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Evaluation of Residual Yield Strength Capacity of Corroded and Exudates / Resins Coated Reinforcing Bars Embedded in Concrete

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ABSTRACT

The corrosion of steel bars embedded in concrete is affected by a wide range of parameters such as water-to-cement ratio, permeability, concrete cover, crack width and the use of supplementary cementitious materials. The investigative work appraised the reduction of corrosion effect on reinforcing steel mechanical properties which in turns led to untimely collapse of concrete structures in salt water regions with the introduction of exudates / resins of invingia gabonesis to reinforcing surface with coated thicknesses of 150µm, 300µm and 450µm, embedded in concrete beams, accelerated for corrosion processes in corrosive laboratory environment and monitored the effect of corrosion on both non-coated and coated members. Non-corroded has percentile value of -22.0005% against 28.20595% and 26.92462% t non-corroded and invingia gabonensis exudates coated specimens. Midspan deflection average values have percentile value of 25.8096% against -20.5148% and -19.7161% non-corroded and coated specimens. Average yield strength summed up to 100% with 0.00% of percentile value. Average ultimate tensile strength has percentile value of -10.7196% against 12.00672% and 12.01235% non-corroded and coated specimens. Average strain ratios have percentile value of 35.57937% against -26.2425% and -46.9991% of non-corroded and coated specimens. Average elongations have percentile value of -29.6435% against 42.13332% and 40.6966% for non-corroded and coated specimens. Detailed experimental results of coated beam members showed indications of resistance against corrosion with no mechanical properties of reinforcing steel negative effects of weight loss, cracks, spalling and diameter reduction. Experimental results showed indications of corrosion potentials of non-coated members with corrosive attributes of mechanical properties diameter reduction, weight loss of steel, cracks presence. These properties has led to high flexural failure load and ultimate yield strength with low applied low, high strain ratios, elongation and midspan deflection.

Key words: Corrosion, Corrosion inhibitors, Flexural Strength, Concrete and Steel Reinforcement

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1. INTRODUCTION

Corrosion of reinforcing steel embedded in concrete structures in the marine coastal regions with salt water (chloride induced) generates tensile stresses in steel reinforcement surroundings of the concrete, resulting to early cracks. Cracks can reduce the overall strength and stiffness of the concrete structure and accelerate the ingress of aggressive ions, leading to other types of concrete deterioration and resulting in further cracking [1]. Principal factors such as concrete pH, chloride ions, oxygen and water needed to be considered in the controlled of corrosion inhibition of reinforcement. Methods adopted to control these factors are the use of epoxy coatings, inhibitors, buffers, electrochemical protection procedures and scavengers all known to be corrosion inhibitors. Macdonald [2] carried out the investigation of inhibitors in solutions of alkaline and extracts from cement. The extracts from cement experiment revealed corrosion was inhibited using sodium nitrite in the presence of chlorides while sodium benzoate did not. Furthermore, the initiation of corrosion was delayed with sodium nitrite, with the delay increasing with inhibitor content.

Novokshcheov [3] studied and showed that calcium nitrite is in no way detrimental to concrete properties as seen in the issue of inhibitors based on sodium or potassium. Latter study by Skotinck [4] and Slater [5] showed that considering long-standing accelerated testing, calcium nitrite was of better quality in terms of strength.

Huang and Yang [6] investigated the corresponding relationship between the corrosion of reinforced concrete beams and load-carrying capacity. Two beam types of (150 x 150 x 500 mm, reinforced with two 6 mm bottom bars) were used: beams without cracks (type S) and beams with a middle surface crack (type K). Their results showed significant reduction in load-carrying capacity with the increase in corrosion was more in beams with a low w/c or predetermined cracks (mix B or type K). They concluded that this behavior was a result of the chloride ions having easier access to the reinforcing steel in cracked beams than in un-cracked ones.

Charles *et al.,* [7] investigated the residual yield strength structural capacity effect of non-corroded, corroded and inhibited steel bar. Results obtained showed that corrosion potential was recorded on uncoated reinforcement with cracks propagations while resin coated showed resistance. The results of coated steel bar with three different resins / exudates extracts of Symphonia globulifera linn, ficus glumosa and acardium occidentale l.) versus corroded on comparison, the flexural strength failure load are 29.50%, 28.505,29.57% against 22.30% corroded, midspan deflection are 31.14%,25.30%, 22.30% against 39,30% corroded, tensile strength 11.84%, 12.13%, 12.14% against 10.17% and elongation are 32.40%, 32.13%, 32.40% against 46.30% corroded. Overall results indicated that coated steel bar showed higher values increased in failure load and tensile strength while corroded decreased in elongation and midspan deflection.

Charles *et al.,* [8] investigated the effect on flexural residual yield strength capacity of three different resins/exudates extract of trees of dacryodes edulis, moringa oleifera lam, mangifera indica paste coated reinforcement on the concrete beam.. Flexural strength failure loads of coated members with dacryodes edulis, moringa oleifera lam, mangifera indica are 35.78%, 27.09%, 29.42% against 22.30% decreased in corroded, midspan deflection are 18.57%, 28.30%, 27.43% against 39.30% increased in corroded, elongation are 28.75%, 31.50%, 31.60 against 46.30% increased in corroded and tensile strength are 14.18%, 12.29%, 12.08% as against 10.17% decreased in corroded respectively. Entire results showed that low load subjection is recorded in coated members at failure loads as against in corroded with high deflection and elongation.

Charles *et al.,* [9] examined the effect/impact of corrosion inhibitors on flexural strength of failure load, midspan deflection, tensile strength and elongation of steel reinforcement layered with resins/exudates of magnifera indica extracts as corrosion inhibitors. Results recorded on experimental work showed flexural strength failure load, midspan deflection, tensile strength and elongation as 29.09%,31.20%, 11.75% and 31.50% for non-corroded, 29.42%, 27.43%, 12.09% and 31.60% for coated concrete beam respectively. For corroded concrete beam members, failure load decreased to 22.505, midspan deflection increased by 39.30%, tensile strength decreased to 10.17% while elongation increased by 46.30%.

Charles *et al.,* [10] investigative study was carried out to ascertain the utilization of natural inorganic extracts of tree resin/exudates to assess the yield strength capacity of reinforced concrete beam members under corrosion accelerated medium.. Non – corroded and coated members in comparison with corroded recorded increasing values on flexural strength failure load by 23.8% and 29.59% against 22.30% of corroded, tensile strength non – corroded and coated increased by 12.03%, 12.14% over 10.17 % of corroded while decreasing values on midspan deflection of 28.30% and 22.30%, elongation 31.5% and 32.46% recorded on non-corroded and coated concrete beam members as against 39.30% and 46.30% of corroded respectively.

Charles *et al.,* [11] investigated the effects of corrosion on the residual structural steel bar capacity of resins/exudates inhibited and non-inhibited reinforced concrete beam members. Results obtained showed corrosion potential presence on uncoated members with cracks and spalling. Further recorded results on non-corroded flexural strength test of failure load 29.09%, midspan deflection 28.30%, tensile strength 12.03% and elongation 31.50%, for coated beam members, failure load 29.42%, midspan deflection 27.42%, tensile strength 12.09% and elongation 31.80%, for corroded beam members, failure load decreased by 22.50%, midspan deflection increased by 39.30%, tensile strength decreased to 10.17% and elongation by increased 46.30%. The entire experimental results showed that corroded specimens has lower flexural load, higher midspan deflection, lower tensile strength and higher elongation due to loss of steel bar fibre from degradation effect from corrosion, inhibitors served as protective coating against corrosion, but no strength was added to steel members.

Otunyo and Kennedy [12] investigated the effect of corrosion on the flexural strength and mid-span deflection of steel reinforcements coated with resins / exudates of trees extract known as inorganic inhibitors (dacryodes edulis-African Pear). Results obtained indicated that the flexural failure strength, and elongation increased by (29%) and (48%) respectively for the dacryodes edulis coated steel members, the mid-span deflection decreased by 26%, elongation increased by 23% and 32% respectively, while the mid-span deflection decreased by 40%. The resin (mdacryodes edulis) added strength to the reinforcement.

Charles *et al.,* [13] experimented on the effects of corrosion and inhibitors (Inorganic origin) extracts known as resins/exudates from trees barks on the residual flexural strength of concrete beam members immersed in corrosion accelerated medium for 90 days to ascertain possible changes on surface conditions of investigated samples. Results obtained of corroded concrete beam members were 22,50%, 39.30%, 10.19% and 46.30 of failure load, midspan deflection, ultimate tensile strength and elongation, for non- 29.09%, 28.30%, 12.03% and 31.50%, for coated beam members , 28.5%, 25.30%, 12.13% and 32.12% respectively. These results indicated increased in flexural failure load and ultimate tensile strength and decreased in midspan deflection and elongation respectively in corroded concrete beam members.

Charles *et al.,* [14] performed and investigated on uncoated and corrosion inhibitors (Symphonia globulifera linn) resins / exudates paste coated steel reinforcing bar.. Results obtained on comparison between uncoated (corroded) and coated are flexural failure load 22.50% to 29.50%, midspan deflection 39.30% to 31.14%, tensile strength 10.17% to 11.84% and elongation 46.30% to 32.40% respectively. Thus, results showed decreased in failure load and tensile strength of corroded members while increased in midspan deflection and elongation.

2. MATERIALS AND METHODS FOR EXPERINMENT

2.1 Aggregates

The fine aggregate and coarse aggregate were purchased. Both met the requirements of BS 882[15]

2.1.2 Cement

Portland limestone cement grade 42.5 is the most and commonly type of cement in Nigerian Market. It was used for all concrete mixes in this investigation. The cement met the requirements of BS EN [16]

2.1.3 Water

The water samples were clean and free from impurities. The fresh water used was gotten from the tap at the Civil Engineering Department Laboratory, Kenule Beeson Polytechnic, Bori, and Rivers State. The water met the requirements of BS 3148 [17]

2.1.4 Structural Steel Reinforcement

The reinforcements are gotten directly from the market in Port Harcourt. BS 4449:2005+A3 [18]

2.1.5 Corrosion Inhibitors (Resins / Exudates) Invingia Gabonensis

The study inhibitor (Invingia Gabonensis Exudates) of natural tree resins/exudates extracts.

2.2 Methods

Present study involves direct application of resins / exudates of trees extract known as inorganic inhibitor Invingia gabonensis xxudates, layered/coated on reinforcement steel ribbed surface. The objective of this study was to determine the usefulness of locally available surface-applied corrosion inhibitors under severe corrosive environments and with chloride contamination. The test setup simulates a harsh marine environment of saline concentration. The samples of reinforced concrete beams of 150 mm x 150 mm × 650 mm, thickness, width and length specimens and ribbed bars of 16mm embedded for corrosion test and flexural test for beam was investigated. This was aimed at achieving the real harsh and corrosive state, concrete specimens were ponded in solutions (NaCl) and the depth of the solution was maintained for the given period of experiment as to observe the significant changes that resulted from the actions of the accelerator (NaCl) and the specimens. The determination of the contribution of the resins will be observed through its adhesive ability with the reinforcement through surface coating application and the bonding relationship between the coated specimens and concrete, its waterproofing and resistive nature (resistance) against accelerator penetration into the bare reinforcement.

2.2.1 Specimen Preparation and Casting of Concrete Beams

Standard method of concrete mix ratio was adopted, batching by weighing materials manually. Concrete mix ratio of 1:2:4 by weight of concrete, water-cement ratio of 0.65. Manual mixing was used on a clean concrete banker, and mixture was monitored and water added gradually to obtain perfect mix design concrete. Standard uniform color and consistency concrete was obtained by additions of cement, water and aggregates. The test beams were cast in steel mould of 150mm x 150 mm x 750 mm. Fresh concrete mix for each batch was fully compacted by tamping rods, to remove trapped air, which can reduce the strength of the concrete and 16 mm reinforcements of coated and non-coated were spaced at 150 mm with concrete cover of 25 mm had been embedded inside the beam and projection of 100 mm for half-cell potential measurement. Specimens were molds are removed from specimen after 24hrs and cured for 28 days. The specimens were cured at room temperature in the curing tanks for accelerated corrosion test process and testing procedure allowed for 120 days first crack noticed and a further 30 days making a total of 150 days for further observations on corrosion acceleration process.

2.2.2 Flexure testing of Beam Specimens

Universal Testing Machine in accordance with BS EN 12390-2 was used for the flexural test and a total of 27 beam specimens were tested. After curing for 28 days, 6 controlled beams (non-corroded) was kept in a control state, preventing corrosion of reinforcement, while 18 beam samples of non-coated and exudates /resins coated were partially place in ponding tank for 150 days and examined accelerated corrosion process. After 150 days, the accelerated corrosion subjected samples were examined to determine residual flexural strength. Beam specimens were simply supported on a span of 650mm. An Instron Universal Testing Machine of 100KN capacity at a slow loading rate of 1 mm/min was used in the flexural test. Beam samples were placed in the machine to specification, flexural test were conducted on a third point at two supports. Load was applied to failure with cracks noticed and corresponding values recorded digitally in a computerized system.

2.2.3 Tensile Strength of Reinforcing Bars

To ascertain the yield and tensile strength of tension bars, bar specimens of 16 mm diameter of non-corroded, corroded and coated were tested in tension in a Universal Testing Machine and subjected to direct tension until failure; the yield, maximum and failure loads being recorded. To ensure consistency, the remaining cut pieces from the standard length of corroded and non-corroded steel bars were subsequently used in the bond and flexural test.

3. RESULTS AND DISCUSSIONS

Results of 27 samples in table 3.1, 3.2 and 3.3 are derived into average values in 3.4 and summarized into summary of averages, percentile values and percentile values difference in 3.5 of flexural strength of concrete beam members as sampled, arbitrarily cast, cured for 28 days on normal and standard method, accelerated in corrosion medium environment for 120days at first crack s observation and 30days extended period and graphically represented in figures 3.1 - 3.3A.

3.1 Non-corroded Concrete Beam Members

Table 3.1 are the results of concrete randomly sampled concrete beams summarized into tables 3.4 and 3.5 as average flexural failure load of non-corroded members as 80.57667kN, 80.44667kN, 80.91667kN, summed up to 80.62212kN into percentile value of 28.20595% against-22.0005% corroded specimens. Average midspan deflection values are 9.08mm, 9.306667mm, 8.766667mm, summed up to 9.07697mm, into percentile value of -20.5148% against 25.8096% corroded specimens. Average yield strength of 460MPa, summed up to 100% into percentile value of 0.00%. Average ultimate tensile strength, are 632.69MPa, 632.4067MPa, and 632.1067MPa, summed up to 632.4279MPa, into percentile value of 12.00672% against -10.7196% corroded specimens. Average strain ratios are 1.883333, 1.87, and 1.86, summed up into percentile value of 26.2425% against -35.57937%. Average elongations are 28.70667%, 28.41333%, 28.81333%, summed up to 28.62909% into percentile value of 42.13332% over -29.6435%. Non-corroded test results showed normal state of mechanical properties of reinforcing steel.

3.2 Corroded Concrete Beam members

Table 3.1 are the results of concrete randomly sampled concrete beams summarized into tables 3.4 and 3.5 as average flexural failure load of corroded members as 63.53333KN, 62.48kN, 62.56kN, summed up to 62.88485kN, into percentile value of -22.0005% over 28.20595% and 26.92462% against non-corroded and invingia gabonensis exudates coated specimens. Midspan deflection average values are 11.62333mm, 11.32333mm, 11.27667mm, summed up to 11.4197mm, into percentile value of 25.8096% against -20.5148% and -19.7161% non-corroded and coated specimens. Average yield strength of 460MPa, summed up to 100% with 0.00% of percentile value. Average ultimate tensile strength, fu, 565.5733MPa, 564.04MPa, 564.1733MPa, summed up to 564.6339MPa, into percentile value of -10.7196% against 12.00672% and 12.01235% of non-corroded and coated specimens. Average strain ratios are 3.523333, 3.533333, and 3.513333, summed up to 3.524242, into percentile value of 35.57937% against -26.2425% and -46.9991% of non-corroded and coated specimens. Average elongations are 20.23333%, 20.01333%, 20.19333%, summed up to 20.14242% , into percentile value of -29.6435% against 42.13332% and 40.6966% for non-corroded and coated specimens. Experimental results showed indications of corrosion potentials of non-coated members with corrosive attributes of mechanical properties diameter reduction, weight loss of steel, cracks presence. These properties has led to high flexural failure load and ultimate yield strength with low applied low, high strain ratios, elongation and midspan deflection.

3.3 Invingia Gabonensis Resins/Exudates Steel Coated Concrete Beam Members

Table 3.3 are the results of concrete randomly sampled concrete beams summarized into tables 3.4 and 3.5 as average flexural failure load of coated members as 79.75667kN, 79.86333kN, 79.83333kN, summed up to 79.81636kN, into percentile value of 26.92462% over -22.0005% over corroded specimens. Midspan deflection average values are 9.136667mm, 9.193333mm, 9.176667mm, summed up to 9.168182mm, into percentile value of -19.7161% over 25.8096% corroded specimens. Average yield strength is 460MPa, summed up to 100% with 0.00% of percentile value. Average ultimate tensile strength, fu, 632.4567MPa, 632.49MPa, 632.4233MPa, summed up to 632.4597MPa and into percentile value of 12.01235% over -10.6626053 % corroded specimens. Average strain ratios are 1.876667, 1.86, and 1.866667, summed up to 1.867879, into percentile value of 46.9991% against 35.57937% of corroded specimens. Average elongations are 28.32%, 28.37667%, 28.31667%, summed up to 28.3397%, into percentile value of 40.6966% against -29.6435% of corroded specimens. Detailed experimental results of coated beam members showed indications of resistance against corrosion with no mechanical properties of reinforcing steel negative effects of weight loss, cracks, spalling and diameter reduction.

Table -3.1 Flexural Strength of Beam Specimens (Non-Corroded specimens)

	Non-corroded Control Beam									
s/no		**SA**	**SB**	**SC**	**SD**	**SE**	**SF**	**SG**	**SH**	**SI**
BAS1-1	Failure Load (KN)	80.62	80.67	80.44	80.41	80.41	80.52	81.22	80.19	81.34
BSA1-2	Midspan Deflection (mm)	8.81	8.89	9.49	9.6	8.69	9.63	8.72	8.89	8.69
BSA1-3	Bar Diameter (mm)	16	16	16	16	16	16	16	16	16
BSA1-4	Yield Strength, fy (MPa)	460	460	460	460	460	460	460	460	460
BSA1-5	Utimate Tensile Strength, fu (MPa)	631.84	633.74	632.44	631.24	633.74	632.24	632.04	632.84	631.44
BkSA1-6	Strain Ratio	1.89	1.85	1.86	1.89	1.86	1.86	1.86	1.85	1.87
BkSA1-7	Elongation (%)	28.59	28.79	28.69	28.76	28.19	28.29	28.79	28.76	28.89

Table -3.2 Flexural Strength of Beam Specimen (Corroded specimens)

		Corroded Specimens								
s/no		**SAA**	**SBA**	**SCA**	**SDA**	**SEA**	**SFA**	**SGA**	**SHA**	**SIA**
BAS2-1	Failure Load (KN)	63.89	64.57	62.14	61.62	63.91	61.91	61.68	64.11	61.89
BSA2-2	Midspan Deflection (mm)	11.86	11.69	11.32	11.29	10.89	11.79	11.32	10.92	11.59
BSA2-3	Bar Diameter (mm)	16	16	16	16	16	16	16	16	16
BSA2-4	Yield Strength, fy (MPa)	460	460	460	460	460	460	460	460	460
BSA2-5	Utimate Tensile Strength, fu (MPa)	567.64	564.24	564.84	564.14	563.84	564.14	563.54	564.84	564.14
BkSA2-6	Strain Ratio	3.53	3.52	3.52	3.56	3.51	3.53	3.52	3.51	3.51
BkSA2-7	Elongation (%)	20.25	20.39	20.06	19.59	20.58	19.87	20.39	20.09	20.1

Table -3.3 Flexural Strength of Beam Specimens (Exudates/Resins Coated specimens)

		Invingia Gabonensis (Exudate/Resin) Coated Specimens								
		150µm (Exudate/Resin) coated			300µm (Exudate/Resin) coated			450µm (Exudate/Resin) coated		
s/no		SAB	SBB	SCB	SDB	SEB	SFB	SGB	SHB	SIB
BAS3-1	Failure Load (KN)	79.34	80.29	79.64	79.68	80.04	79.87	79.64	79.68	80.18
BSA3-2	Midspan Deflection (mm)	9.24	8.64	9.53	9.34	8.9	9.34	9.32	9.32	8.89
BSA3-3	Bar Diameter (mm)	16	16	16	16	16	16	16	16	16
BSA3-4	Yield Strength, fy (MPa)	460	460	460	460	460	460	460	460	460
BSA3-5	Utimate Tensile Strength, fu (MPa)	631.99	632.89	632.49	632.49	632.49	632.49	632.09	632.59	632.59
BkSA3-6	Strain Ratio	1.87	1.89	1.87	1.86	1.86	1.86	1.85	1.87	1.88
BkSA3-7	Elongation (%)	28.08	28.7	28.18	28.15	28.6	28.38	28.29	28	28.66

Table -3.4 Average Flexural Strength of Beam Specimens (Non-Corroded, Corroded Exudates/Resins Coated Specimens)

s/no		**Non-Corroded Specimens Average Values**			**Corroded Specimens Average Values**			**Coated Specimens Average Values of 150µm, 300µm, 450µm)**		
BAS4-1	Failure Load (KN)	80.5766	80.4466	80.9166	63.5333	62.48	62.56	79.7566	79.8633	79.8333
BSA4-2	Midspan Deflection (mm)	9.08	9.30666	8.76666	11.6233	11.3233	11.2766	9.13666	9.19333	9.17666
BSA4-3	Bar Diameter (mm)	16	16	16	16	16	16	16	16	16
BSA4-4	Yield Strength, fy (MPa)	460	460	460	460	460	460	460	460	460
BSA4-5	Utimate Tensile Strength, fu (MPa)	632.69	632.406	632.106	565.573	564.04	564.173	632.456	632.49	632.423
BSA4-6	Strain Ratio	1.8833	1.87	1.86	3.5233	3.5333	3.5133	1.87666	1.86	1.866667
BSA4-7	Elongation (%)	28.7066	28.413	28.813	20.2333	20.0133	20.1933	28.32	28.376	28.3166

Table -3.5 Summary of Percentile Flexural Strength of Beam Specimens (Non-Corroded, Corroded, Exudates/Resins Coated Specimens)

	Summary of Averages			**Percentile Values**			**Percentile Difference**		
Failure load (KN)	80.62212	62.88485	79.81636	128.206	77.9995	126.9246	28.20595	-22.0005	26.92462
Midspan deflection (mm)	9.07697	11.4197	9.168182	79.48519	125.8096	80.28391	-20.5148	25.8096	-19.7161
Bar diameter (mm)	16	16	16	100	100	100	0	0	0
Yield Strength, fy (MPa)	460	460	460	100	100	100	0	0	0
Utimate Tensile Strength, fu (MPa)	632.4279	564.6339	632.4597	112.0067	89.28036	112.0123	12.00672	-10.7196	12.01235
Strain Ratio	2.599394	3.524242	1.867879	73.75753	135.5794	53.00087	-26.2425	35.57937	-46.9991
Strain (%)	28.62909	20.14242	28.3397	142.1333	70.35648	140.6966	42.13332	-29.6435	40.6966

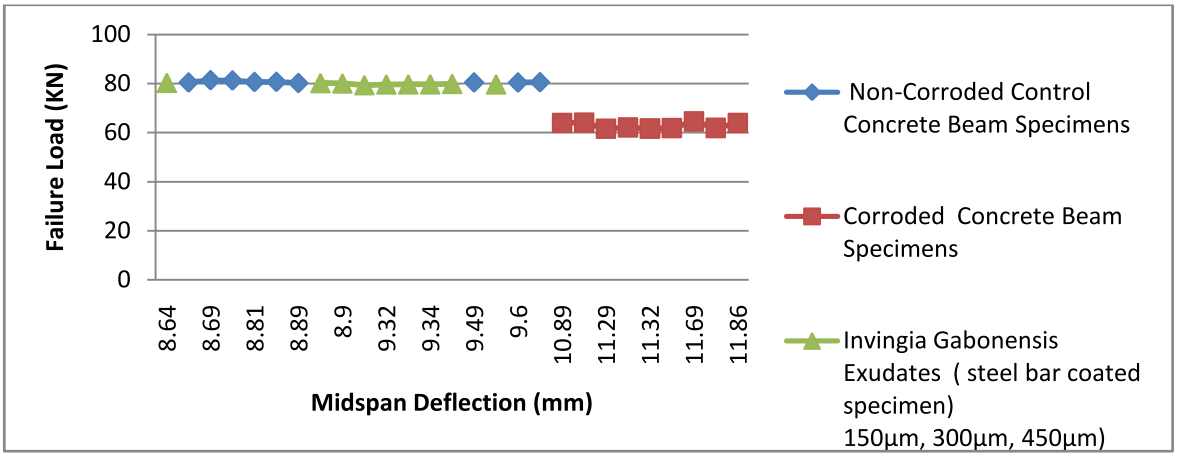

Fig. 3.1 Failure Load versus Midspan Deflection of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

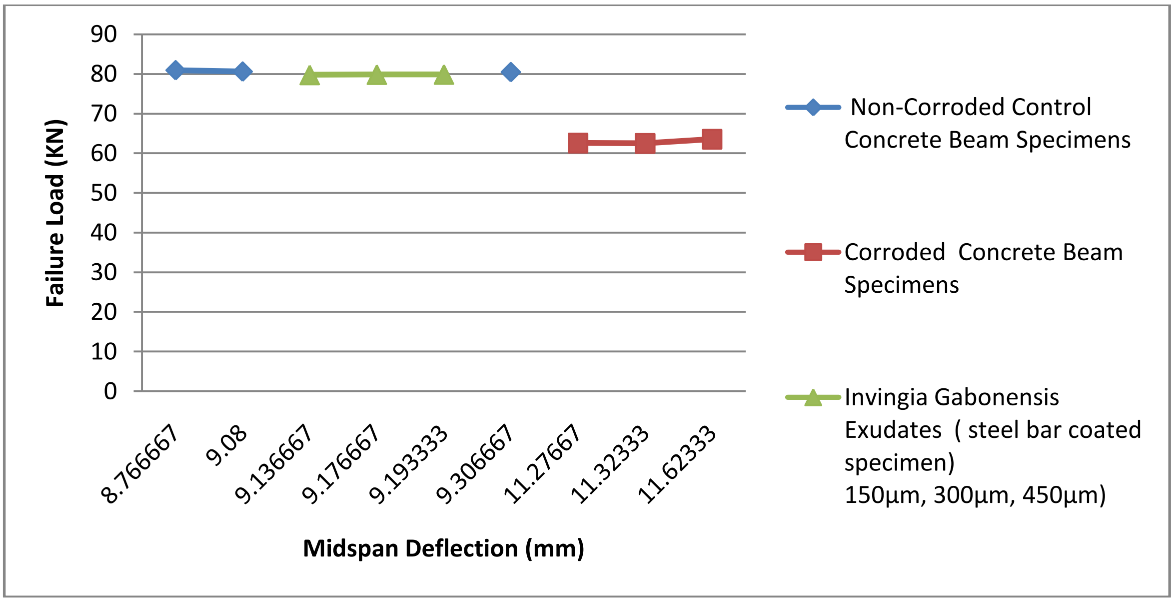

Fig. 3.1A Average Failure Load versus Midspan Deflection of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

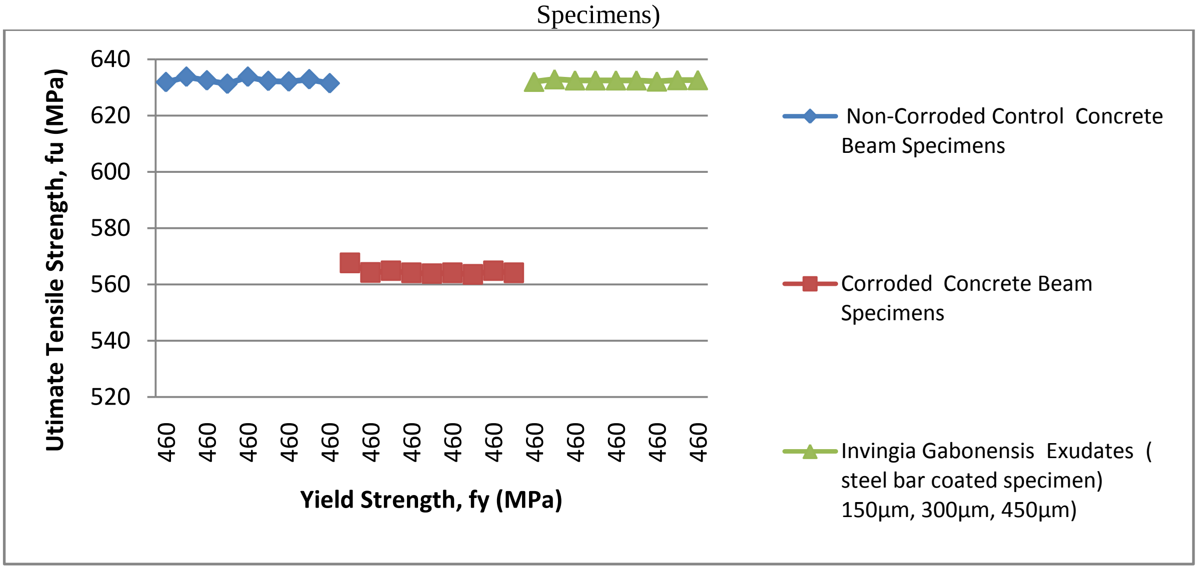

Fig. 3.2 Ultimate Tensile Strength versus Yield Strength of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

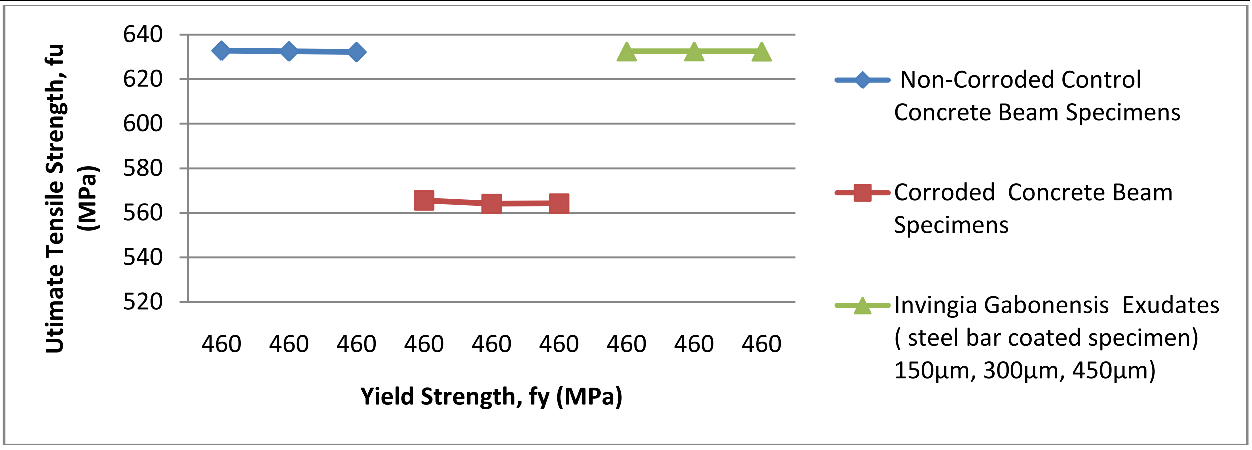

Fig. 3.2A Average Ultimate Tensile Strength versus Yield Strength of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

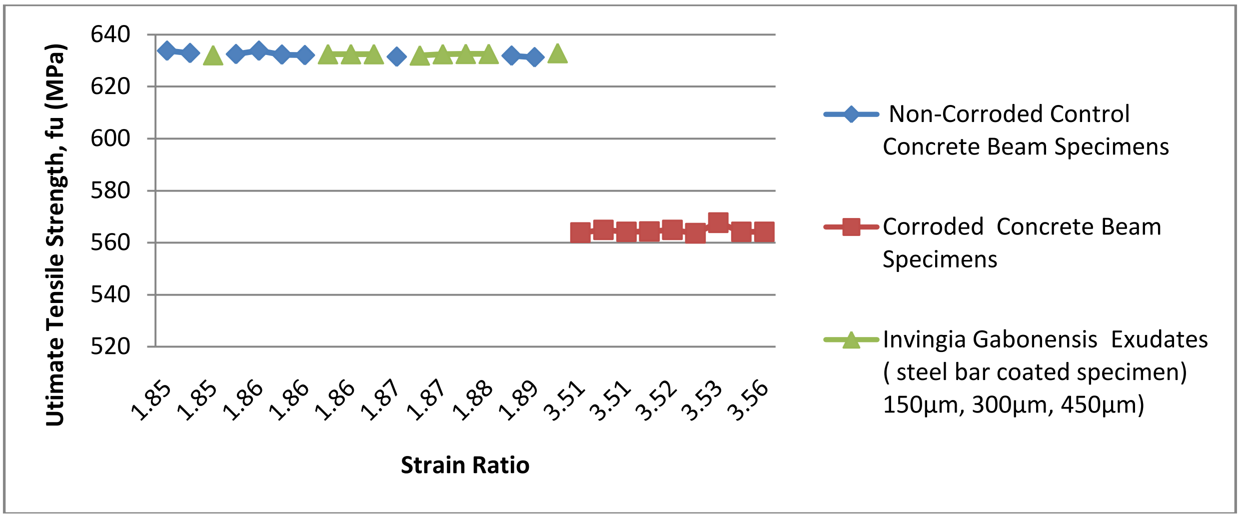

Fig. 3.3 Ultimate Tensile Strength versus Strain Ratio of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

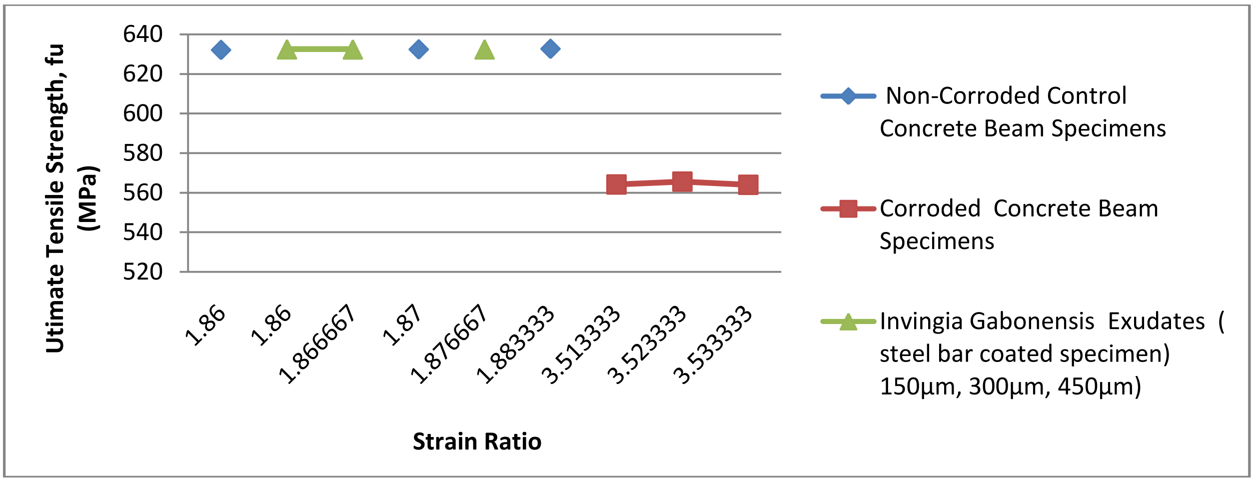

Fig. 3.3A Average Ultimate Tensile Strength versus Strain Ratio of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

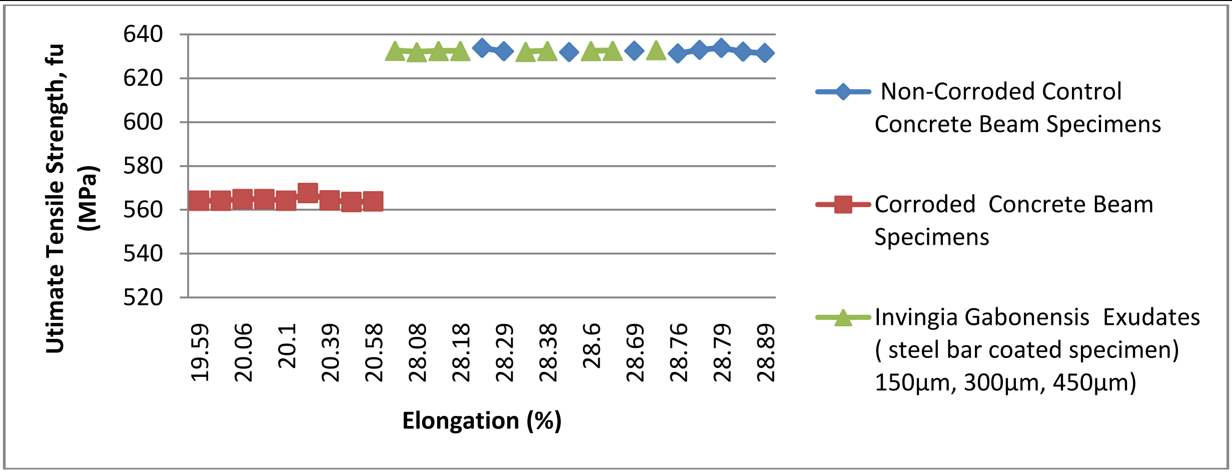

Fig. 3.4 Ultimate Tensile Strength versus Elongation of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

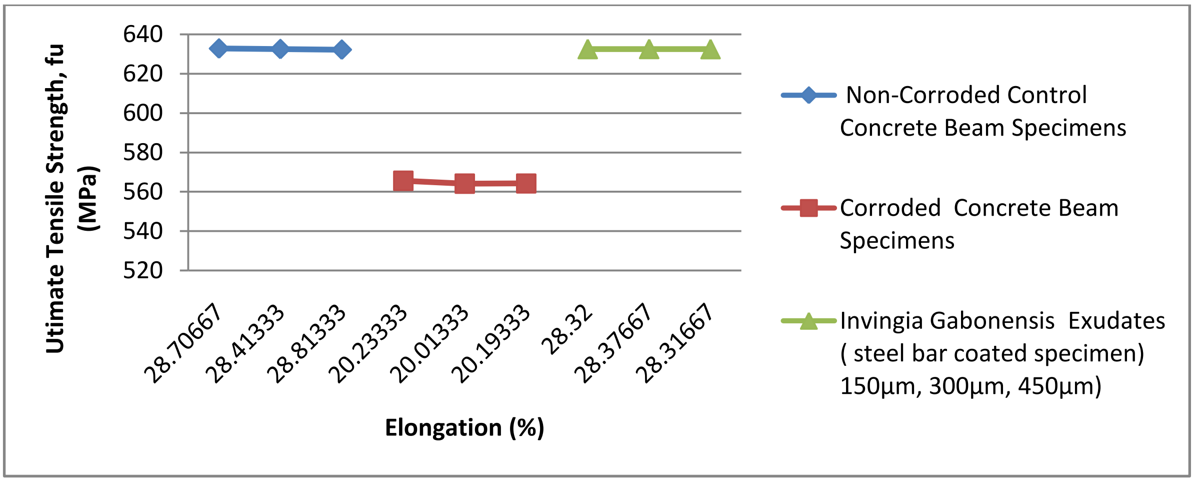

Fig. 3.4A Average Ultimate Tensile Strength versus Elongation of Beam Specimens (Non-Corroded, Corrode and Resin Coated Specimens)

4. CONCLUSIONS

Experimental results gotten from tables 3.1–3.5 and figures 3.1–3.3A, the below conclusions were drawn:

i. Non-corroded test results showed normal state of mechanical properties of reinforcing steel.
ii. Experimental results showed indications of corrosion potentials of non-coated members with corrosive attributes of mechanical properties diameter reduction, weight loss of steel, cracks presence.
iii. These properties has led to high flexural failure load and ultimate yield strength with low applied low, high strain ratios, elongation and midspan deflection.
iv. Detailed experimental results of coated beam members showed indications of resistance against corrosion with no mechanical properties of reinforcing steel negative effects of weight loss, cracks, spalling and diameter reduction.

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