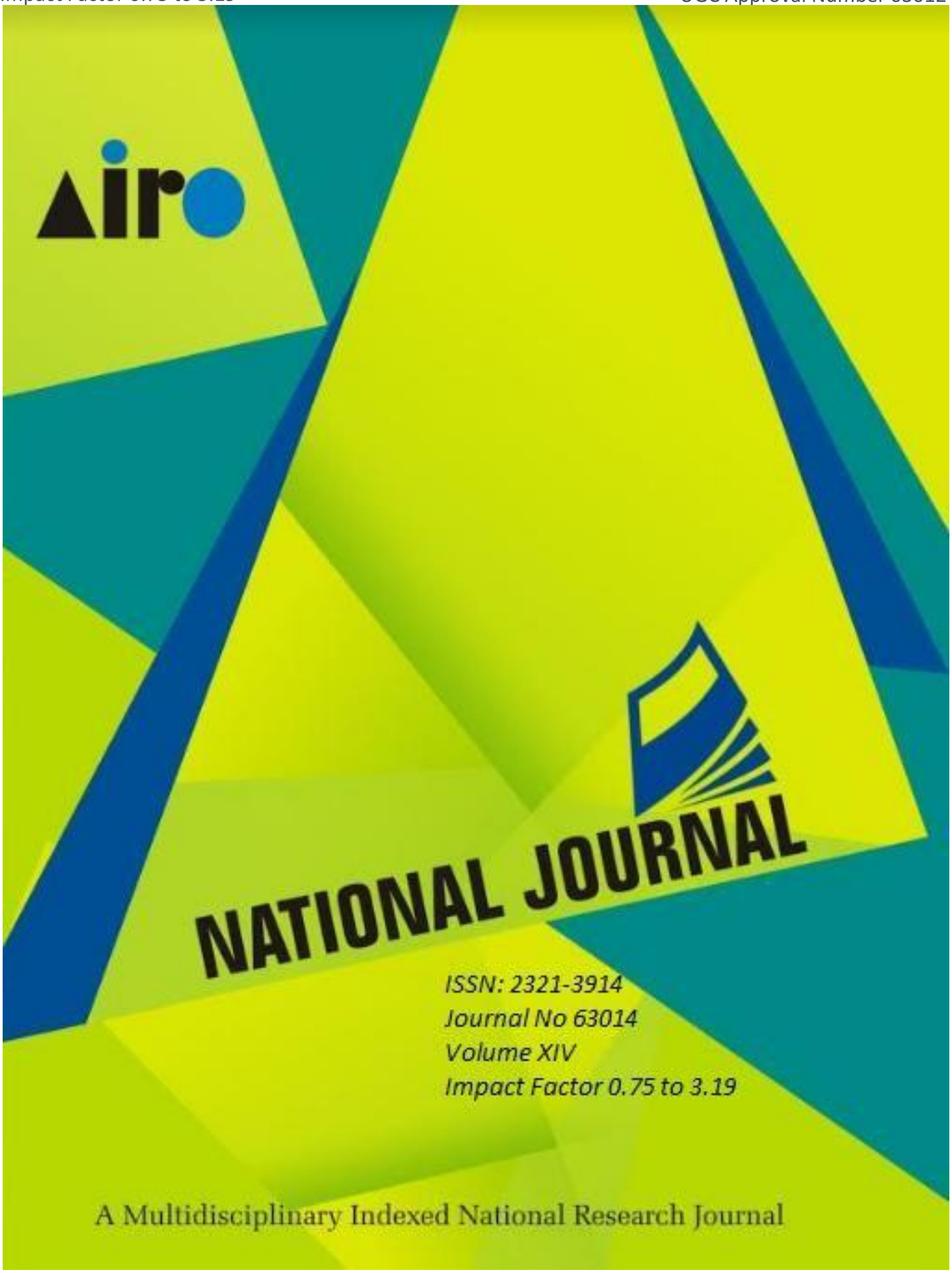
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CONTROL OF CORROSION IN REINFORCEMENT BARS

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Abstract

Corrosion control of reinforcement is necessary to prevent damage and failure of concrete structures. Nearly 40-45% of failure of concrete structures is due to corrosion of embedded steel reinforcement. There can be many causes for corrosion of reinforcement, but mostly it is related to quality of concrete, environment and quality of construction practices. Hence, the first step in corrosion control of rebar is to deliver good quality of concrete through good construction practices. The quality of concrete materials, mixing, placing and compaction techniques and good workmanship can help control the rebar corrosion.

Introduction

Corrosionis a process, thattransforms a refined metal to a more chemically-stable form, such as its oxide, hydroxide, or sulfide. It is the gradual damage of materials (usually metals) by chemical and/or electrochemical reaction through their environment.There are numerous types of corrosion and the science and considerate of these processes are continuously evolving. Here is a brief overview of particularcollective types of corrosion:

- Galvanic corrosion is the best common and impactful form of corrosion. It happens when two dissimilar metals are in contact in the existence of an electrolyte. In a galvanic cell (bimetallic couple), the more active metal (anode) corrodes and the more noble metal (cathode) is protected. There are a number of aspects that distress the galvanic corrosion with types of metals, relative size of anode, and environment.

- Pitting Corrosion happens under certain conditions, that leads to speeded up corrosion in certain areas rather than uniform corrosion through the piece.

- Microbial corrosion, commonly referred to as microbiologically influenced corrosion (MIC) is caused by microorganisms. It applies to both metallic and non-metallic materials with or without oxygen.

- High-temperature corrosion,is deterioration of a metal because of heating. This can happens when a metal is hot atmosphere in the existence of oxygen, sulfur, or other compound capable of oxidizing the material.

- Crevice corrosionhappens in confined spaces where access of fluid from the environment is limited for example gaps and contact areas between parts, under gaskets or seals, inside cracks and seams and spaces filled with deposits.

Steel Surface treatment

Steel rebar's are mostly made of mild steel because of the importance of low cost. The coating of a steel rebar with epoxy is usuallyinuredexpand the corrosion resistance of rebar, but it destroys the bond between rebar and concrete, and the trend of the epoxy coating to debond is a problem also, areas of the rebar where the epoxy coating is damaged and the cut ends of the rebar are not protected from corrosion.galvanized steel attains corrosion protection with its zinc coating,that acts as a sacrificial anode.galvanized steel lean towards bond to concrete healthier than epoxy coated steel, and the tendency of the coating to debond is also less for galvanized steel. areas of the rebar where the zinc coating is injured are quietprotected; the exposed area, such as the cut ends, are protected,if that they are less than 8mm from the zinc coating.steel surface treatments that improve both corrosion resistance and bond strength are attractive. they include sand blasting and surface oxidation.

Admixture in concrete

Corrosion-impeding admixtures rise the passivation of reinforcement and further embedded steel. This can inhibit corrosion when passivation would different have been lost as a result of chloride ingress or carbonation. They are added to concrete during production and are referred to as 'integral' corrosion-inhibitors. So-called 'migratory corrosion-inhibitors' applied to hardened concrete are not admixtures. Corrosion-inhibiting admixtures can significantly reduce preservation costs of secure concrete structures through a usual service life of thirty to forty years. Although corrosion-inhibitors can raise the corrosion threshold, they are not an alternative to impermeable durable concrete.

Corrosion-inhibiting admixtures have little effect on strength at either early or later ages. The purpose of this type of admixture is to improve the strength of reinforced concrete by enhancing passivation to the cathodic and anodic areas of embedded steel. Structures built in the 1970s with calcium nitrite still contain the original level of nitrite and show no signs of deterioration. The addition of corrosion-inhibiting admixtures based on calcium nitrite or amino alcohol does not affect the long-term durability of the base concrete but can offer extended life to the overall structure. Concrete Society Technical Report sixty one, Refining reinforced concrete durability, offersinfo on the effects of corrosion-inhibiting admixtures in concrete on the rates of carbonation and chloride ingress.

Effect of carbon fibers(f), silica fume (SF), Latex (L) and methylcellulose(M) on the corrison resistance of steel rebar in concrete.

Table 1

S.No.		In saturated CaOH2 Solution		In 0.5N NaCl Solution	
		Ecorr (±5,-mV)	Icorr ($\mu A/cm^2$,±0.03)	Ecorr (±5,-mV)	Icorr ($\mu A/cm^2$,±0.03)
1	P	215	0.76	505	1.6
2	+M	220	0.74		
3	+M+F	220	0.67	560	2.05
4	+M+SF	137	0.18		
5	+M+F+SF	170	0.22	350	1.15
6	+L+F	190	0.46	405	1.28

* P- PLAIN (value of 25 weeks of corrosion testing)

Cathodic Protection

The knowledge of using cathodic corrosion security for the rehabilitation of steel reinforced concrete constructions was recognized in the mid-1970s in the USA. Background for this decision has been enormous damages on the concrete surfaces at the bridges of the Interstate Highway Systems. Conventional rehabilitation techniques had all failed. In Europe, it has been Great Britain which did the first attempts with cathodic protection systems at reinforced concrete constructions. V&C has been carrying out cathodic corrosion security at concrete structures since 1996 and is inventor in the Central European region. Cathodic corrosion protection as an active security method attacks - in contrast to other systems - the problem at its roots.

The success of the method rests on the connection between the potential of steel and the corrosion rate. The potential of the reinforcement is carried to a stable passive state through fixing of a negative protective current. Through the formation of hydroxide ions on the reinforcement the protective passive layer is restored.

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Conclusion

Types of corrosion control of steel reinforced concrete contain steel surface conduct, the usage of admixture in concrete and cathodicsecurity