the change happens only in material weight.

Acknowledgement

This work is supported by the University of Anbar-Iraq /Renewable Energy Research Center with Grant No. RERC-TP14.

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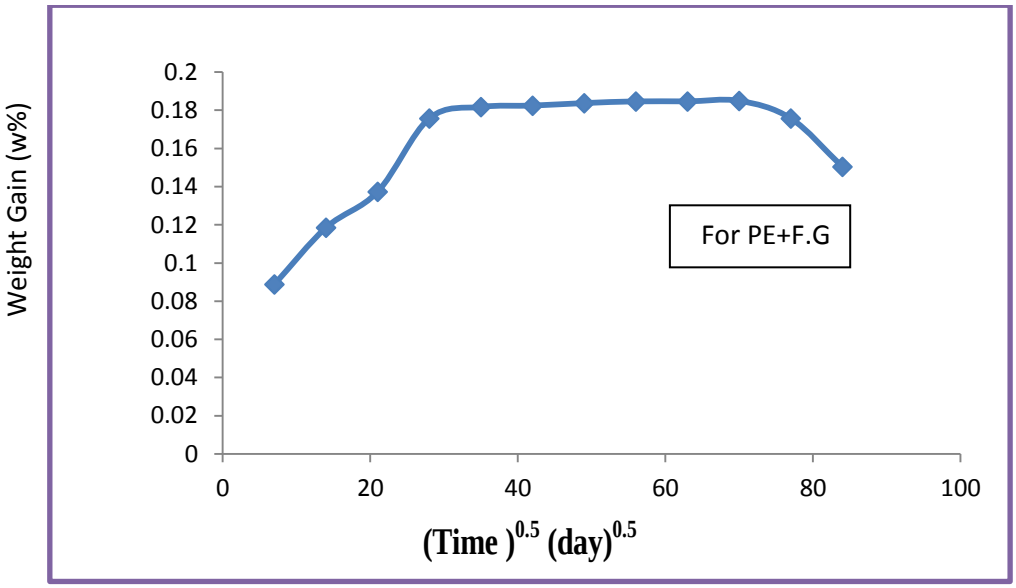
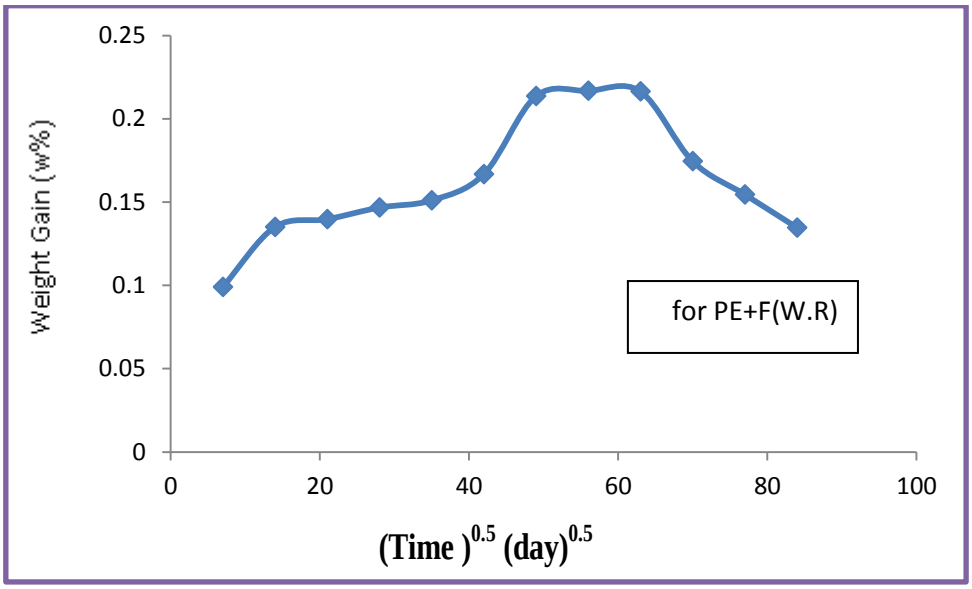
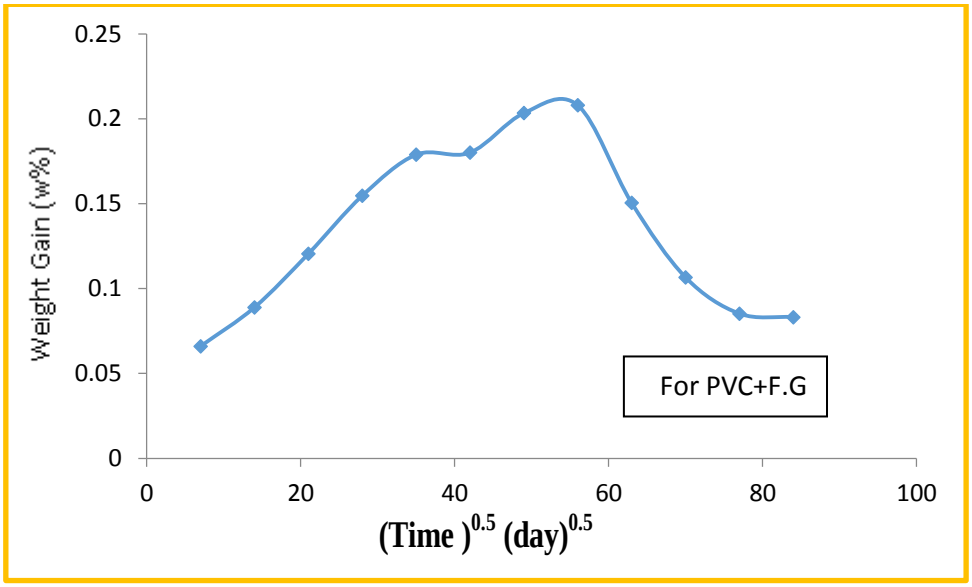


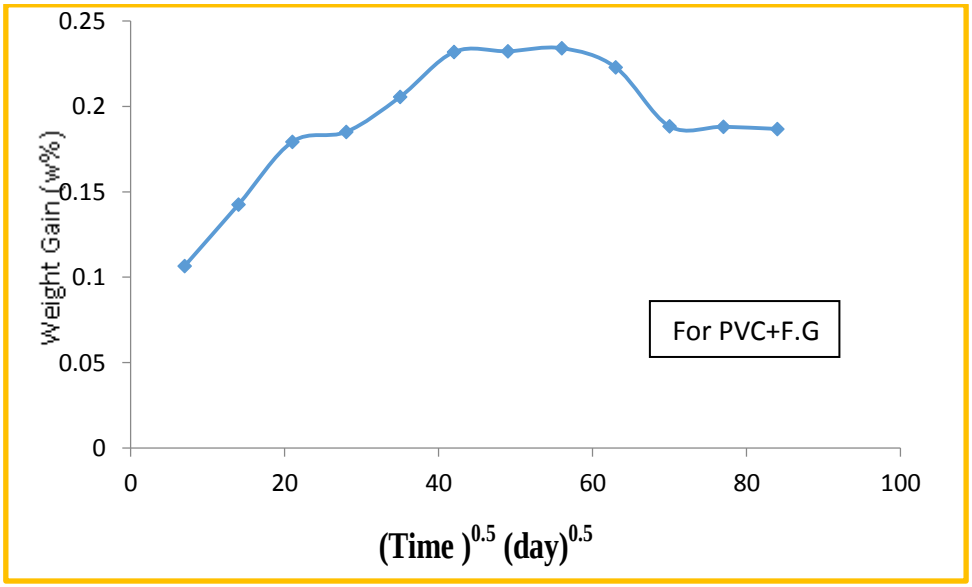
Figure(1) Relation between Weight Gain and the Square root of Time Immersion in $NaCO_3$ (0.5N)



Figure(2) Relation between Weight Gain and the Square root of Time Immersion in $NaCO_3$ (0.5N)



Figure(3) Relation between Weight Gain and the Square root of Time Immersion in $NaCO_3$ (0.5N)



Figure(4) Relation between Weight Gain and the Square root of Time Immersion in $NaCO_3$ (0.5N)

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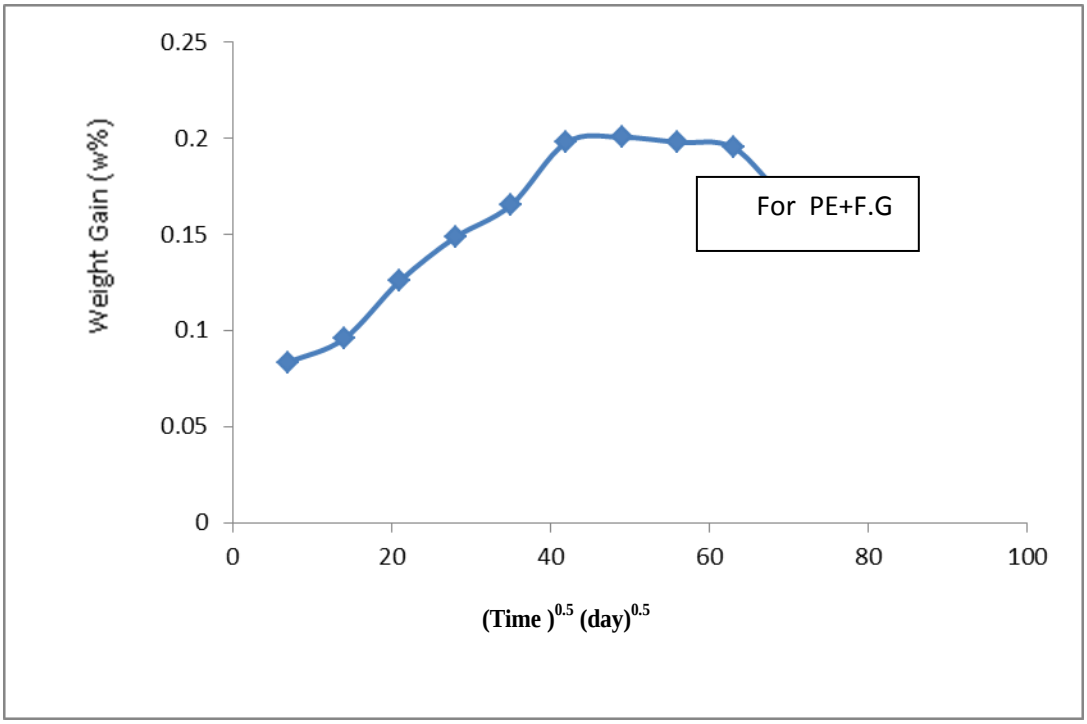
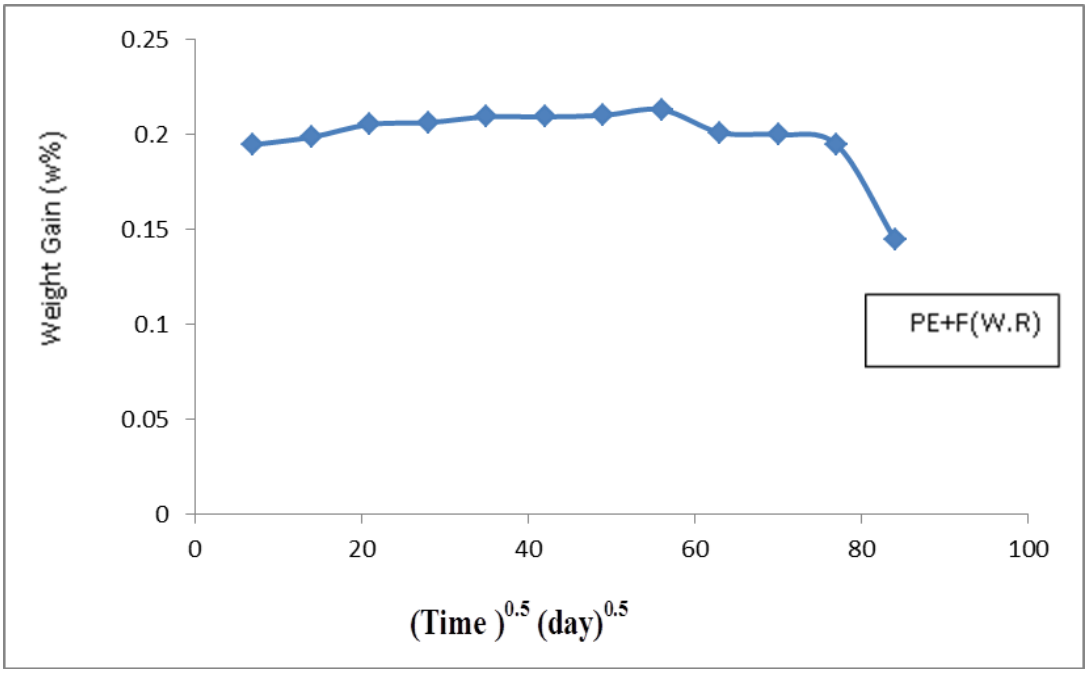
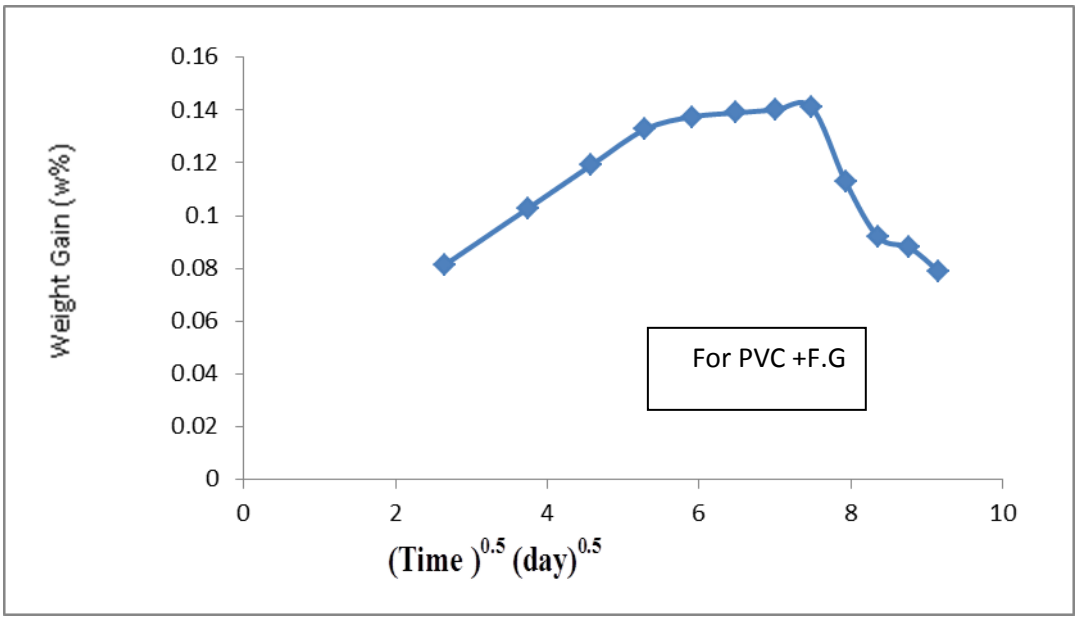


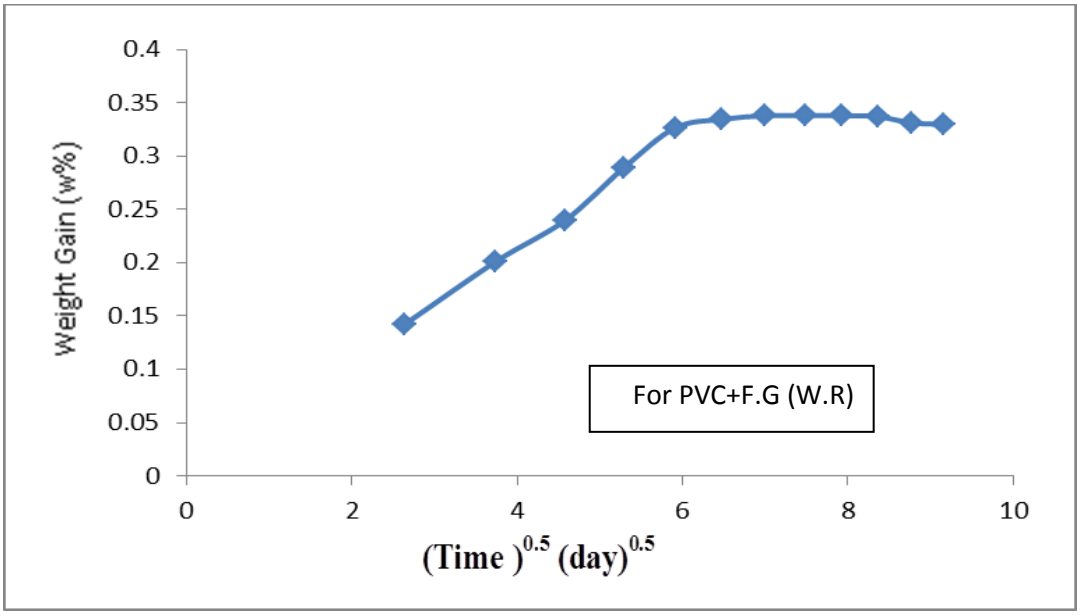
Figure(5) Relation between Weight Gain and the Square root of Time Immersion in KOH (0.5N)



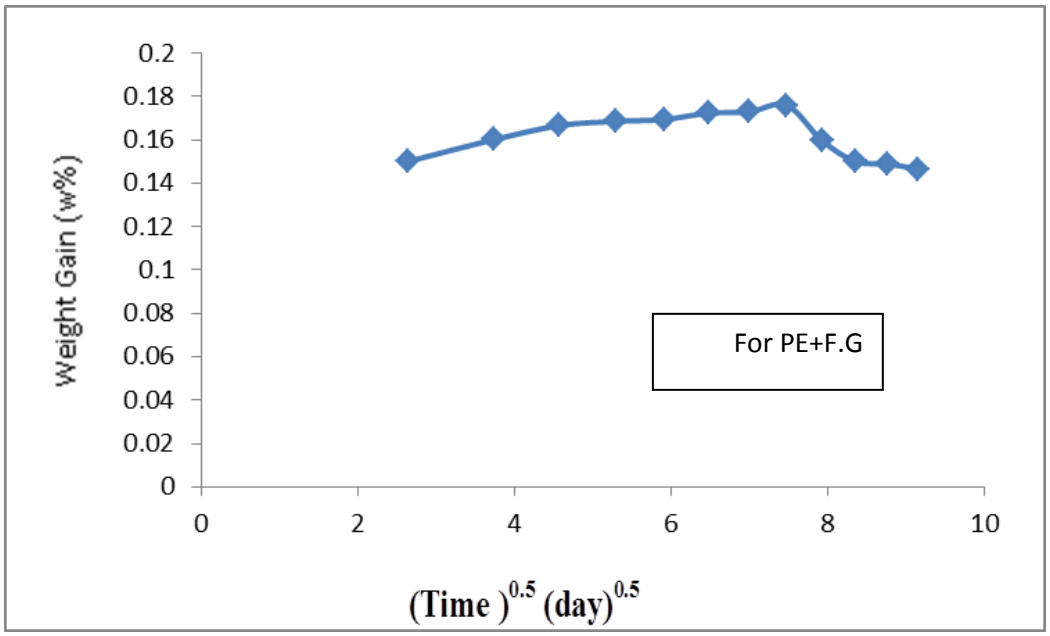
Figure(6) Relation between Weight Gain and the Square root of Time Immersion in KOH (0.5N)



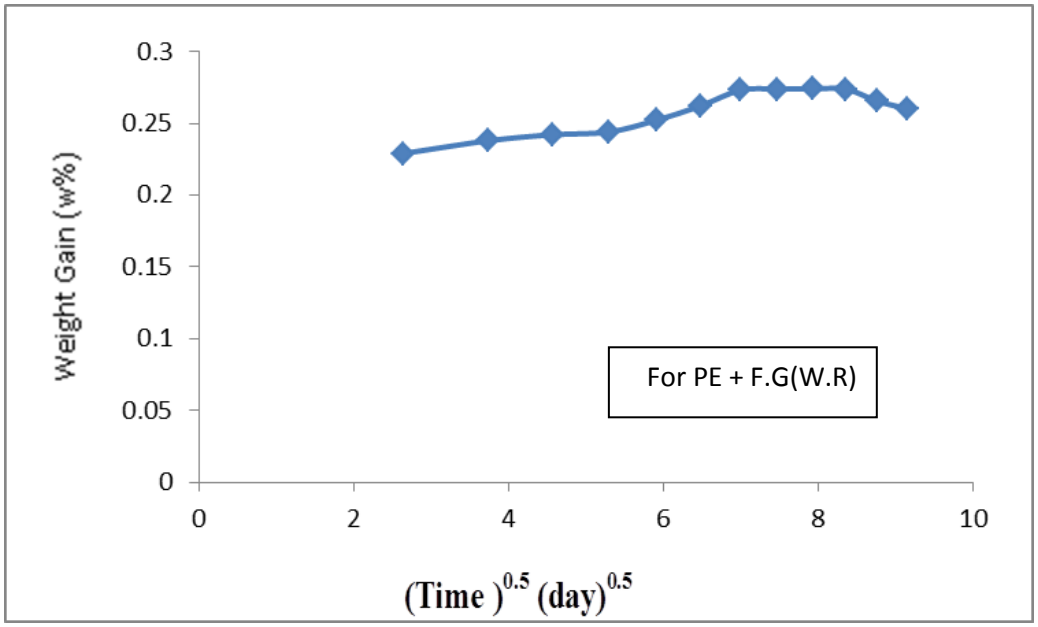
Figure(7) Relation between Weight Gain and the Square root of Time Immersion in KOH (0.5N)



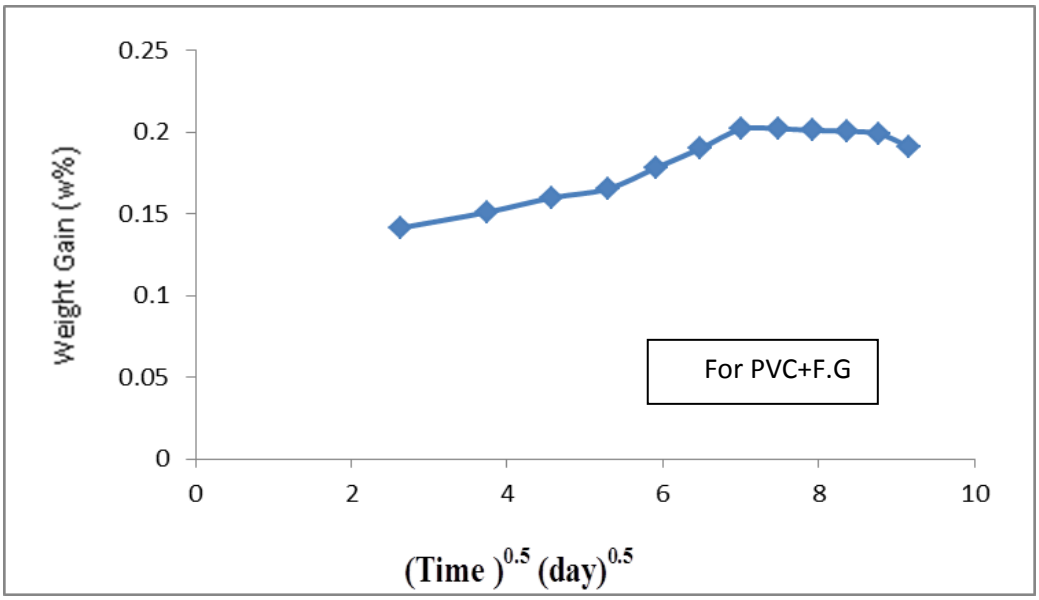
Figure(8) Relation between Weight Gain and the Square root of Time Immersion in KOH (0.5N)



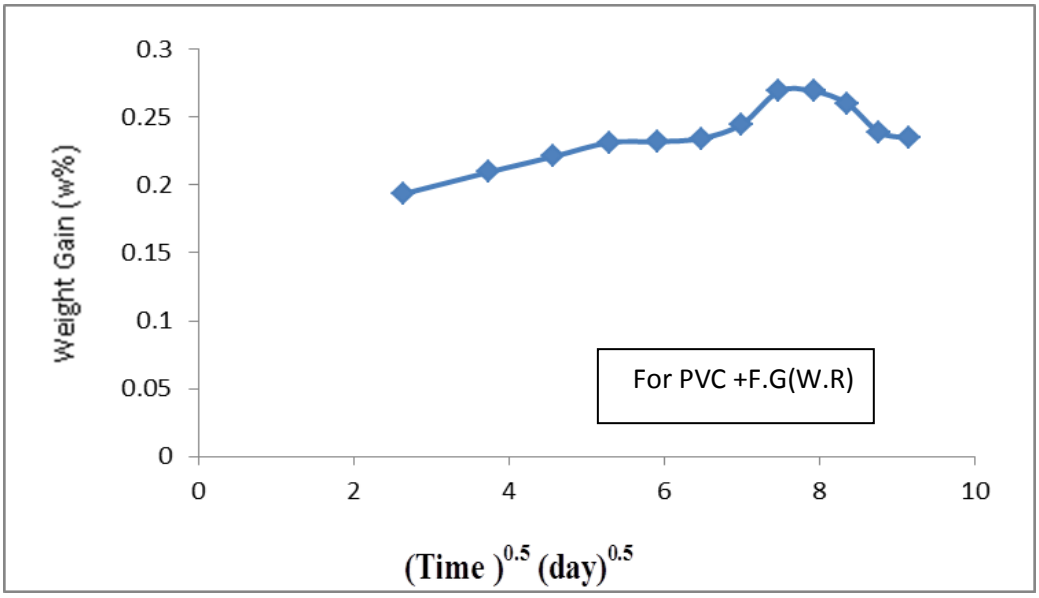
Figure(9) Relation between Weight Gain and the Square root of Time Immersion in HCL (0.5N)



Figure(10) Relation between Weight Gain and the Square root of Time mmersion in HCL (0.5N)



Figure(11) Relation between Weight Gain and the Square root of Time Immersion in HCL (0.5N)



Figure(12) Relation between Weight Gain and the Square root of Time Immersion in HCL (0.5N)

Table (1) Shows the results of (C.S) for the samples of test before and after exposure to chemical solutions.

C.S (N/mm^2)				
chemical solutions	**PE+F.G**	**PE+F.G(W.R)**	**PVC+F.G**	**PVC+F.G(W.R)**
Na CO_3	**0.0328**	**0.2281**	**0.0436**	**0.0273**
KOH	**0.0020**	**0.0007**	**0.0158**	**0.0106**
HCL	**0.0009**	**0.0190**	**0.0201**	**0.0144**