The Investigation of the Corrosive Effects of Sulphates and Salts on the Concrete and the Study of Environmental Changes on it

Ramesh K. Gupta, Amoli Hassan, Saravana Kumar

Department of Civil Engineering, Indian Institute for Civil Engineering, New Delhi, India

Keywords

Sulfate,
Rice Shell,
Carbon Nanotubes,
Ash Pozzolan.

Abstract

Due to the environmental impact of sulphates and salts on concrete and the significant reduction in concrete strength, extensive research has been carried out to reinforce concrete against these types of attacks. The results show that the use of coal ash increases Concrete quality is counteracting the attack of sulfates. The sulfates include calcium sulfate, sodium sulfate, magnesium sulfate, and the like. Sulfate attack in tropical coastal areas with hot and humid weather causes very severe damage. One can refer to ash of cane sugar syrup (bagasse) as one of the most suitable alternatives for cement in concrete. Other materials that can be considered for preventing attack of sulfates include concrete containing carbon nanotubes and shells ash pozzolan Rice. Using 80% cement, carbon nanotubes and 15% zirconium rice ash in concrete structure can improve concrete performance against sulfate attack and corrosion resistance. According to the results of concrete containing nanotube Carbon and rice structure has the highest corrosion resistance.

1. Introduction

The impact of destructive factors such as salts, sulfates and chloride ions on the deterioration and reduction of the strength of concrete structures is visible. Impact of atmospheric and environmental damages can be damaged to concrete and reinforced concrete structures. Therefore, retrofitting Concrete sections are necessary against these attacks [1-3]. On the other hand, cement is one of the important components of various types of mortars and concrete. As we know, the process of cement production causes environmental pollution and hazard inputs. Due to Serious effects the environment of human life, therefore it is necessary to try to provide the scientific solutions with the amount of cement used to produce impure concrete Natural and mineral additions such as slag and copper, micro silica, sugar cane, and ash blasting simultaneously increase compressive strength and reduce porosity and permeability, and can also be used as an additive rather than volumetric Cement used in concrete, therefore, using the additives, in addition to improving the properties of concrete in terms of durability, strength, porosity and permeability, the amount of cement used in the mixing scheme can be significantly reduced and the cleanliness of the environment and eliminating environmental contaminations as much as possible [4-8]. BAGAS is another additive that can be used with Adding to concrete mixing will help us to achieve these goals. BAGAS is in fact one of the products in sugar and sugar production that is used as a source of energy in sugar and sugar factories [9-14]. Bagasse ash is used as a raw material for the production and manufacture of paper. Sugar cane is another natural additive that comes from cane sugar. Micro Silica is another additive that is used to enhance Compressive strength, reinforcement of concrete against environmental degradation and mechanical properties are added. Micro-silica is usually produced in the form of powder and gel and should be added to water-soluble to concrete. In this paper, the methods of reinforcing concrete sections against invasions of sulfates, salts, chloride ions and agents Atmospheric and environmental degradation [15-19]. In addition to bagasse ash, which can improve the properties of permeability, porosity and durability of concrete, rice hulls can be added to the concrete mixing plan by adding them to the same optimum results. Rice has a very low density or mass volume and, by mixing in concrete, can position concrete against sulfate and salt invasions. It also protects against the impact of chloride ions as a strong protector against concrete contamination. According to the

above, the use of natural additives is recommended as a suitable strategy for reinforcing concrete structures and prolonging its useful life. These materials, in addition to their environmental compatibility and the improvement of concrete mechanical properties, cause the durability of reinforced concrete structures and enhance their resistance to environmental factors [20-25].

2. Materials and Methods

Based on what has been said, bagasse ash, sugar cane and rice husk are used as additives. These natural additives, in addition to playing an effective role in increasing resistance, durability, reducing permeability and porosity as a volumetric portion Cement substitute. Table 1 shows the physical properties of cement and bagasse ash used in this study. Chemical blends of Portland cement and bagasse ash are also presented in Table 2 [26-32].

Figure 1. Bagasse sugarcane

Table 1. Physical Properties of Portland Cement and Bagasse Ash

Grain size (micrometer)	Density	Special Weight	special surface	Materials
21	15.1	3	300	Cement
5.91	0.4	1.8	900	Bagasse ashes

In this paper, seven mixing schemes were used, in which each amount of bagasse ash varied from 5% to 30% of cement mass (figure 1).

Table 2. Chemical composition of Portland cement and Bagasse ash

SO ₃	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Materials	SO ₃	SiO ₂
2.48	21.55	5.69	3.39	64.25	0.85	0.33	0.59	Cement	2.48	21.55
0.11	87.41	3.69	4.90	2.56	0.69	0.15	0.47	Bagasse ashes	0.11	87.41

3. Chloride Penetration

Based on the ASTM C1202 standard, the concrete resistance to chloride ion penetration in bagasse ash samples was measured after treatment periods in a humidity of 28 and 90 days. According to this standard, in order to calculate the amount of penetration Chloride ions are used from two reservoirs with opposite poles. The positive reagent is filled with NaOH solution and the negative reservoir is filled with NaCl solution. Then, the DC potential (direct) differs by 60 volts across the sample [31-42] (Figure 2).

Table 4 shows the results of the chloride permeability test for bagasse ash containing samples. The transfer of bagasse containing ash samples continuously increases with increasing bagasse ash to 25% to 30%. The result is the same for both 28 and 90 days. With careful data, it can be concluded that replacing part of bagasse ash with a mixture of Portland cement significantly reduces the permeability of chloride in concrete.

Figure 2. Chloride attack

At this stage, concrete specimens between two compartments come from a penetrating cell containing 3% NaCl and 3% NaOH. For this experiment, 12 volts of Dc potential and titanium electrodes are used. The amount of chloride ion penetration to concrete samples Containing bagasse ash is monitored for 28 and 90 days in a humid environment [4] (Table 3).

Table 3. Mixing scheme for concrete containing bagasse ash

Mix	Bagasse Ash	Cement	Water	Bagasse Ash	Sand	Cement
	(%)			(kg/m ³)		
CB0	0	100	7.78	0	24.88	16.75
CB1	5	95	7.78	0.83	24.88	15.74
CB2	10	90	7.78	1.66	24.88	14.91
CB3	15	85	7.78	2.49	24.88	14.08
CB4	20	80	7.78	3.31	24.88	13.27
CB5	25	75	7.78	4.14	24.88	12.43
CB6	30	70	7.78	4.97	24.88	11.60

The only percentage of bagasse and cement has changed in concrete samples. All of the above table sizes and sizes are in kilograms. Chloride emission coefficients for bagasse containing samples are presented in Table 4. These data show that chloride penetration is significantly reduced by replacing part of the bagasse ash with Portland cement (figure 3). Also, these results indicate a decrease 50% of the chloride penetration coefficient in concrete samples containing 20% bagasse ash. The results of previous studies show that the use of bagasse ashes in concrete mixing reduces the volume of cavities in hydrated cement paste, resulting in inert impermeability of concrete Against chloride ions even at an early age (7 and 8 days). In the present study, the smoothness of bagasse ash samples is 3 times greater than that of cement. Studies show that concrete permeability

has improved significantly when using bagasse ashes in concrete mix designs compared to non-bagasse concrete; Therefore, the use of bagasse as additive will result in a better result than when used solely from cement. The use of bagasse ashes in the mixing scheme of concrete increases the water absorption and since bagasse ash from Al₂O₃ and SiO₂ It is rich, the hardening process and clamping of concrete samples are accelerated. Also, the presence of calcium oxide the combination of bagasse ash accelerates the process of hardening and stacking of concrete [43-50]. The influence and displacement of chloride ions depends on the structure and pore of concrete. As stated, the smoothness of bagasse ash particles is three times greater than that of cement particles. Therefore, the use of bagasse ashes will clog pores of concrete and reduce the penetration of chloride and its release, so using bagasse as an alternative to cement will increase the strength and decrease the permeability of concrete.

Table 4. Permeability and release of chloride in concrete containing bagasse ash

Replacement of cement (%)	Tensile strength	Charging		10 ⁻⁸ *chloride diffusion coefficient	
		28 days	90 days	28 days	90 days
0	4.5	2.7	2.5	3.5	3.25
5	4.9	2	1.6	2.51	2
10	5	1.9	1.4	2.5	1.9
15	4.9	1.3	1.2	2	1.57
20	4.5	1.2	1.1	1.57	1.5
25	4	1.1	1	1.5	1.3
30	3	2.1	2	2.4	1.8

Figure 3. Release of chloride

4. Tensile Strength

The tensile strengths of concrete specimens containing bagasse ash at 28 days are presented in Table 4. As can be seen, in samples containing 20% bagasse ash, there is an increase in tensile strength, while When we use 25% or 30% of the cement content of bagasse ash, we will lose resistance.

5. Laboratory Studies

The study also examines the addition of rice bran and its effect on reducing the permeability of concrete against chloride ions. Studies have shown that rice husk can be used as a corrosive inhibitor in concrete. Also, rice bran, besides having the ideal anticorrosion properties and preventing corrosion of steel reinforced concrete in concrete, will not have any effects on the concrete's resistance properties. Table (5) details the chemical composition of samples containing rice husk ash for Three different examples are presented. For the production of samples of ordinary Portland cement and Rice husk ash is used for 30% cement mass.

Table 5. Chemical composition of rice husk ash

No	Specified specimen as	1	2	3
		(Percentage of mass)		
1	Drop in influence	8.71	7	3.07
2	Silica (SiO ₂)	83.6	84	90.47
3	Aluminium (Al ₂ O ₃)	3.05	3.84	3.13
4	Iron (Fe ₂ O ₃)	1.10	0.6	0.32
5	Titanium (TiO ₂)	0	0	0
6	Calcium (CaO)	1.80	2.85	1.96
7	Magnesium (MgO)	1.28	1.35	0.35
8	Sodium (Na ₂ O)	0.17	0.13	0.22
9	potassium (K ₂ O)	0.29	0.23	0.48

Each ton of rice has about 200kg of bran. Rice husk is produced by burning the outer shell of rice. After burning the rice husk and reaching the temperature of about 500 °C, it can be obtained that can increase the durability of concrete and reduce its permeability and porosity. One of the problems that we face in the production of rice husk ash is to cool the ash after burning the rice husk. The best way to cool rice molded shells is by cooking It is water. When this is done, the ash is saturated with moisture, so it is necessary to dry again. In Between different methods, drying the shells under the sun or using dryers are the most appropriate options. The dimensions of the sample are based on a standard size of 100mm × 150mm and a length of 1000mm. For reinforcement of concrete specimens, four rebar fittings with a diameter of 8 mm are used. Also, to reinforce the shear of two 6 mm diameter raw materials. The level of the bars should be cleaned with full wires and no rust should be observed on them [6]. After closing the bars and shaping, the concrete made on the basis of the mixing plan is poured into molds and treated for a full 28-day period. After the preparation and preparation of the samples, they are the corrosive ozone is transported to accelerate the process of corrosion.

6. Asbestos Containing Rice Husk Ash

Concrete mixed with rice husk ash is in addition to durable and more resistant to corrosive environmental factors that are more environmentally friendly. Adding rice husk ash improves the properties of concrete, as mentioned below. Gets:

- Heat loss due to the hydration reaction and the thermal cracking of the concrete
- Reduced permeability and porosity of concrete
- Increase resistance of concrete against attacks of sulfates, chlorides and mild acids

Therefore, rice husk ash can be used as a cement-based and environmentally compatible supplement. RHA rice can be added to a wide range of applications for cement and concrete. Adding this material to concrete It can be used against chemical attacks, chlorides, sulfates, salts, mild acids and alkalis. RHA can be used on the floor of baths, pools, industrial floors or any concrete exposed to attacks. Chlorides and sulfates.

7. Corrosion Process

After making and processing samples, we have to put them in a corrosive environment in order to prevent corrosion from occurring. It is a destructive chemical or electrochemical reaction between the surface of the metal and its surroundings. Given that In terms of thermodynamics, oxidized materials are at a lower level than energy compared to conventional materials, so the desire to achieve lower energy levels results in oxidation or, in other words, metal corrosion [5]. With this explanation it can be stated that it can never be completely prevented from corrosion, but it must in some way reduce corrosion to an acceptable level. In fact, all environments are corrosive, However, their corrosion is different. For example, air, moisture, steam and other gases such as chlorine, ammonia, hydrogen sulfide, sulfur dioxide and mineral acids such as hydrochloric, sulfuric and nitric acids, and excellent acids such as acetic acid and formic acid They have different corrosion rates. As stated, they are placed in corrosive environments after the processing of the specimens and the effect of corrosive agents on

samples B We examine the tin [4]. To accelerate the corrosion process, the Galvanostat method is used. In this method, the steel embedded as anode and an external stainless-steel sheet as Cathodes. Concrete examples and steel plates are immersed in a 3% sodium chloride electrolyte solution to simulate seawater conditions. The sample is then subjected to a low voltage and the corrosion process is performed for a period of 15 days. In the final step, concrete samples are collected from the adjoining side of the rings to determine the PH and concentration of chloride.

Table 6. Chloride content in concrete samples for M30 & M35 concrete rice husk ash

No	Sample	pH	Chloride/Concrete Dust (%)
OPC concrete grade 30M			
1	M30opc control	1086.9	942.4
2	M30opc z	1108.6	1062
3	M30opc IP**	1062.3	1047.5
RHA concrete grade 30m			
4	M30RH control	1063.5	993.4
5	M30RH z	1092.7	1051
6	M30RH IP**	1073.5	1065.8
Concrete OPC Grade 35M			
7	M35opc control	1086.7	1004.2
8	M35opc z	1105.7	1089.9
9	M35opc IP**	1075.6	1063.63
RHA grade 35mm			
10	M35RH control	1065.5	1017.4
11	M35RH z	1091.5	1076.6
12	M35RH IP**	1074.8	1068.3

8. Test Results

The use of rice husk ash in the structure and design of concrete mix significantly reduces its weight. According to the table 6, it is observed that in concrete with M35 grade, the chloride content of concrete in rice husked concrete is about 30 The percentage less of the concrete is made purely with ordinary Portland cement, which indicates a decrease in the permeability of rice hulling concrete. Therefore, it can be concluded that rice husk ash controls the entry and penetration of chloride ions into the texture and structure of concrete It is not difficult to remove the rice husk concrete. The only thing that is there is that the slip. These concretes are slightly less than conventional concrete.

9. RHA Microstructure Studies

Microfilm electron microscopes (SEMs) can be used to capture concrete samples of RHA and OPC (Figure 4 and 5). These images are magnified by 2000 times. In Figure 4, scanning the OPC electron microscope and scanning the microscope The RHA electron is shown. Enlarged images of concrete containing rice husk ash clearly show a large number of silicon fibers in the concrete structure. The silicon fiber in the rice husk has a very high corrosion resistance and environmental corrosivity factors. The images taken show that the rice shell structure is similar to composite material, and this is the same. Inch permeability is reduced.

Figure 4. OPC electron microscope scanning

Figure 5. Scanning electron microscopy RHA

10. Conclusion

According to the data presented in this study, it can be stated that the use of natural additives such as bagasse, sugar cane ash and rice bran ash in the concrete structure, in addition to being able to replace a portion of a volume of Portland cement It also increases the strength and durability of concrete and reduces its permeability against sulfate, salt and chloride attacks. At best, bagasse ash may be used in the mixing and concrete production of 20% cement mass. Usage Bags in concrete have advantages such as increased resistance, reduced permeability and porosity and reinforced concrete against h It will be followed by chlorides, salts and sulfates. Rice husk ash is also introduced as an ideal material for reinforcing concrete in aggressive environments. The experiments performed on concrete containing pozzolan ash represent Reducing the penetration of chloride ions in these concrete samples. Using pozzolan as bagasse as an alternative to one volume of cement improves concrete properties such as durability and permeability. The results show a 50% decrease in chloride ion penetration in concrete samples Contains 20% bagasse ash.

Declaration of Conflict of Interests

The authors of this paper declared that there is no conflict of interest in this research paper.

References

- [1.] Ghasemian, M.B., et al., Evidence of phase coexistence in hydrothermally synthesized $K_0.5Na_0.5NbO_3$ nanofibers. *Journal of Materials Chemistry A*, 2020.
- [2.] Ghasemian, M.B., et al., Peculiar piezoelectricity of atomically thin planar structures. *Nanoscale*, 2020. 12(5): p. 2875-2901.
- [3.] Heidari, M., S. Ghasemi, and R. Heidari, The Effects of Leadership and Employment in Technical Capabilities of Sport Teams. *Journal of Humanities Insights*, 2019. 3(02): p. 75-80.
- [4.] Ghasemian, M.B., et al., Self-Limiting Galvanic Growth of MnO_2 Monolayers on a Liquid Metal—Applied to Photocatalysis. *Advanced Functional Materials*, 2019. 29(36): p. 1901649.
- [5.] Ghasemian, M.B., et al., Approaching Piezoelectric Response of Pb-Piezoelectrics in Hydrothermally Synthesized $Bi_0.5(Na_{1-x}K_x)_{0.5}TiO_3$ Nanotubes. *ACS Applied Materials & Interfaces*, 2018. 10(24): p. 20816-20825.
- [6.] Ghasemian, M.B., et al., Lattice evolution and enhanced piezoelectric properties of hydrothermally synthesised $0.94(Bi_{0.5}Na_{0.5})TiO_3-0.06BaTiO_3$ nanofibers. *Journal of Materials Chemistry C*, 2017. 5(42): p. 10976-10984.
- [7.] Ghasemian, M.B., et al., Morphology control and large piezoresponse of hydrothermally synthesized lead-free piezoelectric $(Bi_{0.5}Na_{0.5})TiO_3$ nanofibres. *RSC Advances*, 2017. 7(25): p. 15020-15026.
- [8.] Anbia, M., et al., Employing a new modified nanoporous carbon for extraction and determination of 1,10-phenanthroline and 2,2'-bipyridine by SPE and use of the Taguchi optimization method. *Analytical Methods*, 2012. 4(12): p. 4220-4229.
- [9.] Pasban, A., Mostafavi, S. M., Malekzadeh, H., Nazari, B., Quantitative Determination of LPG Hydrocarbons by Modified Packed Column Adsorbent of Gas Chromatography Via Full Factorial Design. *Journal of Nanoanalysis*, 2017. 4(1): p. 31-40.
- [10.] Heidari, S., Imani, M., Mostafavi, S. M., A Validated and Rapid HPLC Method for Quantification of Human Serum Albumin in Interferon beta-1a Biopharmaceutical Formulation. *MedBioTech Journal*, 2017. 1(01): p. 29.
- [11.] Mostafavi, S. M., Bagherzadeh, K., Amanlou, M., A new attempt to introduce efficient inhibitors for Caspas-9 according to structure-based Pharmacophore Screening strategy and Molecular Dynamics Simulations. *Medbiotech Journal*, 2017. 01(01): p. 1-8.
- [12.] Amanlou, M., Mostafavi, S. M., In silico screening to aim computational efficient inhibitors of caspase-9 by ligand-based pharmacophore modeling. *Medbiotech Journal*, 2017. 01(01): p. 34-41.
- [13.] Mostafavi, S. M., A.A.P., Masoumeh Piryaei, Saeed Sadeghpour, Majid Masoumi, Ahmad Rouhollahi, Ali Akbar Miran Beigi, Acidity removal of Iranian heavy crude oils by nanofluid demulsifier: An experimental investigation. *Journal of Nanoanalysis*, 2017: p. 10-17.
- [14.] Parvanian, S., Mostafavi, S. M., Aghashiri, M., Multifunctional Nanoparticle Developments in Cancer Diagnosis and Treatmen. *Sensing and Bio-Sensing Research*, 2016. 1(2): p. 22.
- [15.] Eissazadeh, S., Mostafavi, S. M., Piryaei, M., Taskhiri, M. S., Application Of Polyaniline Nanostructure Based Biosensor For Glucose And Cholesterol Detection. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 2019. 10(1): p. 150.
- [16.] Eissazadeh, S., Piryaei, M., Taskhiri, M. S. and Mostafavi, S. M. Improvement of Sensitivity of Antigen-Antibody Detection of Semen Through Gold Nanoparticle. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 2019. 10(1): p. 144.
- [17.] Eissazadeh, S., Piryaei, M., Mostafavi, S. M., Measurement of Some Amino Acid Using Biosensors Based on Silicon-Based Carbon Nanotubes. *Journal of Computational and Theoretical Nanoscience*, 2019. 16: p. 1.
- [18.] Shabestari, A. B., Mostafavi, S. M., Malekzadeh, H., Force Degradation Comparative Study on Biosimilar Adalimumab and Humira. *Revista Latinoamericana de Hipertensión*, 2019. 13(06): p. 496-509.
- [19.] Mostafavi, S. M., S.E., Piryaei, M., Comparison of Polymer and Ceramic Membrane in the Separation of Proteins in Aqueous Solution Through Liquid Chromatography. *Journal of Computational and Theoretical Nanoscience*, 2019. 16(1): p. 157-164.
- [20.] Jafari, S., Mostafavi, S. A., Investigation of nitrogen contamination of important subterranean water in the plain. *Medbiotech Journal*, 2019. 03(01): p. 10-12.
- [21.] Man, Z., Mostafavi, S.M., Surendar, A., Fuel oil characteristics and applications: economic and technological aspects. *Petroleum Science and Technology*, 2019. 37(09): p. 1041-1044.
- [22.] Mostafavi, S. M., Malekzadeh, H., Taskhiri, M. S., In Silico Prediction of Gas Chromatographic Retention Time of Some Organic Compounds on the Modified Carbon Nanotube Capillary Column. *Journal of Computational and Theoretical Nanoscience*, 2019. 16(01): p. 151-156.
- [23.] Mostafavi, S. M., Ebrahimi, A., Mercury determination in work place air and human biological samples based on dispersive liquid-liquid micro-extraction coupled with cold vapor atomic absorption spectrometry. *Analytical Methods in Environmental Chemistry Journal*, 2019. 2(04): p. 49-58.
- [24.] Shabestari, A. B., Shekarchi, M., Mostafavi, S. M., Development of Environmental Analysis for Determination of Total Mercury in Fish Oil Pearls by Microwave Closed Vessels Digestion Coupled with ICP-OES. *Ekoloji*, 2018. 27(106): p. 1935.
- [25.] Bayat, M., Mostafavi, S. M., Investigation of Interleukin 2 as Signaling Molecule in Human Serum Albumin. *The*

- Pharmaceutical and Chemical Journal, 2018. 5(02): p. 183-189. Abolfazl Davoudiroknabadi, S.M.M., Seyed Sajad Sajadikhah, An Introduction to Nanotechnology. 2016, Australia: Mikima Book Publication.
- [26.] Davoudiroknabadi, A., Mostafavi, S. M., Sajadikhah, S. S., An Introduction to Nanotechnology. 2016, Australia: Mikima Book Publication.
- [27.] Davoudiroknabadi, A., Mostafavi, S. M., Pasban, A. A., Fundamentals of Nanostructure and Nanomaterial. 1 ed. 2016, Australia: Mikima Book Publication.
- [28.] Mostafavi, S. M., 3D Graphene Biocatalysts for Development of Enzymatic Biofuel Cells: A Short Review. *Journal of Nanoanalysis*, 2015. 2(2): p. 57-62.
- [29.] Mostafavi, S. M., Piryaee, M., Rouhollahi, A., Mohajeri, A., Separation and Quantification of Hydrocarbons of LPG Using Novel MWCNT-Silica Gel Nanocomposite as Packed Column Adsorbent of Gas Chromatography. *Journal of NanoAnalysis*, 2014. 1(01): p. 01.
- [30.] Mostafavi, S. M., Piryaee, M., Rouhollahi, A., Mohajeri, A., Separation of Aromatic and Alcoholic Mixtures using Novel MWCNT-Silica Gel Nanocomposite as an Adsorbent in Gas Chromatography. *Journal of NanoAnalysis*, 2014. 1(01): p. 11.
- [31.] Zabihi, O., Khodabandeh, A., Mostafavi, S. M., Preparation, optimization and thermal characterization of a novel conductive thermoset nanocomposite containing polythiophene nanoparticles using dynamic thermal analysis. *Polymer degradation and stability*, 2012. 97(1): p. 3-13.
- [32.] Shamsipur, M., Miran Beigi, A. A., Teymouri, M., Poursaberi, T., Mostafavi, S. M., Soleimani, P., Chitsazian, F., Tash, A. Biotransformation of methyl tert-butyl ether by human cytochrome P450 2A6. *Biodegradation*, 2012. 23(2): p. 311-318.
- [33.] Mostafavi, S. M., Rouhollahi, A., Miranbeigi, A. A., *Handbook of Mineral Analysis*. 2012: Mani Publication, Ltd, Isfahan, Iran.
- [34.] Zabihi, O., Mostafavi, S. M., Ravari, F., Khodabandeh, A., Hooshafza, A., Zare, K., Shahzadeh, M., The effect of zinc oxide nanoparticles on thermo-physical properties of diglycidyl ether of bisphenol A/2, 2'-Diamino-1, 1'-binaphthalene nanocomposites. *Thermochimica acta*, 2011. 521(1-2): p. 49-58.
- [35.] Mostafavi, S. M., Rouhollahi, A., Adibi, Pashae, F., Piryaee, M., Modification of Glassy Carbon Electrode by a Simple, Inexpensive and Fast Method Using an Ionic Liquid Based on Imidazolium as Working Electrode in Electrochemical Determination of Some Biological Compounds. *Asian Journal of Chemistry*, 2011. 23(12).
- [36.] Mostafavi, S. M., Rouhollahi, A., Adibi, M., Pashae, F., Piryaee, M., Electrochemical Investigation of Thiophene on Glassy Carbon Electrode and Quantitative Determination of it in Simulated Oil Solution by Differential Pulse Voltammetry and Amperometry Techniques. *Asian Journal of Chemistry*, 2011. 23(12): p. 5356-5360.
- [37.] Mostafavi, S. M., Mohajeri, A., Determination of molecular structure by identification of functional groups. 2010: Toranj Group Publication, Ltd., Isfahan, Iran.
- [38.] Mostafavi, S. M., Zabihi, O., *Thermodynamics: an engineering approach*. 2010: Mani Publication, Ltd, Isfahan, Iran.
- [39.] Mostafavi, S. M., Rafiei, B., *Nanomaterial Chemistry*. 2010: Toranj Group Publication, Ltd.
- [40.] Mostafavi, S. M., Asian, S., Iman Seyedi, Mohammad Hoseini, *Excel for Engineers*. 2009: Toranj Group Publication, Ltd.
- [41.] Mostafavi, S. M., Rouhollahi, A., Piryaee, M., *Electrochemistry; principles, methods, and applications*. 2009: Toranj Group Publication, Ltd.
- [42.] Mostafavi, S. M., Pashae, A., Rouhollahi, A., Adibi, M., Electrochemical Study and Determination of Thiophene by Cobalt Oxide Nanoparticle Modified Glassy Carbon Electrode. in 6th Aegean Analytical Chemistry Days (AACD), Denizli, Turkey. 2008.
- [43.] Heidary, S., Nezhad A.Y., Mehrabi Far, A., Colonization and Investigation of Vibrio Cholera Recombination Protein in E-Coli. *International Journal of Engineering & Technology*, 2018. 7(4.7).
- [44.] Najafzadeh, N., Sultan, S. S., Spotin, A., Zamani, A., Taslimian, R., Yaghoubinezhad, A., Parvizi, P., The existence of only one haplotype of Leishmania major in the main and potential reservoir hosts of zoonotic cutaneous leishmaniasis using different molecular markers in a focal area in Iran. *Revista da Sociedade Brasileira de Medicina Tropical*, 2014. 47(5).
- [45.] Spotin, A., Parvizi, P., Ghaemmaghami, P., Haghighi, H., Amirkhani, A., Bordbar, A., Yaghoubinezhad, A., Different Phenotypic Aspects with No Genotypic Heterogeneity in Leishmania Major Isolates of Suspected Patients in Northern Khuzestan Province. *Iranian Journal of Public Health*, 2014. 43(2).
- [46.] Samei, N., Parvizi, P., Spotin, A., Khatami Nezhad, M. R., Najafzadeh, N., Yaghoubinezhad, A., Identifying of Causative Agents of Cutaneous Leishmaniasis by Amplifying Cyt B Gene in Indigenous Foci of Iran. *Iranian Journal of Public Health*, 2014. 43(2).
- [47.] Samei, N., Parvizi, P., Spotin, A., Khatami Nezhad, M. R., Najafzadeh, N., Yaghoubinezhad, A., Finding various molecular haplotypes of Leishmania major in human using three HSp70, ITS-rDNA and Cyt b genes, in 1st and 13th Iranian Genetics Congress. 2014: Tehran.
- [48.] Kurt M, Kotan, T., Gül, M.S., Gül, R., Aydin, A.C., The Effect of Blast Furnace Slag to Self-Compactability of Pumice Aggregate Lightweight Concrete, *SADHANA Academy Proceedings in Engineering Sciences*, 41(2), February 2016, pp.253-264.
- [49.] Kurt M, Aydin, A.C., Gül, M.S., Gül, R., Kotan, T., The Effect Of Fly Ash To Self-Compactability Of Pumice Aggregate Lightweight Concrete, *SADHANA Academy Proceedings in Engineering Sciences*, Vol. 40, Part 4, June 2015, pp. 1343-1359.
- [50.] Aydin A.C., Nasl V.J. , Kotan T., "The synergic influence of nano-silica and carbon nano tube on self-compacting concrete", *Journal of Building Engineering*, vol.20, pp.467-475, 2018.

How to Cite This Article

Gupta, R.K., Hassan, A., Komar, S., The Investigation of the Corrosive Effects of Sulphates and Salts on the Concrete and the Study of Environmental Changes on it, *Cement Based Composites*, 2(2020), 1-5. <https://doi.org/10.36937/cebacom.2020.002.001>