

(2011 / 6 / 6 2010 / 12 / 23 )

.% 20 (E-glass woven)  
'( I . S) (E) .(C · S) '(B . H)

( HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>)  
( )

## **Studies of the Mechanical Properties of Unsaturated Polyester Composite Reinforced by Randomly Woven Fiber Glass and Effect of Acidic Solutions on some of its Physical Properties**

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### **ABSTRACT**

Preparation of unsaturated polyester reinforced with 20% (v/v) glass fiber woven randomly E–were studied and the mechanical properties such as, Yong modulus (E), Impact Strength (I.S), Brinell hardness (B.H) and compression Strength (C.S) were investigated, at room temperature.

The resistance to the stress of the reinforced polyester and its mechanical properties were improved.

The effect of the acidic solutions like (HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>) at different concentrations, has been studied on some physical properties (absorbance and diffusion coefficient) of polyester before and after reinforcement, and the results revealed obvious improvement in its physical properties.

)

.(2008

.(1993 )

:(1983 )

(Heterogenous)

.....

:

.Stiffness	-1
.Dimentional Stability	-2
.Impact Strength	-3
.Distortion Temperatur	-4
.	-5
.	-6
.	-7

Fairings Doors 1940

.(Jacobs, 1985)

Moloney 1983

)

(

.(Monoly *et al.*, 1983)

Hanoush Adam 1999

.(Adam and Hanoush,1999)

2008

(E-glass)

(Chrysolite)

.(2008 )

2010

%10 (E-glass)

)

) (

(

.(2010 )

2009

(0.5N) (HCl, NaOH)

.(2009 )

(2001 ) (Hanoush and Adam 2000)

.(2010 )

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**(Matrix)**

**-1**

( Henkel A.S )

.....

( )

<sup>3</sup> / 1.5

%2

**(Reinforcement material)**

**-2**

(E-glass woven randomly)

<sup>3</sup> / 2.6

REDEL- DE )

**HCl, H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>**

**-3**

(1.5 N; 1 N; 0.5 N)

( HAEN AG

:

% 2

(MEKP)

% 20

(Hull, 1981)

1

$$\phi = \frac{1}{1 + (\psi P_f / \psi P_m)}$$

:ψ

:( P<sub>m</sub> P<sub>f</sub>)

:φ

(Hand-Lay up Molding)

(% 2

)

(

)

( %80

%20 )

(10 cm × 20 cm)

24

50 °C

(curing)

(ASTM)

:

(1.5 N; 1 N; 0.5 N)

HCl, H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>

:

ELE-England

( 3- Point test)

Tokyo Koki Seizosho, LTD

(D-6700)

(Brinel HBr)

.WOLPERT - Germany

:

(Young's Modulus)

-1

(Stress)

(stress - strain curve) -

)

.(1983

(σ)

.....

$$\sigma = F / A \quad \text{-----}(1)$$

(ε)

$$\epsilon = \Delta L / L_0 \quad \text{-----}(2)$$

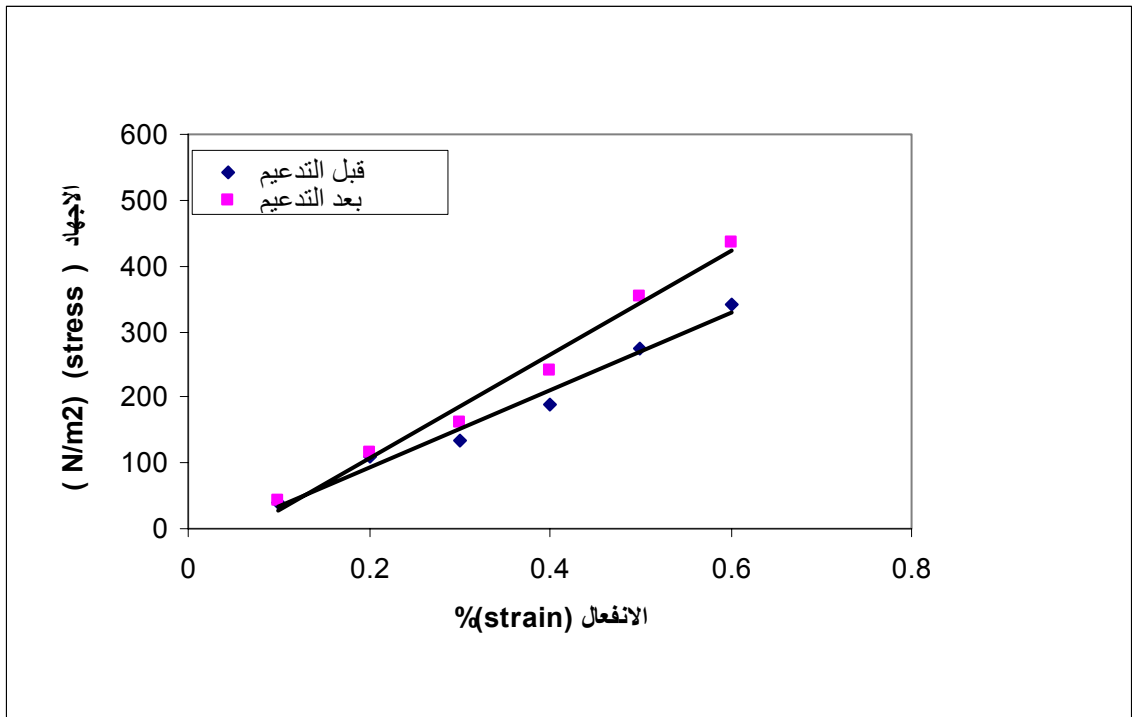
(Three-point test)

: [( E ) ]

$$E = \sigma / \epsilon \quad \text{-----}(3)$$

°25 (1)

( ) ( )

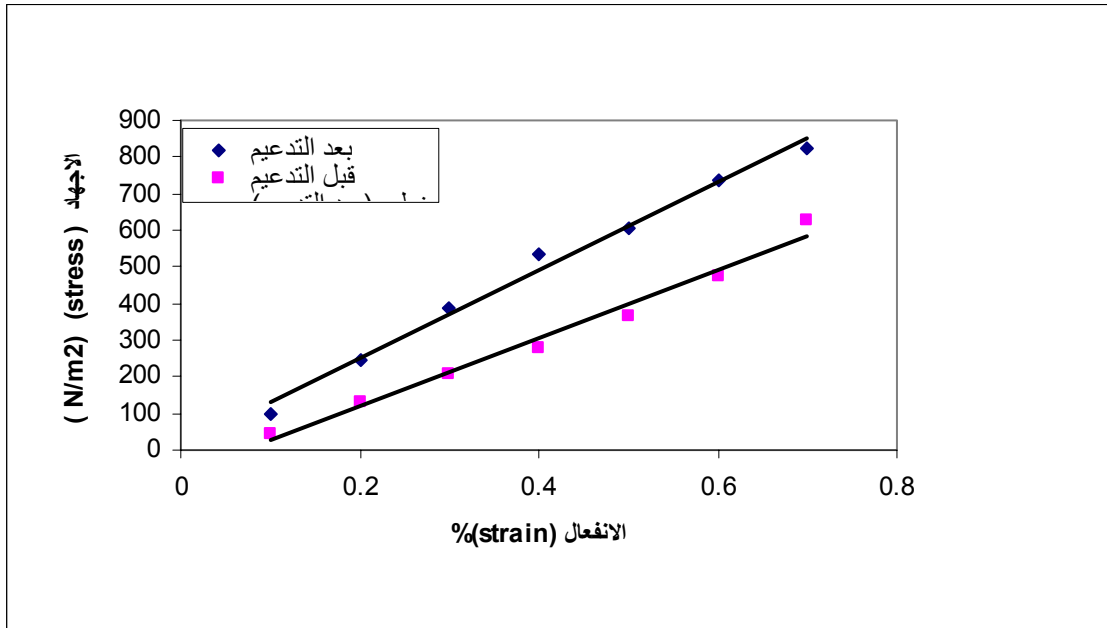


. °25

( )

:1

° 55 (2)



° 55 ( ) :2

(1 )

°55 (Chawla,1987)

.( °55 °25) :1

°25	$5.4 \times 10^{10} \text{ N/m}^2$	$7.903 \times 10^{10} \text{ N/m}^2$
°55	$4.45 \times 10^{10} \text{ N/m}^2$	$6.915 \times 10^{10} \text{ N/m}^2$

Impact Strength (I.S) -2

(1983 )

.(4)



.....

Impact Strength (Joule/m<sup>2</sup>) = ----- (4)  
 (I.S)

( 0.20 Kg.m )  
 ( ) (2)

.(Rechardson , 1977)

**Hardness (B. Hr) -3**

.(1993 )

.(2001 ) (5)  
 (2)

$$B.Hr = \frac{p}{\pi Dt} = \frac{2p}{\pi D[D-(D^2-d^2)^{1/2}]} \left( \frac{kg}{mm} \right) \text{-----(5)}$$

- :
- (kg) = P
  - (mm) = D
  - (mm) = d
  - = π
  - = t

**Compressive Resistance (C.S)**

**-4**

(brittle)

(ductile)

.(Seymour,1990)

:

(C.S) = ----- (6)

(6)

.(2 )

.%20

:2

I.S	2.5382 Joule/ m <sup>2</sup>	2.597 Joule/ m <sup>2</sup>
B.Hr	36.4Kg/mm <sup>2</sup>	71.4 Kg/mm <sup>2</sup>
C.S	3. 0982 Kg/ mm <sup>2</sup>	5.1709 Kg/mm <sup>2</sup>

.(2004 )

.....

-5

:

.

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)

.(salih , 2009) (

(7) (Weight Gain %)

$$\text{Weight Gain \%} = \frac{M_2 - M_1}{M_1} \times 100 \quad \text{----- (7)}$$

= M<sub>1</sub>

= M<sub>2</sub>

(Diffusion Coefficient)

:(8 ) (2004 )

$$D = \pi(k b / 4M_{\infty})^2 \quad \text{-----}(8)$$

= k

= b

= M<sub>∞</sub>

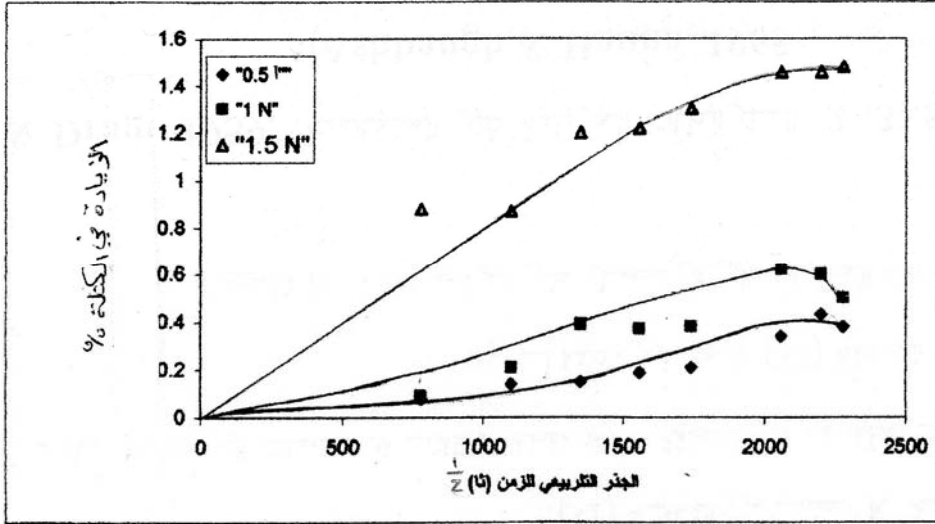
.( )

( ) (3-8)

% 20

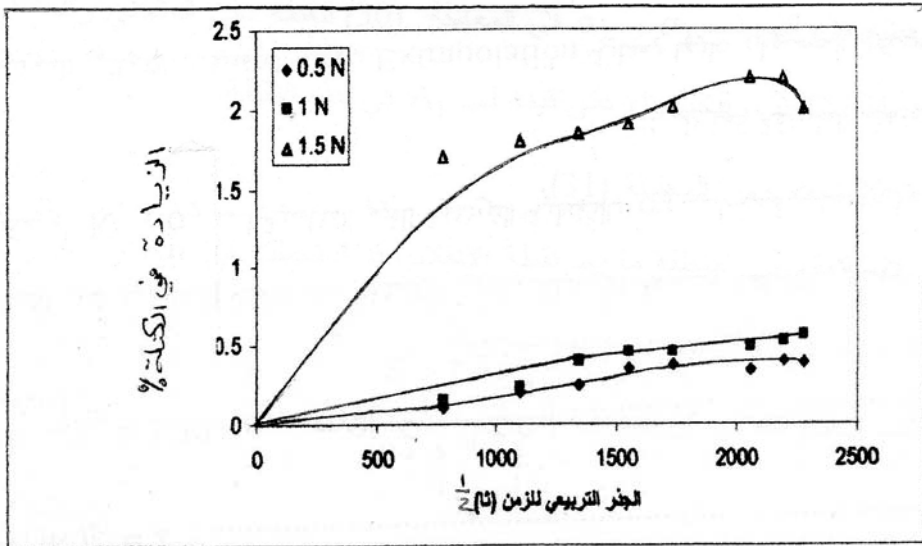
.HCl, H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>

( )



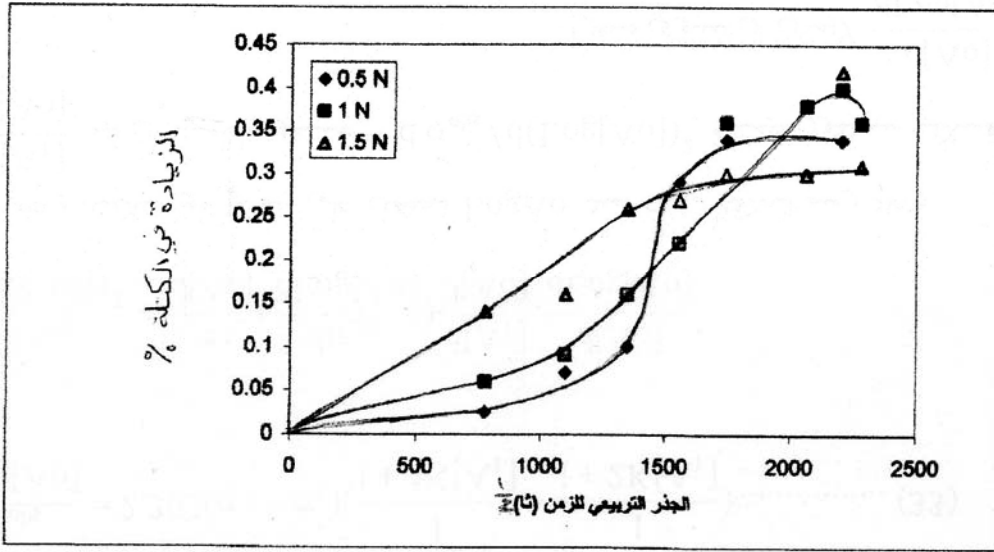
: 3

.HNO<sub>3</sub>



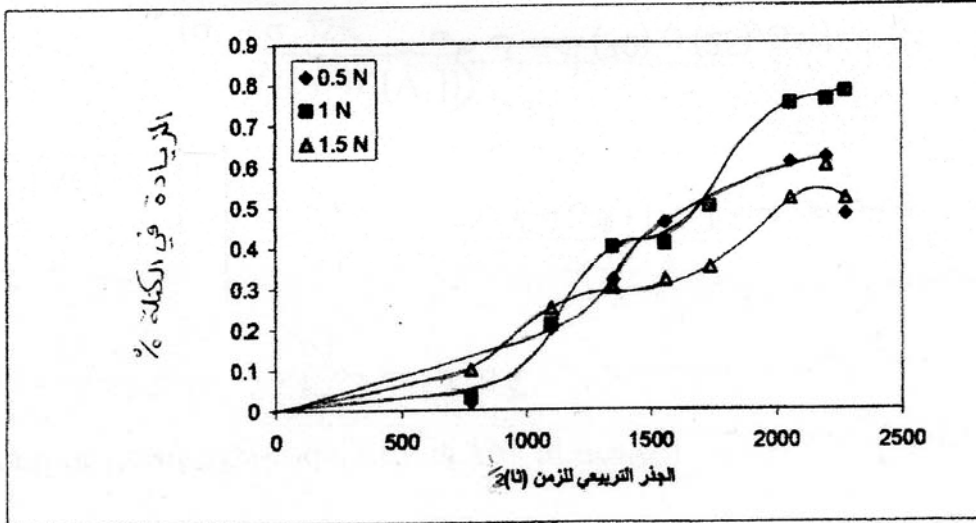
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.HNO<sub>3</sub>



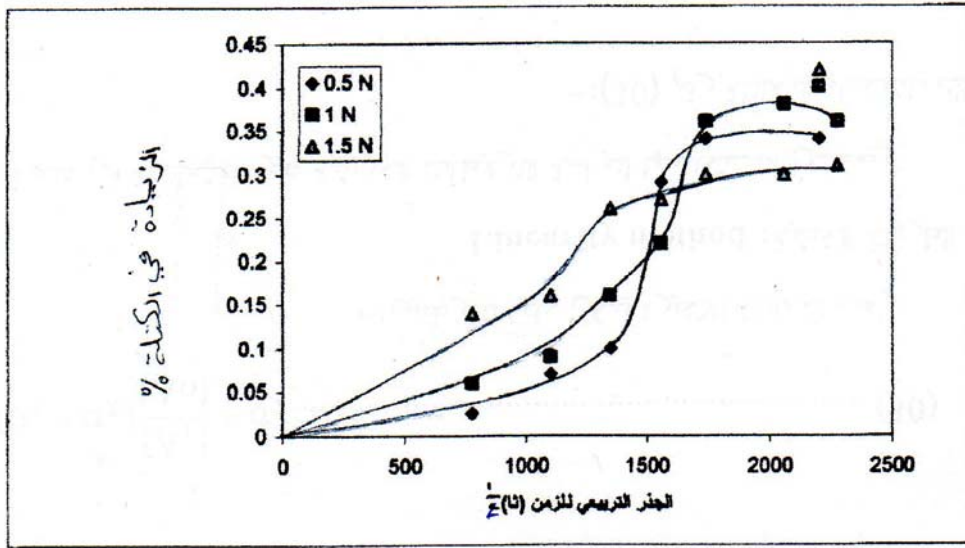
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.H<sub>2</sub>SO<sub>4</sub>



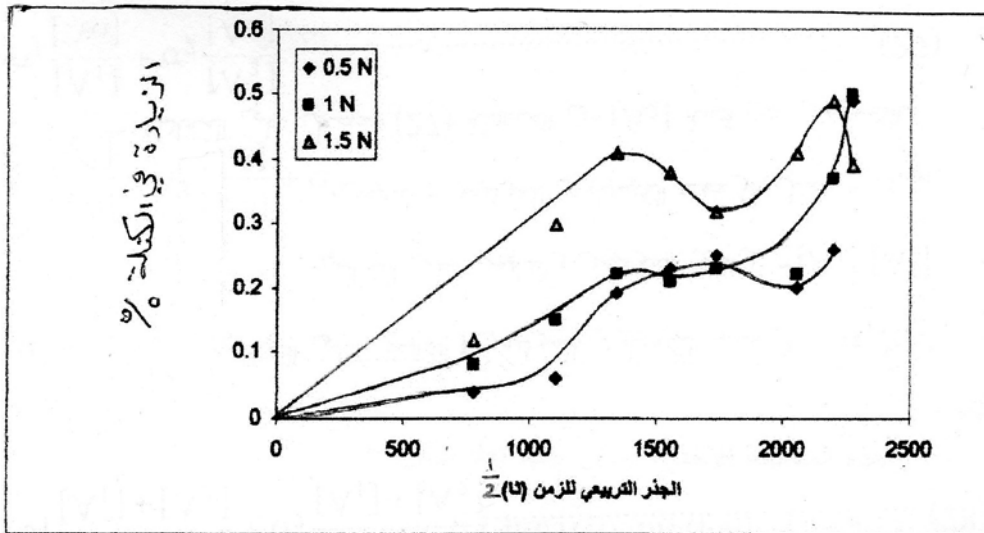
:6

.H<sub>2</sub>SO<sub>4</sub>



: 7

.HCl



: 8

.HCl

(3)

.....

: 3

	Diffusion Coefficient $\times 10^{-9}$ m <sup>2</sup> /sec					
	0.5 N	1 N	1.5 N	0.5 N	1 N	1.5 N
HNO <sub>3</sub>	5.345	38.01	327.0	9.503	85.52	847.6
H <sub>2</sub> SO <sub>4</sub>	1.336	4.65	17.96	14.84	38.01	100.4
HCl	1.520	8.278	20.44	2.024	11.09	32.38

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-1

-2

-3

.(Salih, 2009)

-4

.(Salih , 2009)

" (1983) .755  
 ( ) (2004)  
 (2001)  
 (2010)  
 (4) 28  
 (2008)  
 (11) 26  
 (2009)  
 (14) 27  
 (2001)  
 .258 " (1993 )

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