Jan-2023 ISSUE-IV(I), VOLUME-X

Published Special issue
With e-ISSN 2394-8426 International Impact Factor 6.305
Peer Reviewed Journal

Published On Date 31.01.2023

Issue Online Available At :http://gurukuljournal.com/

Organized &
Published By

Chief Editor,
Gurukul International Multidisciplinary Research Journal
Mo. +919273759904 Email: chiefeditor@gurukuljournal.com
Website : http://gurukuljournal.com/

e-ISSN No. 2394-8426
Jan-2023
Issue–IV(I), Volume–X

INDEX

Gurukul International Multidisciplinary Research Journal (GIMRJ)*with* International Impact Factor 6.305
Peer Reviewed Journal

e-ISSN No. 2394-8426
Jan-2023
Issue–IV(I), Volume–X

Piezoelectric Nano-materials for Energy Harvesting Application

Jawahar M. Bodulwar, Ajay B. Lad
Department of Physics, Amolakchand Mahavidyalaya, Yavatmal-445001, Maharashtra, India.
Corresponding Author e-mail address: jawaharbodulwar@gmail.com

Abstract
In fact, piezoelectricity has its origins in many electronic applications such as sensors and actuators. The recent discovery of piezotronics, which combines the piezoelectric and semiconducting properties of materials, has opened new avenues for piezoelectric researchers worldwide. The emergence of micro- and nano-sized devices has created new opportunities and challenges for small-scale power generation. Nanoscale energy harvesting has applications in wearable and implantable medical devices, structural health monitoring sensors, and many other areas. The use of nanogenerators for energy harvesting is gradually improving, and there are still many opportunities to improve efficiency and design devices robust enough for commercial applications. There are also many exciting opportunities to explore nanogenerators based on new materials such as monolayer materials. This brief overview aims to explore some of the new piezoelectric materials that are essential for nanoscale energy harvesting and to highlight important milestones for energy harvesting using these materials.

Keywords: Piezoelectric; Piezoelectricity; Energy Harvesting

1. Introduction

Pierre Curie and Jacques Curie were pioneers who discovered the piezoelectric phenomenon in 1880 while studying crystals of quartz, tourmaline, and Rochelle salt. There are two types of piezoelectric effect: direct effect and inverse effect. In the direct piezoelectric effect, a material is polarized and a voltage is generated when subjected to tensile or compressive stress. Conversely, applying an electric potential causes a mechanical displacement in the material.

Piezoelectric materials are commonly referred to as "smart" materials because they can convert applied mechanical pressure into electrical signals and vice versa. They are widely used to extract mechanical energy from vibration, human movement, mechanical stress, etc. and convert it into electrical energy for low power devices. Piezoelectric transducers offer high scalability, simple device design, and high-power density compared to electromagnetic/static and triboelectric transducers. The piezoelectric Energy Collector is a device that generates energy using an external force acting on a piezoelectric element. This technology is typically used to convert ambient waste energy into usable electrical energy. The piezoelectric energy collector mechanism is based on the direct piezoelectric effect. When the harvester is stressed, a proportional charge is generated on the material surface. When connected to an external circuit, the charge will cause current to flow through the load. Therefore, in this process, the piezoelectric material is essentially a source of voltage, current, charge, or current. Piezoelectric energy collectors are sometimes called energy catchers or generators.

Traditionally, the direct piezoelectric effect was used in piezoelectric sensors such as force, pressure, and acceleration sensors. In recent decades, the application of the direct piezoelectric effect to energy harvesters has received increasing attention for several reasons. The first is the answer to the energy crisis.

Piezoelectricity is a property of non-centrosymmetric crystals in which applied strain induces charge polarization. Piezoelectric materials also exhibit an inverse piezoelectric effect. This causes a voltage to be induced in the piezoelectric material by the applied bias voltage. There are 21 non-centrosymmetric crystal classes. Of these 21 classes, the cubic class has 432 piezoelectric

charges, which cancel along the <111> axis, so there is no piezoelectricity. As discussed later in this chapter, piezoelectric materials such as zinc oxide (ZnO) nanowires have recently enjoyed great success in nanoscale energy harvesting applications. Recently, there has been a great deal of interest in monolayer MoS2. This has the potential of energy harvesting from a single atomic layer. Biologically inspired materials, including diphenylalanine (FF) peptide nanotubes, have also been studied for their striking structural and piezoelectric effects. Electromechanical coupling in piezoelectric materials is well suited for nanoscale mechanical energy harvesting. Piezoelectric materials can also have semiconducting properties that can play an integral role in energy harvesting performance. This combination of piezoelectric and semiconductor properties is known as the piezotronics effect. The semiconducting properties of nanomaterials such as ZnO have been instrumental in the development of nanogenerators. Nanomaterials are particularly well-suited for harvesting because there are a number of hitherto neglected mechanical energy sources, such as biomechanical energy and low-intensity vibrations from the environment [1, 2]. Table 1 enlist the various types of piezoelectric materials.

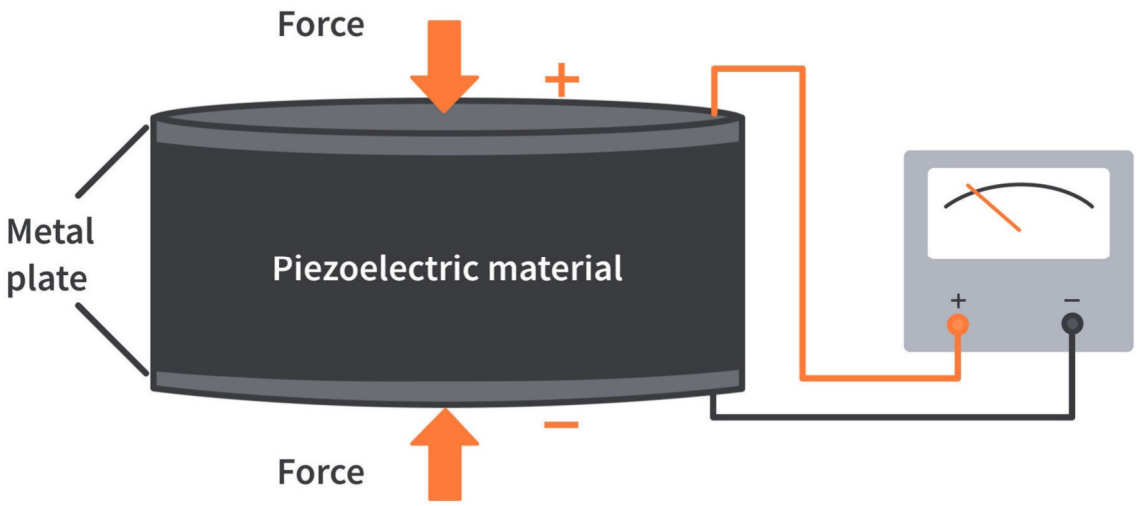


Figure 1. Pictorial representation of piezoelectric effect.

Table 1. List of materials used for piezoelectric application

Category	Typical materials
Synthetic crystals	Gallium orthophosphate, langasite, and di-isopropylammonium bromide
Synthetic ceramics	$BaTiO_3$, $PbTiO_3$, $Pb(Zr,Ti)O_3$, $KNbO_3$, $LiNbO_3$, $LiTaO_3$
Lead-free piezoceramics	$BiFeO_3$, $Bi4Ti_3O_{12}$, $Na_{0.5}Bi_{0.5}TiO_3$
Polymers	Polyvinylidene fluoride

2. Potential Nano-materials for Piezoelectric Applications

2.1 Zinc Oxide

Zinc oxide is one of the potential piezoelectric and semiconducting materials which has huge potential to use in the developments of energy harvesting at nanoscale. Zinc oxide available in

three crystalline phases, which named as wurtzite, zinc blende and rock salt. All these three types of crystalline phases have lack inversion symmetry, which enables them for energy harvesting applications using piezoelectric effect. Among these three forms hexagonal wurtzite form blatantly been discovered for energy harvesting applications [3, 4]. Figure 2 depicts the various structural phases of ZnO crystal.

Features of Zinc Oxide Crystal

- Zinc oxide nanomaterials are available in a quasi-1D, high aspect ratio structure capable of generating large piezo-potentials along the length of the wire.
- Zinc oxide exhibits the direct bandgap of the order 3.37 eV.
- The electron affinity value associated with zinc oxide is 4.2 eV. Therefore, ZnO can form Schottky contacts with high work function metals.
- The mechanical characteristics of zinc oxide nanowires show the often-promising scaling properties of nanostructures.

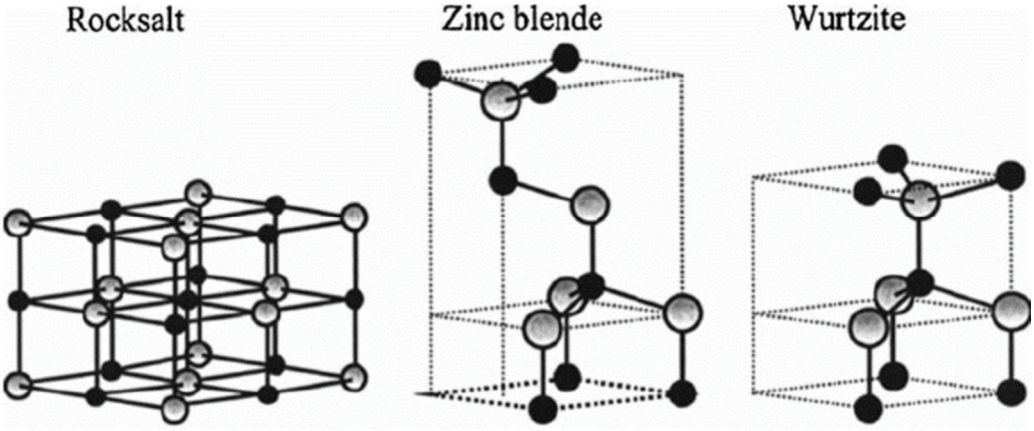


Figure 2. Various structural phases of ZnO crystal.

The experimental demo of energy harvesting from ZnO nanomaterials was explored Wang et al group in 2006. In this study, the researchers used an array of zinc oxide nanowires to alter mechanical energy from atomic force microscopy into electrical energy. Wires were grown on alumina substrates using a gas-liquid-solid process. Gold was used as catalyst in the reaction, resulting in tiny gold nanoparticles on top of each wire. Deflection of separate wires can be assessed from the atomic force microscopy topography. From this, the researchers calculate the energy required for elastic deformation of the wire and compared it with the measured energy of the piezoelectric discharge. Comparing these energies, the computed efficiency was 17-30%. In this experiment, the piezo potential arises from the lateral bending of the nanowire and the potential distribution [5].

2.2 Molybdenum Disulfide

Molybdenum disulfide (MoS_2) is another promising material for piezoelectric energy harvesting. Molybdenum disulfide is an inorganic transition metal dichalcogenide compound with a hexagonal crystal structure [6]. Figure 3 shows the molybdenum disulfide in atomically thin state.

Features of Molybdenum Disulfide Crystal

In monatomic molybdenum disulfide, the two orthogonal crystal orientations are often referred to as 'chairs' or 'zigzags' for their respective appearances. The
lattice constants are a = b = 3.16 Å and c = 12.29 Å. The indirect bandgap of
bulk molybdenum disulfide is about 1.2 eV. However, the direct bandgap of monolayer MoS2 is about 1.8 eV. Since molybdenum disulfide can withstand large strains, strain techniques can be used to further tune the bandgap.

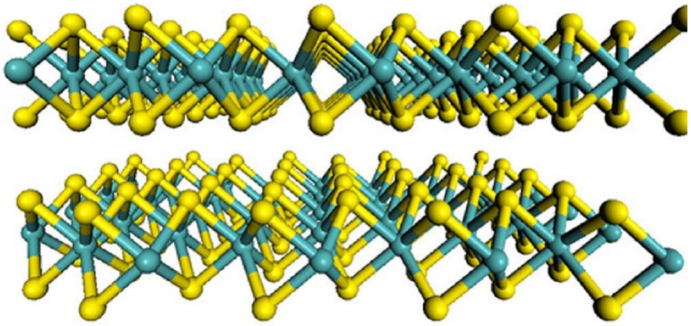


Figure 3. Molybdenum disulfide.

Wu et al experimentally shows that the prospect of energy harvesting based on 2 dimensional materials with the examination of piezoelectricity in single layer MoS_2. Single layer MoS_2 flakes were prepared by exfoliation. Once the atomic layer thickness was verified, the authors used single harmonic generation to identify the crystal structure orientation of a single flake. This information was superimposed onto an optical image of the flake so as to identify the “armchair” and “zigzag” directions of the lattice [7].

Conclusions

Piezoelectric nanomaterials are imperative intelligent and functional materials that are used in a wide range of applications comprising consumer products, automobiles, medical diagnostics and advanced scientific instruments. Piezoelectric nanomaterial has fascinated noteworthy research efforts due to its small size, low power consumption, excellent mechanical robustness, and better performance, and has great potential in renewable energy and physical sensor applications. is expected to hide ZnO nanostructures are the most studied piezoelectric nanomaterials due to their significantly enhanced piezoelectricity further enhanced at the nanoscale. Established synthetic approaches can grow ZnO nanowires on almost any substrate. Besides ZnO nanomaterials, many other materials have been discovered that can be used to develop piezoelectric energy harvesters. In bulk state MoS2 crystal cannot shows the piezoelectric effect, but 2-dimentional thin layers of MoS2 showed piezoelectric effects.

Acknowledgement

Authors are very much thankful to Principal, Amolakchand Mahavidyalaya, Yavatmal for providing necessary academic help.

References

1. Z.L. Wang, J. Song, Piezoelectric nanogenerators based on zinc oxide nanowire arrays, Science 312, 242–246 (2006)

2. R. Yang, Y. Qin, C. Li, G. Zhu, Z.L. Wang, Converting biomechanical energy into electricity by a muscle-movement-driven nanogenerator, Nano Lett. 9, 1201–1205 (2009)

3. H. Morkoç, U. Ozgur, Zinc Oxide: Fundamentals, Materials and Device Technology (Wiley-VCH, Weinheim, 2009.
4. X. Wang, J. Song, J. Liu, Z.L. Wang, Direct-current nanogenerator driven by ultrasonic waves. Science 316, 102–105 (2007).
5. Z.L. Wang, J. Song, Piezoelectric nanogenerators based on zinc oxide nanowire arrays. Science 312, 242–246 (2006).
6. P. Young, Lattice parameter measurements on molybdenum disulphide. J. Phys. D Appl. Phys.1, 936 (1968).
7. W. Wu, L. Wang, Y. Li, F. Zhang, L. Lin, S. Niu, D. Chenet, X. Zhang, Y. Hao, T.F. Heinz, J. Hone, Z.L. Wang, Piezoelectricity of single-atomic-layer MoS2 for energy conversion and piezotronics. Nature 514, 470–474 (2014).

मानवाधिकार व शेतक–यांच्या समस्या

डॉ. जयंतकुमार एम. मस्के, अर्थषास्त्र विभाग प्रमुख, एस. एन. मोर महाविद्यालय, तुमसर
(E-mail : jayantmaskey17@gmail.com, Mob. No. : 9421803327)

सारांष :

स्वातंत्र्याची 75 वर्ष पूर्ण होत असतांना आर्थिक विकासाचा दर वाढला आहे. मात्र याचा फायदा श्रीमंत, उद्योजकांना झाला. शेतकरी, सर्वसामान्य वर्ग मात्र गरीबच राहीला आहे. नैसर्गिक संकटामुळे शेती उत्पादनात होणारी घट, शेतमालाला योग्य भाव न मिळाल्यामुळे कर्जाचा वाढता डोंगर अशा विविध कारणांमुळे देशात शेतक–यांच्या समस्या वाढल्या आहेत. शेतक–यांच्या मानवाधिकाराचे रक्षण करणे आजची गरज झाली आहे. प्रस्तुत लेखामध्ये मानवाधिकार व शेतक–यांच्या समस्या याचा मागोवा घेण्यात आला आहे.

बीजषब्द : मानवाधिकार, शेतकरी आत्महत्या, कृषी.

प्रस्तावना :

मानवाधिकाराची संकल्पना मानवतेच्या इतिहासाषी संबंधीत आहे. भारतीय संविधानामध्ये मानवाच्या मुलभूत अधिकारांना पूर्ण सन्मान मिळाला आहे. समाजातील विषमता दूर करण्यासाठी संविधानाने प्रामुख्याने प्रयत्न केले आहेत. यामध्ये मुलभूत अधिका–याच्या सुरक्षिततेकरीता सामाजिक, राजकिय व आर्थिक समानता व न्याय प्रस्तापित करण्याची व्यवस्था केली आहे. मानव अधिकारांना सुरक्षित करण्याकरीता भारत सरकारने केंद्र व राज्य स्तरावर मानवाधिकार आयोगाची स्थापना केली आहे. स्वातंत्र्याचा अर्थ दुस–यांच्या विचारांचा सन्मान करणे आहे व दुस–यांच्या विचारांचा सन्मान केल्यावरच मानवाधिकाराचे रक्षण होईल. जेव्हा आम्ही स्वतःच्या अधिकाराची गोष्ट करतो तेव्हा आम्ही दुस–याच्या अधिकाराचे हनन तर करीत नाही यावरही लक्ष देणे आवष्यक आहे.

सर्वसाधारणतः मानवी हक्कामध्ये व्यक्तीच्या (मानवाच्या) समता, स्वातंत्र व बंधुता या घटकांवर विशेष भर देण्यात येतो. यामध्ये काही शंका नाही की संयुक्त राष्ट्रसंघटनेने जेव्हापासून मानवी हक्काच्या संकल्पनेला विशेष अधिकार प्राप्त करून दिले तेव्हापासून संपूर्ण जगामध्ये मोठ्या प्रमाणात लोकांमध्ये मानवाधिकाराच्या संदर्भात जागरूकता निर्माण झाली आहे. 1950 नंतर जगामध्ये विविध देशांच्या झालेल्या आर्थिक विकासात मानवी हक्काच्या घटकांचा विशेष सहभाग आहे किंवा या घटकांकडे आर्थिक विकासात दुर्लक्ष झाले नाही. असे असले तरी जागतीकीकरणाच्या कालावधीत भारतामध्ये उत्पन्न विषमतेत वाढ झाली आहे. मानवाधिकार हे असे मूलभूत अधिकार आहेत जे प्रत्येक व्यक्तीला ते 'मानव' आहेत म्हणून मिळालेले असतात. मानव अधिकार म्हणजे व्यक्तीला जन्माने प्राप्त झालेले आणि सन्मानाने जीवन जगण्यासाठी आवश्यक असलेले अधिकार होय. 1928 ला संयुक्त राष्ट्र संघाच्या आमसभेत मानवी हक्क जाहीर करणारे घोषणापत्र संमत केले. या घोषणापत्रानुसार यापुढे कोणत्याही देशातील सरकारचा आपल्या देशातील नागरिकांना मानवी हक्कापासून वंचित ठेवता येत नाही.

राज्यघटनेच्या मूलभूत अधिकारामध्ये कलम 21 मध्ये जगण्याचा हक्क हा भारतीय नागरिकांचा मूलभूत अधिकार आहे.

भारत हा कृषिप्रधान देश असला तरीही आजही शेतक–यांचे प्रश्न सुटलेले नाही. शेती हा व्यवसाय वेगवेगळया आपत्तीशी संबंधित असलेला व्यवसाय आहे. दुष्काळ, अतिवृष्टी, गारपीट, अवकाळी पाऊस, पिकावरील रोग या नैसर्गिक कारणाबरोबरच उत्पादन खर्चाइतकेही उत्पन्न शेतमालाच्या विक्रीतून न निघणे, शेतमालाच्या किंमतीमध्ये सातत्याने चढ–उतार होत राहणे व व्यापा–यांकडून फसवणूक होणे आदी कारणामुळे शेतक–यांना शेती पासून प्राप्त होणारे उत्पन्न अनिश्चित राहते. शेतमालाच्या बाजाराइतकी अनिश्चितता अन्य उत्पादनांमध्ये नाही. आज कसे पिकवायचे हे सांगण्यापेक्षा कसे विकायचे हे सांगा असे म्हणणारे शेतकरी अधिक आहेत. अर्थात कसे पिकवायचे याचे संपूर्ण ज्ञान शेतक–यांपर्यंत पोहोचले असा याचा अर्थ होत नाही. पण जर महा प्रयासाने अतिशय दर्जेदार शेतमाल पिकवला आणि त्याला बाजार भाव चांगला मिळाला नाही तर शेतक–यांचा हिरमोड होणार आणि तो तोट्यात जाणार हे उघड आहे. शेतकरी आर्थिक संकटात आहे. त्याला शेतीतून पुरेसे उत्पन्न मिळत नाही, तो कर्जबाजारी आहे. वारंवार आपल्याला शेतक–यांच्या आत्महत्याच्या दुःखदायक बातम्या समजतात. वर्षाला देशांमध्ये सरासरी पंधरा हजाराहून अधिक शेतकरी आत्महत्येच्या घटना घडतात. राष्ट्रीय गुन्हे अन्वेषण विभागाच्या आकडेवारीनुसार वर्ष 2015 मध्ये देशातील कृषिक्षेत्रात 12,602 व्यक्तींनी आत्महत्या केली आहे. ज्यामध्ये 72.00 टक्के पेक्षा अधिक शेतकरी दोन हेक्टरपेक्षा कमी जमीन धारक (सीमांत शेतकरी) होतो तसेच राष्ट्रीय कृषी व ग्रामीण विकास बँक (नाबार्ड) च्या अहवालानुसार वर्ष 2018 मध्ये भारतात 10.07 कोटी शेतक–यांपैकी 52.05 टक्के शेतकरी कर्जबाजारी होते. यावर प्रभावी उपाययोजना म्हणून सध्याच्या सरकारने राष्ट्रीय स्तरावरील बाजारपेठ तयार करण्याचा प्रयत्न केला आहे. सरकारच्या शेतीविषयक नवीन कायद्यांमुळे मुख्यतः बाजार समितीच्या आवारातील मुठभर पर्याय, त्यांचे संगणमत आणि त्यातून भाव पाडले जाणे या सगळयाला पर्यायी निर्माण होईल असे वाटत होते पण कायदा मागे घेण्यात आला. या कायद्यामुळे शेतकरी संघटनांनी केलेला उठाव दुर्लक्षित करून चालणार नाही. शेतक–यांच्या हितासाठी शेतकरी संघटनांच्या रास्त मागण्या सरकारने मान्य करून योग्य कायदा आणायला पाहीजे होता.

मानवी हक्कांच्या संकल्पनेमध्ये सर्वच स्तरातील लोकांच्या हक्कांच्या संरक्षणाचा समावेश होतो. मग तो उद्योजक असो, व्यापारी असो, नौकरदार असो वा शेतकरी असो सर्वांच्या हक्कांना समान अधिकार असतो. परंतू विकासाच्या प्रक्रीयेमध्ये जेव्हा राष्ट्रीय उत्पन्नाचा प्रवाह शेतक–यांकडून उद्योजक व उद्योजकाकडून सेवा क्षेत्रातील लोकांकडे जातो. तेव्हा राष्ट्रीय उत्पन्नाचा मोठा भाग हे मुठभर लोकांकडे जमा होते तर सर्वसामान्य व्यक्ती दोन वेळेच्या जेवणासाठी झगडतो. आजही भारतामध्ये जवळपास 23 टक्के लोक दारिद्रयरेषेच्या खाली जिवन जगत आहे. त्यांच्या मानवाधिकाराचा विचार व्हायला पाहिजे.

गेल्या काही वर्षांपासून शेतकरी हा नैसर्गिक संकटांमुळे आर्थिक अडचणीत सापडला आहे. कृषी उत्पन्न बाजार समितीमध्ये दलालांकडून शेतक–यांची होणारी पिळवणूक लक्षात घेता शेतक–यांना शेतीसाठी लावलेला खर्चसुद्धा निघणे कठीण होत आहे. ऐन हंगामात बँकेतून कर्ज मिळेपर्यंत शेतीपेरणीची वेळ निघून जाते. त्यामुळे बहुतांश शेतक–यांना खासगी सावकरांच्या असतो दारात उभे राहावे लागते. यानंतर अस्मानी आणि सुलतानी संकटांशी असल्या शेतकरी सतत लढत असतो. पावसाने मारलेली दडी किंवा खते, बी–बियाणे, कीटकनाशके इत्यादींचा ताळमेळ बसत नाही. त्यामुळे शेतकरी हतबल होतो. कुटुंब, संसार, मुलांच्या शिक्षणाचा खर्च सांभाळणे शेतक–यांना डोईजड होते. खासगी सावकार कर्ज वसूल करण्यासाठी शेतक–यांच्या मानगुटीवर बसून असतो. अशा स्थितीत शेतकरी टोकाचा आत्महत्येचा निर्णय घेत असल्याचे दिसून येते. वर्ष 2021 मध्ये भारतात 10,881 शेतकरी, शेतमजुरांनी आत्महत्या केली असून महाराष्ट्र शेतकरी आत्महत्येच्या आकडेवारीत पहिल्या क्रमांकावर असल्याची धक्कादायक माहिती राष्ट्रीय गुन्हे नोंदणी अहवालातून समोर आली. वर्ष 2021 मध्ये महाराष्ट्रात सर्वाधिक 4,064 शेतकरी–शेतमजुरांनी आत्महत्या करून जीवन संपवले आहे. दुस–या क्रमांकावर कर्नाटक राज्यात 2,169 तर तिस–या क्रमांकावर आंध्र प्रदेश या राज्यामध्ये 1,065 शेतकरी–शेतमजुरांनी आत्महत्या केल्या आहेत.

शेतक–यांची होणारी आत्महत्या मानवी हक्काच्या दृष्टीकोणातून गंभीर बाब आहे याला शेतक–यांच्या मानवी हक्काचे हननसुद्धा म्हणता येईल. जे शेतक–यांना आत्महत्येस प्रवृत्त करत आहे. भारतीय शेतक–यांच्या आत्महत्या रोखण्यासाठी आणि त्याच्या मानवी अधिकाराच्या रक्षणासाठी काही उपाय करने आवश्यक आहे. जीवीत राहण्याचा अधिकार सर्वांचा आहे. त्यासाठी महत्तम सामाजिक कल्याणाचे उद्दिष्ट केंद्रस्थानी ठेवून प्रयत्न करण्याची आवष्यकता आहे. शासन शेतक–यांच्या हितासाठी ज्या योजना सुरू केल्या त्यांची अंमलबजावणी योग्य होते आहे का? जर हे सगळे व्यवस्थीत असले तर शेतक–यांनी इतक्या मोठया प्रमाणावर आत्महत्या का केल्या असत्या. मध्यस्थ, दलाल आणि बाजार शक्तीला आपल्या लाभाचाच विचार न करता मानवतेच्या दृष्टीकोणातून शेतक–यांची चिंता करायला हवी. सरकार उद्योगपतींना ज्या प्रमाणात मोठ्या–मोठया सोई सुविधा पुरवितात. त्या शेतक–यांना दिल्या जाव्या. उदा. कमी व्याजदरावर कर्ज, मालाला योग्य बाजार भाव. शेतक–यांच्या आत्महत्या रोखण्यासाठी सरकारतर्फे मोठ–मोठया पॅकेजची वारंवार घोषणा करण्यात येते परंतु शेतक–यांपर्यंत योग्यप्रकारे पोहचत नसल्याने शेतकरी हवालदील होतात. यासाठी शासन स्तरावरून ठोस पावले उचचली जावीत.

निष्कर्ष :

आधुनिक अर्थषास्त्राच्या आधारावर आपण जे विकासाचे प्रारूप स्वातंत्र्य मिळाल्यापासून आत्तापर्यंत राबविले आहे. त्यानेतरी आपले बेकारीचे, गरीबीचे व आर्थिक विषमता कमी करण्याचे मुळ प्रष्न सुटू शकले का? याचे उत्तर नकारार्थीच येते. उलट हे प्रष्न देषाच्या स्वातंत्र्याचा अमृत महोत्सव साजरा करण्याच्या काळात अधिकच गंभीर झालेले दिसतात. देशामध्ये होणारी शेतक–यांची आत्महत्या एक गंभीर बाब आहे. नुसते शेतक–यांना रोख रकमा देऊन आत्महत्या

थावणार नाहीत तर शेतीच्या विकासाच्या संदर्भात योजना आखणे महत्वाचे आहे. यामध्ये सिंचनाचा सोईचा विकास, बियाणे, खते, कृषी मालाचा दर जाहीर करणे. योग्यवेळी कृषी संसाधनांची उपलब्धता करून देणे. जर असे केले तर शेतक–यांची आत्महत्या थांबविण्यास मदत होईल व त्यांच्या मानव अधिकारांचे रक्षणसुद्धा होईल.

संदर्भ सूची :

1. मौर्य, शैलेंद्र (2012) ''महिला मानवाधिकार – ज्वलंत मुद्दे एवं प्रमुख व्यवस्थाएँ'', अविष्कार पब्लिशर्स, डिस्ट्रीब्यूटर्स, जयपूर.
2. डॉ. निळकंठ भुसारी, प्रा. गणेश माकडे, प्रा. जे. जे. जाधव, मानव अधिकार – विस्थापीतांच्या व पर्यावरणाच्या समस्या, अथर्व पब्लिकेशन, धूळे.
3. गौरव दत्त व अस्विनी महाजन (2018), भारतीय अर्थव्यवस्था, एस. चंद प्रकाशन, नवी दिल्ली.
4- प्रताप सिंह विरेन्द्र (2014), ''कृषी अर्थषास्त्र'', विष्वभारती पब्लिकेषन, नई दिल्ली.
5- दैनिक लोकसत्ता, दि. 9 सप्टेंबर 2022.

महिलांचे मानवाधिकार

डॉ. मदन जी. प्रधान, अर्थशास्त्र विभाग प्रमुख, ऑर्टस् कॉलेज, सिहोरा, तह. तुमसर, जि. भंडारा
(E-mail : pradhan.madan277@gmail.com, Mob. No. : 8668382649)

सारांष :

स्त्री व पुरूष हे एक दुस–यारा पुरक आहेत. कुटुंब केवळ पुरूषामुळेच न बनता स्त्री–पुरूष या दोघांमुळे बनतो तसेच कुटुंबातुन समाज बनतो. परंतू आज मानव या सामाजिक व्यवस्थेला विकृत करायला लागला आहे. समाजाचा अर्धा भाग असणा–या महिलांच्या मानवाधिकाराचे उल्लंघन होत असल्याचे दिसते. भारतात महिलांच्या मानवी अधिकारांना सन्मान देण्याची संस्कृती अजूनही विकसित झाली नाही किंवा यासाठी कोणत्याही प्रकारची सामाजिक, आर्थिक व सांस्कृतिक पार्श्वभूमी निर्माण झाली नाही. त्यामुळे देशात विविध स्तरावर महिला मानवाधिकाराचे उल्लंघन होत आहे. प्रस्तुत लेखामध्ये महिलांचे मानवाधिकार याविषयी विष्लेषण करण्यात आले आहे.

बीजषब्द (Keywords) : मानवाधिकार, महिला हिंसाचार, भ्रुणहत्या, लिंग गुणोत्तर, बालविवाह.

प्रस्तावना :

आज सामाजिक न्याय मनुष्य जीवनाची आवश्यकता आहे. समाजामध्ये जाती, धर्म, लिंग इत्यादींच्या आधारावर भेदभावपूर्ण व्यवहार केला जातो. या भेदभावपूर्ण व्यवहारामुळे समाजामध्ये वैमनस्य वाढून व्यक्तीच्या मानवाधिकाराचे उल्लंघन होते. मानवाधिकार म्हणजे प्रत्येक व्यक्तीला असणारे नैसर्गिक मुलभूत अधिकार. हे अधिकार त्याला जन्मतःच मिळतात. समाजाचे संचालन काही नैतिक मापदंडावर होत असते. समाजाच्या संतुलनाकरिता नैतिक मूल्यांचे पालन करणे गरजेचे आहे. जेव्हा एखादा व्यक्ती या नैतिक मूल्यांचे पालन करत नाही. तेव्हा तो नियमानुसार दंडास पात्र होतो. सर्वसाधारणतः मानवी हक्कांमध्ये व्यक्तीच्या समता, स्वातंत्र्य व बंधुता या घटकावर विशेष भर देण्यात येतो. संयुक्त राष्ट्र संघटनेने जेव्हापासून मानवाधिकाराच्या संकल्पनेला विशेष अधिकार प्राप्त करून दिले तेव्हापासून संपूर्ण जगामध्ये मोठया प्रमाणात लोकांमध्ये मानवाधिकाराच्या संदर्भात जागृकता निर्माण झाली. लिंगाच्या आधारावर जेव्हा कोणत्याही स्त्री सोबत भेदभाव केला जातो तेव्हा ती स्त्री एक मानव म्हणून मानवाधिकारापासून वंचित राहते. भारताच्या संविधानात महिला मानवाधिकाराचा समावेश करण्यात आला आहे.

महिलांसाठीचे काही मानव अधिकार खालीलप्रमाणे आहेत.

1. महिलांना हिन मानणा–या विचारांवर आधारित सर्व त–हेच्या प्रथा व परंपरांना संपवून पूर्वग्रहांना समाप्त करण्याच्या दिशेने जनमताला शिक्षित करण्यात येईल.
2. खास करून महिलांना आपला जीवनसाथी निवडणे, आपल्या स्वतःच्या सहमतीनेच विवाह करण्याचे पुरुषासारखे स्वातंत्र्य असणे, विवाहाच्या वेळी किंवा विवाहानंतर महिलांचे अधिकार पुरुषासारखेच असतील. सर्वच बाबतीत मुलांचे हित सर्वोच्च असेल. मुलांच्या बाबतीत माता–पित्याचे अधिकार व कर्तव्य समान असतील. याबाबतीत त्यांच्या हक्कासाठी प्रयत्न करण्यात येईल.

3. महिलांच्या विरोधात असणा–या परंपरा, रीती–रिवाज, प्रथा, कायदे, नियम व व्यवहार यांना समाप्त करण्यासाठी योग्य ती पावले उचलण्यात येतील. तसेच त्यांच्या हक्कासाठी पर्याप्त कायद्याचे संरक्षण देण्यात येईल.
4. महिलांना प्रत्येक क्षेत्रात पुरुषाबरोबर समान अधिकार देण्यात येतील. जर कोणी यासाठी विरोध, अत्याचार, अन्याय व मर्यादा आणल्या तर तो एक अपराध मानता येईल.

महिलांवर केल्या जाणा–या अत्याचाराच्या गुन्हयासंबंधीची सांख्यिकीय माहिती भारत सरकार गृह मंत्रालयाद्वारे दरवर्षी प्रकाशित केली जाते. या माहितीच्या आधारे भारतात महिला अत्याचाराच्या गुन्ह्यांमध्ये सतत वाढ होत असल्याचे दिसून येते. वर्ष 2010 मध्ये देषातील महिला अत्याचाराची एकूण गुन्हे 2,13,549 होते ते वर्ष 2018 ला 3,78,277 इतकी झाली आहेत. एकूणच या आठ वर्षाच्या काळामध्ये महिलांवर केल्या जाणा–या अत्याचाराच्या गुन्ह्यांमध्ये 77.13 टक्के वाढ झालेली आहे. महिलांवरील बलात्कार, अपहरण व हुंडाबळी इ. गुन्हयांचे प्रमाण वाढलेले दिसून येते. महिलांच्या हिंसाचाराच्या संदर्भात नोंदविलेल्या तक्रारी आणि प्रत्यक्षात घडणा–या घटनांची संख्या कितीतरी पटीने अधिक असते. कारण आपल्यावर झालेला अन्याय चव्हाटयावर येऊ नये म्हणून मुकाटयाने सहन करणा–या महिलांची संख्या फार मोठी आहे. महिलांना कायद्याची जाणीव नगण्य असल्यामुळे त्या आपल्या अधिकाराचे रक्षण करू शकत नाही. त्यामुळे विविध कायद्याद्वारे देण्यात येणा–या सुरक्षिततेपासून त्या अनभिज्ञ असतात. जन्मापासून मृत्यूपर्यंत प्रत्येक व्यक्तीवर कायद्याचे बंधने असतात. महिलांच्या सुरक्षिततेच्या हेतूने अनेक कायदे आहेत. तरीपण भारतामध्ये महिलांच्या प्रति प्रत्येक क्षेत्रात भेदभाव केला जातो. नॅशनल क्राईम रेकॉर्ड ब्युरोने सांगितलेल्या आकडेवारीनुसार, भारतात प्रति 54 व्या मिनीटाला एखाद्या स्त्रीवर बलात्कार, प्रति 51 व्या मिनिटाला एखाद्या स्त्रीसोबत छेडछाड तसेच प्रति 102 व्या मिनिटाला एखाद्या स्त्रीचा हुंडयामुळे मृत्यु होत असल्याचे दिसून येते. ही आकडेवारी सरकारी आकडेवारी असून वास्तविक संख्या यापेक्षा अधिक पण राहू शकते.

महिलांच्या मानवाधिकाराचे उल्लंघन तिच्या जन्म घेण्याच्या पूर्वीच स्त्रीलिंग गर्भाची हत्या करून सुरू केले जाते. 0 ते 6 वयोगटातील दरहजार मुलांमागे असणारी मुलींची संख्या मोजून लिंग गुणोत्तर काढले जाते. भारतामध्ये हे गुणोत्तर दिवसेंदिवस विषम होत आहे. 2011 च्या जनगणनेनुसार 0 ते 6 वयोगटातील लिंग गुणोत्तर 918 आहे. 2001 च्या जनगणनेनुसार हे गुणोत्तर 927 होते. देशातील बिहार, झारखंड व बंगाल राज्यातील आकडेवारीचा विचार करता परिस्थिती गंभीर असल्याचे दिसून येते. झारखंडमध्ये वर्ष 2001 मध्ये मुलींची संख्या 965 होती. ती 2011 मध्ये घटून 948 झाली. बंगालमध्ये 2001 मध्ये संख्या 960 होती. ती घटून 2011 मध्ये 956 झाली. तसेच बिहार मध्ये ही संख्या 942 वरून कमी होऊन 935 झाली. अशाप्रकारे स्त्रियांचा जगण्याचा अधिकार हिरावून घेतला जात आहे. ज्या मुली या भ्रुणहत्यापासून वाचतात त्यांचे पूर्ण जीवन आपल्या मानवाधिकाराच्या प्राप्तीकरिता एक संघर्ष बनत असते. त्यांना त्यांच्या कुटुंबामध्ये सन्मानाची वागणूक मिळत नाही, की जी त्यांच्या भावांना मिळत असते. भारतीय कुटुंबामध्ये मुलाचे ज्या प्रमाणात स्वागत होते, त्याप्रमाणे मुलीचे होत नाही. जगात

सर्वसाधारणपणे पुरुष व स्त्रियांचे प्रमाण 1:1 असे अपेक्षित असले तरीही प्रत्येक देशात हे गुणोत्तर वेगवेगळे आहे. भारतात स्त्रियांच्या संख्येचा विचार करता स्त्रियांची घटणारी लोकसंख्या चिंतेची बाब झाली आहे. 2011 च्या जनगणना अहवालानुसार भारतात 1,000 पुरुषांमागे 940 स्त्रिया आहेत. भारतातील लिंग अनुपात स्त्रियांवर होत असलेल्या अन्यायाचे द्योतक आहे. स्त्री व पुरुष हे एक दुस–यांना पुरक आहेत. कुटुंब केवळ एकटया पुरुषामुळे बनत नसून, स्त्री–पुरुष दोन्हीमुळे बनत असते. स्त्री व पुरुष एक दुस–यांवर अवलंबून असण्याच्या प्रवृत्तीमुळे कुटुंब बनतो व कुटुंबापासून समाज बनत असते. स्त्री–पुरुषांच्या गुणोत्तरातील साम्य सामाजिक व्यवस्थेच्या संतुलनाकरिता आवश्यक आहे. परंतु आज मानव या सामाजिक व्यवस्थेला विकृत करण्यासाठी लागला आहे.

महिला मानवाधिकारांचे हनन महिला ज्या ठिकाणी काम करते त्या ठिकाणी शारीरिक व मानसिक त्रास देऊन करण्यात येते तसेच स्त्री व पुरुषांच्या समान कामाकरिता समान वेतन न देताही करण्यात येते. कमकुवत आर्थिक परिस्थितीमुळे महिलांना काम करून उदरनिर्वाह करावे लागते. श्रमशक्तीमधील स्त्रियांचा सहभागाचा दर भारतात कमी असल्याचे दिसून येते. देषातील एकूण स्त्री लोकसंख्येच्या तुलनेत कार्यक्षम वयोगटातील स्त्रियांचे गुणोत्तर कमी झाले आहे. भारतात श्रमशक्तीमधील स्त्रियांच्या सहभागाचा दर 2011–12 मध्ये 31.2 टक्के होता. तो 2017–18 साली 23.3 टक्क्यांपर्यंत खाली आला आहे. ग्रामीण भागात हा दर अधिक प्रमाणात कमी झाला आहे. स्त्रिया श्रमशक्तीतून बाहेर पडत आहेत. महिलांना दुहेरी भूमिका पार पाडावी लागते. यामध्ये एका बाजूला तिला व्यवसाय करावा लागतो तर दुस–या बाजूला घरांमध्ये कौटुंबिक जबाबदारी सांभाळावी लागते. अशाप्रकारे स्त्री दुहेरी तणावामध्ये जीवन व्यतीत करते की ज्याच्या परिणाम तिच्या शारीरिक व मानसिक आरोग्यावर होते.

भारतामध्ये बालविवाह हे एक स्त्री अत्याचाराचे रूप आहे. भारतात प्राचीन काळापासून बालविवाहाची प्रथा विद्यमान आहे. बालविवाहामुळे मुलींवर लवकर मातृत्व लादल्या जाते व पोषण आहाराच्या कमतरतेमुळे 'एनिमिया' सारख्या रोगाची ती शिकार होते. युकेस्थित 'सेव्ह द चिल्ड्रन इंडिया' या स्वयंसेवी संस्थेने प्रसिद्ध केलेल्या अहवालानुसार, भारताच्या ग्रामीण भागातील बालविवाहाचे प्रमाण अद्यापही चिंताजनक आहे. 15 ते 19 वर्षे वयोगटातील मुलीचा विवाह होण्याचे प्रमाण ग्रामीण भागात 14.1 टक्के व शहरी भागात 6.9 टक्के आहे.

लिंगाच्या आधारावर महिलांसोबत देण्यात येणा–या आहारातही भेदभाव केला जातो. मुलांच्या तुलनेत मुलींना पोषण आहार कमी देण्यात येतो. त्यामुळे त्याचा विपरित परिणाम तिच्या आरोग्यावर होतो. प्रो. अमर्त्य सेनने पण पोषण तत्वाच्या अभावामुळे स्त्री शिषुचा मृत्युदर अधिक असल्याचे स्पष्ट केले आहे. 'नॅशनल फॅमिली हेल्थ सर्वे – 4', वर्ष 2015–16 च्या अहवालानुसार देशात कुपोषणाचा दर 55 टक्के आहे. देशातील मुलींच्या संख्येतील एक–तृतीयांश मुली कुपोषण ग्रस्त आहेत. भारतात पाच वर्षाखालील मुलींच्या मृत्यूचे प्रमाण मुलांपेक्षा अधिक असल्याचे संयुक्त राष्ट्राच्या 'द वर्ल्ड्स वीमेन 2015' या अहवालात म्हटले आहे, मुला–मुलींना वाढविण्यामध्ये अजूनही ग्रामीण भागांमध्ये फरक केला जातो. बालकाच्या वाढीसाठी दोन

वर्षापर्यंतचा कालावधी महत्त्वाचा असतो. परंतु या कालावधीत मुलींना दिला जाणारा आहार, आजारी पडल्यानंतर दिले जाणारे उपचार, घेतली जाणारी काळजी याकडे अनेकदा दुर्लक्ष केले जात असल्याने पाच वर्षाखालील मुलींच्या मृत्यूचे प्रमाण अधिक असल्याचे दिसून येते. लहानपणी आवश्यक पौष्टिक व संतुलित आहार न मिळाल्यामुळे लग्नानंतर महिलांना अनेक आजारांना सामोरे जावे लागते.

भारतामध्ये साक्षरतेच्या दरात वाढ झाली आहे. मात्र देशातील महिलांमध्ये साक्षरचे प्रमाण पुरुष साक्षरतेपेक्षा कमी आहे. 2011 च्या जनगणनेनुसार देशात महिलांमध्ये साक्षरतेचे प्रमाण 65. 46 आहे. हेच प्रमाण झारखंड, बिहार व महाराश्ट्र राज्यामध्ये अनुक्रमे 59.00 टक्के, 54.00 टक्के व 67.51 टक्के आहे. शिक्षण विभागाच्या आकडेवारीनुसार मुलींमध्ये शाळा सोडण्याचा दर अधिक आहे. जिथे शिक्षणाची स्थिती चांगली आहे तिथेही गर्भलिंग निदान होत असल्याचे दिसून येते. महिलांच्या मानवाधिकाराबाबत जाणिव जागृती ही केवळ शिक्षणातूनच निर्माण होऊ शकते. म्हणून सर्व स्तरातील स्त्री शिक्षणात वाढ हा स्त्री अत्याचार कमी करण्याचा उपाय ठरतो. वर्ष 2014 पासून केंद्र शासनाने देशातील 100 जिल्हयात 'बेटी बचाओ, बेटी पढाव' ही योजना सुरू केली आहे. ज्या जिल्हयात मुलींचे जन्माचे प्रमाण कमी आहे, त्या जिल्ह्यांमध्ये ही योजना लागू करण्यात आली आहे.

निष्कर्ष :

समाजामध्ये स्त्रियांकडे दुर्लक्ष केले जाते आहे व त्यांना अनेक प्रकारचा भेदभाव सहन करावा लागतो. अपुरा आहार, आरोग्य व शिक्षणापासून वंचित ठेवणे, श्रमषक्तितील सहभागाचा कमी दर या समाजातील दुहेरी मापदंडामुळे महिलांना स्वतंत्र वातावरणात राहण्याचा मानवाधिकार पण हिरावला गेला आहे. त्याच्या जीवनातील महत्त्वपूर्ण निर्णय पण त्या घेऊ शकत नाहीत. त्यांना लहानपणी वडील व भावाच्या, लग्नानंतर पतीच्या व पतीनंतर पुत्राच्या संरक्षणामध्ये जीवन व्यतीत करावे लागते. समानता, न्याय व मानवाधिकाराच्या तत्वावर आधारीत समाजाची स्थापना करण्यासाठी विकासाच्या प्रक्रियेमध्ये महिलांचा सहभाग वाढविणे आवश्यक आहे. महिला मानवाधिकाराचे होणारे उल्लंघन लक्षात घेता महिला सुरक्षितता व सक्षमीकरणाच्या प्रयत्नांना आता वेग आला आहे. भारतामध्ये महिलांसोबत होणारे भेदभाव रोखण्याकरिता तसेच त्यांना सक्षम करण्याकरिता अनेक महत्त्वपूर्ण पावले उचलली गेली आहेत. स्त्री भ्रुणहत्या रोखण्याकरिता शासनामार्फत 'गर्भधारणापूर्व व प्रसवपूर्व निदानतंत्र–लिंगनिवडीस प्रतिबंधक कायदा 1994' आणि सुधारित कायदा 2003 उपलब्ध आहेत. तसेच मुलीच्या शिक्षणाकरीता विशेष योजना चालविल्या जात आहेत. त्यामुळे 2001 च्या तुलनेत 2011 मध्ये महिला साक्षरतेच्या प्रमाणात 11.79 टक्क्यांनी वृद्धी झाली आहे. कामाच्या ठिकाणी महिलांना स्वातंत्र्य व सुरक्षित वातावरण प्राप्त व्हावे तसेच कामाच्या ठिकाणी होणारे लैंगिक शोषण थांबविण्यासाठी कायदे बनविण्यात आले आहेत. घरात पण स्त्री सुरक्षित नाही म्हणून सरकारने 'कौटुंबिक हिंसाचार प्रतिबंधक कायदा 2005' बनविला आहे. या कायद्याअंतर्गत प्रत्येक जिल्ह्यात संरक्षण अधिका–यांना नेमण्यात आले आहे. तसेच संपत्तीमध्ये महिलांना बरोबरीचा वाटा मिळावा म्हणून

कायदा आहे. महिलांच्या सुरक्षेकरिता आज अनेक कायदे अस्तित्वात आहेत. पण फक्त कायदे अस्तित्वात असून चालत नाही, तर त्या कायद्याचे पालन होणे सुद्धा आवश्यक आहे. त्यासाठी समाजातील प्रत्येक व्यक्तीने सकारात्मक विचार करून समोर यावे लागेल. या सर्व कायद्याचे पालन चांगल्याप्रकारे व्हावे म्हणून राजकीय, सामाजिक व्यवस्थेमध्ये स्त्रियांनी जास्तीत जास्त सहभाग घ्यावा. स्त्री ही समाजाची रचनात्मक शक्ती असते. येणा–या काळाला सुधारण्याकरिता आजच्या महिलांच्या स्थितीमध्ये सुधारणा करणे आवश्यक आहे. त्याकरिता आपल्याला परंपरागत दृष्टिकोन बाजूला ठेवून नवीन मानवतावादी दृष्टिकोन स्वीकारावा लागेल.

संदर्भ :

१. Crime in India, 2018, Statistics volume – 1, National Crime Records Bureau, Ministry of Home Affairs.
२. Census of India 2001 and 2011.
3. मौर्य, शैलेंद्र (2012) ''महिला मानवाधिकार – ज्वलंत मुद्दे एवं प्रमुख व्यवस्थाएँ'', अविष्कार पब्लिशर्स, डिस्ट्रीब्यूटर्स, जयपूर.
4. नाटाणी, प्रकाश नारायण (2004) ''महिला एवं बाल विकास के नूतन आयाम'', माया प्रकाशन मंदिर, नागपुर.
5. उपाध्याय, एस. सी. (1997) ''स्टेट ऑफ विमेन इन इंडिया'', अनमोल पब्लिकेशन, न्यू दिल्ली.
6. माथुर, कृष्ण मोहन (2000) ''स्वातंत्र्योत्तर भारत मे मानवाधिकार'', ज्ञान पब्लिशिंग हाऊस, नई दिल्ली.
7. लोटे, रा. ज. (2009) ''भारतीय समाज आव्हाने आणि समस्या'', पिंपळापुरे ॲण्ड कं. पब्लिशर्स, नागपूर.

Gurukul International Multidisciplinary Research Journal (GIMRJ)*with* International Impact Factor 6.305
Peer Reviewed Journal

e-ISSN No. 2394-8426
Jan-2023
Issue–IV(I), Volume–X

Synthesis Of 1-(4-Chlorophenyl)-2-(3-Sulphoxyphenyl-4-(4-Substituted Benzylidene)-5-Imidazolones

Dr Suraj A Deshmukh
Department of Chemistry, Indira Mahavidyalaya.
Kalamb, 445001 (M.S) INDIA.
E-mail:- surajdeshmukh1001@ gmail.com

ABSTRACT
Now a day imidazolones have attracted great attention of chemists due to interesting properties shown by them. They are believed to be associated with several pharmacological activities. Their significance lies in the fact that they show diverse biological activities. Which include anticancer, anticonvulsant, antiparkinsonian, CNS depressant, antimicrobial, antihelmintic, anti HIV, anti-inflammatory etc.However no work is reported on imidazolone from substituted benzoyl glycine.Therefore it was thought interesting to attempt synthesis of imidazolones containing new substituent. In the proposed work, we have reported eight newly synthesized sulphoxy substituted imidazolones from oxazolones and 4-chloroaniline in presence of zeolite as a catalyst. The oxazolones were obtained from 3-sulphoxy benzoyl glycine and variedly substituted aromatic aldehydes in presence of anhydrous sodium acetate and acetic anhydride. The characterisation of these compounds was made by chemical properties, elemental analysis and spectral data like IR, ^{1}H-NMR.The use of zeolite as a catalyst enabled us to reduce reflux time and increase percentage yield of the products.

Keywords*: Sulphoxy benzoyl glycine,oxazolones,Zeolite catalyst ,5-imidazolones.*

INTRODUCTION
Ruhemann and Cunnington [1]reported the first synthesis of 5-imidazolone in 1889 by the condensation of ethyl phenyl propiolate with benzanidine hydrochloride in the presence of sodium ethoxide and obtained 2-pheyl-4-benzylidene-5(4H)- Imidazolone. Imidazolones form an important class of heterocyclic compounds since they can be converted into amino acid [2-3],used in drugs[4],pigments and electrodes[5].They have also shown diverse bioactivities including anticancer[6], anti HIV[7], antiparkinsonian[8-9], CNS depressant[10], antihelmintics[11]. Gabillet S, et al reported A Phosphine-Catalyzed Preparation of 4-Arylidene-5-imidazolones [12]. Snehalatha P and Subhashini N. J. P carried out, "Synthesis, characterization and biological evaluation of novel imidazolones derived from azlactones[13].Ming and coworkers[14] synthesized 2-alkoxy 4H-imidazole-4-ones from aza-witting reaction of iminophosphorane with phenyl isocyanate to form carbodiimide which on subsequent reaction with ROH in presence of RONA gave the target compounds. Kedar and Dehmukh[15]reported "synthesis of 1-(-4-methyl phenyl)-2-(3-bromo phenyl) -4-(4-substituted benzylidene) -5-imidazolones. Chopra et al [16] carried out Microwave assisted synthesis of some 5-substituted imidazolone analogues as a new class of nonpurine xanthine oxidase inhibitors. However no work is reported on imidazolones synthesized from substituted benzoyl glycine. Thus, due to their diverse applications and also part of our study, it was thought interesting to synthesize some new imidazolones containing different substituents.

MATERIALS AND METHOD
Aromatic aldehydes, benzoylglycine, 4-chloroaniline,sodium acetate, acetic anhydride and zeolite are required chemicals purchased from sd fine chemicals. All the chemicals used were of AR grade. Melting points were measured in open capillary tube. The purity of the compounds were checked by TLC on silica gel in petroleum ether and ethyl acetate (80:20).The IR spectra were recorded on Agilent Technologies cary 630 FTIR.^{1}H-NMR spectra were recorded on Brucker AVANCE 400MHz spectrometer using TMS as internal standard. This work involved condensation of 3-sulphoxy benzoyl glycine with substituted aldehyde in acetic anhydride in presence of anhydrous sodium acetate to obtain variedly substituted oxazolones.Oxazolones were further reacted with 4-chloro aniline in presence of zeolite as a catalyst to obtain the target compounds 1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-substituted benzylidene)-5-imidazolones.

Step-I: Synthesis of 2-(3-sulphoxyphenyl)-4-(4-methoxybenzylidene)-5-oxazolone.

To the solution of 3-sulphoxy benzoyl glycine 2.14gm(0.01mol)in acetic anhydride ,added 1.36gms of anisaldehyde(0.01mol)and then .0.7gms anhydrous sodium acetate (0.01mol).The contents were dissolved in ethyl alcohol .The solution was refluxed under water condenser for 3-hours It was poured to ice cold water when an yellowish solid was obtained. Washed it 2-3times with ice cold water and recrystallised from ethanol.

Yield: 65% melting point: 145^{0}C

Molecular formula $C_{17}H_{12}NO_5$ Molecular weight: 342

IR (KBr) in cm^{-1}:3045 (Ar,C-Hstr);2937(Aliph,C-Hstr);1787(C=Ostr);1651(C=Nstr);1596(C=Cstr);1311(C-O bend);1263(C-N bend);1028(S-O Asymmetric str);981(S-O symmetric str).

^{1}H-NMR(∂) : 8.27(d,2H,Ar-H);8.11(d,2H,Ar-H);7.66-7.68(t,1H,Ph-CH);7.58-7.61(t,2H,Ar-H);7.60(d,2H,Ar-H);3.87(s,3H,-OCH_3). Elemental analysis for $C_{17}H_{12}NO_5$ (342)

Calculated	%C=59.64	%H=3.50	%N=4.09	%S=9.35
Found	%C=59.60	%H=3.48	%N=4.02	%S=9.30

Step-II: - Synthesis of 1-(4-clorophenyl)-2-(3-sulphoxyphenyl)-4-(4-methoxybenzylidene)-5-imidazolone

To the ethanolic solution of oxazolone(3.42gm,0.01M) obtained in step-I, added 4chloro aniline (1.27gm,0.01M)and zeolite (1gm) as a catalyst followed by 1ml of 2%aq NaOH solution. The reaction mixture was reflux under water condenser for two and half hours it was allowed to cool and poured to ice cold water obtained colourless solid on acidification with dil HCl Washed it 2-3times with cold water and recrytalised from ethanol

Yield: 60% Melting point: 235^{0}C

Molecular formula $C_{23}H_{16}N_2SClO_4$ Molecular weight: 451

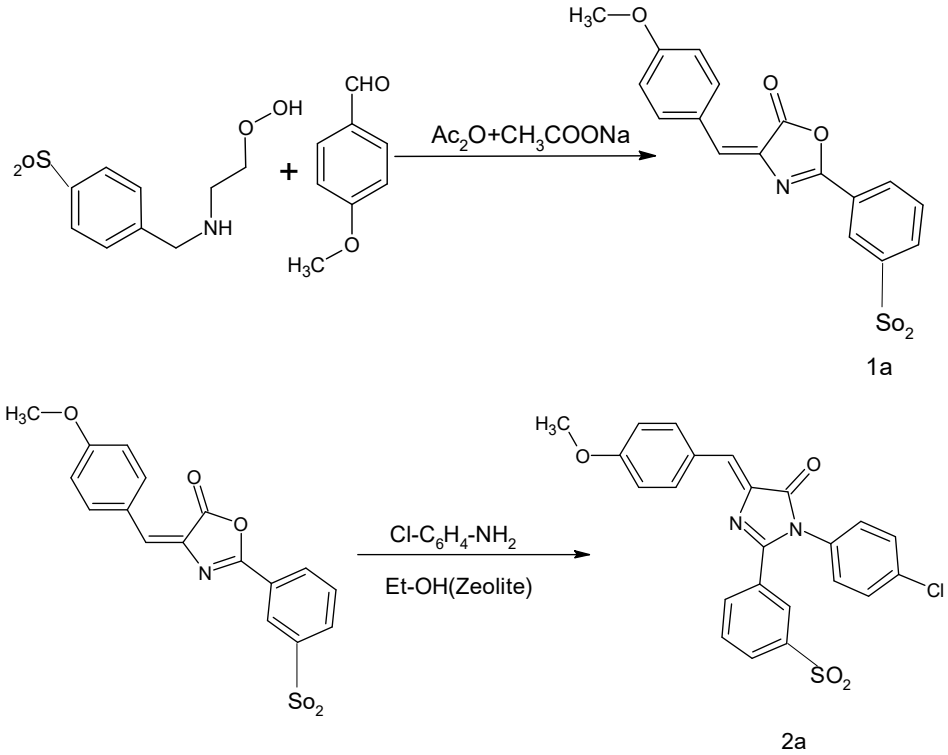
IR (KBr) :3030cm^{-1}(Ar,C-Hstr);2925cm^{-1}(Aliph,C-Hstr)1710cm^{-}

^{1}H-NMR(∂) : 8.04(d,2H,Ar-H);7.74(d,2H,Ar-H);7.56-7.61(m,3H,Ar-H);7.48.-7.52(t,1H,Ph-CH);7.29(d,2H,Ar-H);7.14(S,1H,Ar-H);6.92(d,2H,Ar-H);3.78(S,3H,OCH3)

Elemental analysis for $C_{23}H_{16}N_2SClO_4$ (451.5)

Calculated	%C=61.12	%H=3.54	%N=6.20	%S=7.08	% Cl =7.86
Found	% C=61.05	%H=3.50	% N=6.18	%S=7.02	% Cl =7 .78

REACTION



RESULTS AND DISCUSSION

The oxazolones required for the synthesis of imidazolones were prepared by condensation of newly synthesied 3-sulphoxy benzoyl glycine with variedly substituted aldehydes in presence of anhydrous sodium acetate in acetic anhydride Their formation was confirmed by physical and chemical tests. Thus eight variedly substituted oxazolones were obtained from different aldehyde and 3-sulphoxy benzoyl glycine. The target compounds 1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-substituted arylidene)-5-Imidazolones were synthesized by reacting each of these oxazolones with p-chloroaniline in ethanolic medium in presence of zeolite as a catalyst. It offered easy to workout methodology and also reduced reflux time to two and half hours. The compound (2a) gave positive test (orange colour)with ethanolic solution of 2,4dinitrophenyl hydrazine in presence of cone H_2SO_4 confirming the presence of (2a). It showed absorption bands at 2925cm-1due to Aliphatic ,C-H str;1710cm^{-1}due to C=Ostr;1639cm^{-1} C=N str;1035-1025cm^{-1}S-O Asymmetric str and symmetric str 690 C-Cl str similarly ^{1}H-NMR spectrum of 2 (a) showed the following chemical shift(∂)8.04(d,2H,Ar-H);7.74(S,1H,Ar-H);7.56-7.61(m,3H,Ar-H);7.48-7.52(t,1H,Ph-CH);7.29(d,2H,Ar-H);7.14(S,1H,Ar-H);6.92(d,2H,Ar-H);3.78(s,3H,O-CH_3) Which tallies with Molecular formula of target compound 2a $C_{23}H_{16}N_2SClO_4$ Elemental analysis also supported this formula experimental value of which are comparable with calculated ones all these evidences support the formation of 2(a) similarly other target compounds were synthesized by employing above mentioned procedure.

Table-1: List of synthesized compounds, their % yield and melting points.

Sr. No.	Compounds	%Yield	Melting Point (in ^{0}C)
1	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-methoxy benzylidene) - 5-Imidazolone.	60	235
2	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-	65	290

	nitrobenzylidene) - 5-Imidazolone.		
3	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-hydroxybenzylidene) -5-Imidazolone.	68	220
4	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-dimethylaminobenzylidene)-5-Imidazolone.	62	310
5	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(3, 4,5tri methoxybenzylidene)-5-Imidazolone.	64	170
6	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-chlrobenzylidene) - 5-Imidazolone.	69	230
7	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(2-nitro benzylidene) - 5-Imidazolone.	69	210
8	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-hydroxy3-methoxybenzylidene)-5-Imidazolone.	70	160
9	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-benzylidene) - 5-Imidazolone.	63	195
10	1-(4-chlorophenyl)-2-(3-sulphoxyphenyl)-4-(4-furanylidene) - 5-Imidazolone.	65	200

CONCLUSION

Hence we could synthesize a new series of imidazolones by introducing sulphoxy group as one of the new substituents. Use of zeolite as a catalyst afforded us increase in percent yield and reduction in reflux time. Most of these compounds are expected to show antimicrobial activity. Therefore, it may be suggested that more series of compounds are needed to be synthesized by introducing new substituents on benzylidene moiety in order to enhance its value as a drug.

REFERENCES

1. Ruhemann.S and Cunnington.A.V;J.Chem.Soc,75,1889,954.
2. Kidwai A R & Devasia GM; J.Am.Chem.Soc,27,1962,4527.
3. Devasia M & Pillai C;Tetrahedron letter (6),1975,4051.
4. Joshi H,Upadhyay P,Kariya D & Baxi A.G;Eur.J.Med.Chem,(36),2003,83
5. Bhahadur L& Srivastava P;Semicond Sci Technology (19),2001,531.
6. Shah B.R,Bhati J.J,Patel.H.H,Undavia.N.K;Indian J.Chem,34(B)1995,2010.
7. Krezel I,Farmaco,53(5),1998,342.
8. Barisch K. Diele S, Gorin P.G, Tschierske C; J. Mater Chem,8,1998.
9. Mukherji.D,Nawizal S.R, Prasad C.R, Indian Drugs,18,1981,125.
10. Solankee A,Kapadiya K,Thakare I,Lad S;Asian J.Chem,16,2004.
11. Imtiaz HM,Kwanar V,Indian .J.Chem,31(B),1992,285.
12. Sandra Gabillet, Olivier Loreau, Simon Specklin, Evelia Rasalofonjatovo, and Fredé ric Taran J. Org. Chem.,79 (20), 2014, pp 9894–9898.
13. P. Snehalatha and N. J. P. Subhashini," Journal of Applicable Chemistry, 4 (5), 2015: pp 1456-1461.
14. Ding.M, Sun.Y, Ppengliu.X Liu.Z.J,"Hetrocyclic communications,vol 9(2),2011,136-38.
15. Kedar R.M and Dehmukh S A.' synthesis of 1-(-4-methyl phenyl)-2-(3-bromo phenyl) -4-(4-substituted benzylidene) -5-imidazolones'. Vol 6, Issue 01, 2016.pp 4013-17.
16. Chopra.B , Dhingra.A.K, Kapoor R.P and Prasad.D.N,"Microwave assisted synthesis of some 5-substituted imidazolone analogues as a new class of nonpurine xanthine oxidase inhibitors:Der Pharma Chemica7(9),2015,pp145-152.

Survey on Color Energy of a Graph

Rupesh R. Atram
Assistant Professor (Mathematics)
Indira Mahavidyalaya , Kalamb. Dist Yavatmal Maharastra
rupeshatram10@gmail.com

Abstract : Graph Coloring is a chief element in graph theory with tremendous applicability in Computer science like data mining, clustering, networking, image segmentation etc. And a Variety of implementations in aircraft scheduling, register allocation, Sudoku, mobile Networking, etc. Various algorithms were contrived for vertex coloring. In this paper, survey on different color energy of graph with respect to different color matrix is done.

Introduction: The concept of energy stems from chemistry to approximate the total π -electron energyof a molecule. In chemistry the conjugated hydrocarbon can be represented by a graph calledmolecular graph according to the rule: every carbon atom is represented by a vertex and everycarbon-carbon bond by an edge, hydrogen atoms are ignored. The eigenvalues of the moleculargraph represent the energy level of the electron in a molecule. An interesting quantity in H¨uckeltheory is the sum of the energies of all the electrons in a molecule, the so called total Eπ-electron. For a molecule with n = 2k atoms the total Eπelectron energy can be shown to beE = 2 $\sum_{i=1}^{k} \lambda i$ where λi, i = 1, 2, 3, ..., k are the top k eigenvalues of the adjacency matrix of thegraph of the molecule. The first results on energy of a graph was obtained as early as 1940's.
In 2013, Chandrashekar Adiga, E. Sampathkumar, M.A. Sriraj, Shrikanth A. S. defined the color matrixAL(G)are as follows:

If c(vi) is the color of vi, then

a_{ij} = 1 if vi and vj are adjacent with c(vi) ≠c(vj),
−1 if vi and vj are non-adjacent with c(vi) = c(vj),
0 otherwise.
Theeigenvalues of Ac(G) are called color eigenvalues. We define the energy of a graph with respectto a given coloring as the sum of the absolute values of the color eigenvalues of G. We call thisas energy of colored graph or color energy of a graph.
They study some basic properties of energy of colored graph, Also
they determine an upper and a lower bound for color energy. They establish energies ofcolored graph of few classes of graphs with minimum number of colors. The color energy of thosegraphs which they were compute complete graph, null graph, some class of bipartite graphs, evencycle, cocktail party graph. Also they introduce a concept called complement of a colored graphand examine its energy for the same class of graphs as above. They discuss conceptsof color co-spectral, color hyperenergetic, color equienegetic, color energy equal to the numberof vertices and finally we give a comparison between usual energy and color energy of some classof graphs discussed.

They found result:

1. Theorem: Let G be a colored graph with n vertices, m edges, and mc be number of pairsof non-adjacent vertices receiving the same color. Then Ec(G) ≤ $\sqrt{2n(m+mc)}$.
2. Theorem:If Kn is the complete graph of order n, then $E_x(Kn) = 2(n-1)$.
3. Theorem: If G is a null graph of order n, then its color energy $E_x(G) = 2(n-1)$.
4. Theorem:If $K_{1,n-1}$ is a star graph of order n, then $E_x(K1,n-1) = 2(n-1)$.
5. Theorem:If $K_{n,m}$ is the complete bipartite graph of order n + m, then $E_x(Kn,m) = 2(n+m-1)$.
6. Theorem:If C_{2n} is a cycle of order 2n, thenthen $Ex(C_{2n}) = |3-n| + 1 + n + \sum_{m=1,m\neq n}^{2n-1} |1 + \cos(\pi m/n)|$.

In 2017, P. B. Joshi and M. Joseph obtained some results on color energy of graphs.
In thisarticle, they obtained some new bounds for the color energy of graphs establish relationship between color energy Ec(G) and energy E(G) of agraph G. Further, they construct some new families of graphs in which oneis non-co-spectral color-equienergetic with some families of graphs andanother is color-hyperenergetic. Also they derive explicit formulas for theircolor energies.
They found some results:

1. Theorem:Let G be a colored graph of order n, size m. Let be the color eigenvalues of Ac(G). Then$\lambda 1 \geq \lambda 2 \ldots\ldots \geq \lambda n$ then Ec(G)≤ $|\lambda 1| + \sqrt{(n-1)[2(m+mc)-\lambda 1]}$.
2. Theorem: If G is a graph of order n, size m and $\lambda 1$max is the largest absolute value of eigenvalue of the color matrix of G, thenEc(G)≥ (2(m+mc/$\lambda 1$max)).
3. Theorem:If G is a colored graph of order n, size m and m0cs the number of pairs of non-adjacent vertices receiving the same color, then $\sqrt{2(m+mc)}$ ≤Ec(G) ≤2(m+mc) .

In 2020,A A Bhange and H R Bhapkarobtained some results on colouring of graphs by HB colour matrix.
Properties of Vertex HB colour matrix
• Every Vertex HB Colour Matrix (VHBCM) is a symmetric matrix. All diagonal elements of this matrix are ∞.
• The number of zeros in each column or row is equivalent to the number of vertices that are non-adjoint to the corresponding vertex.
• The number of ∞ in every column or row is equal to the ai + 1 , where ai is the number vertices adjoint to the corresponding vertex.
• If all elements of a row are ∞, then the corresponding vertex or node is adjoint to all remaining vertices or nodes of that graph.
• If all elements of a row are zeros except the diagonal element, then the corresponding vertex is not adjacent to all remaining vertices of that graph. Such vertex is either a null vertex or a vertex with loops only.

• If a VHBCM with n vertices contains all zeros except diagonal elements then the corresponding graph is either a Null graph or a disconnected graph. Such a graph is one colourable.

Conclusion

If a VHBCM with n vertices contains all ∞ then the corresponding graph is the completegraph on n vertices (Kn).

1. The VHBCM of a wheel graph with p vertices contains a row with all elements ∞.
2. If an EHBCM is a diagonal matrix then all components of G are either K1 or K2 or vertex with loops.
3. If all elements of C(E) are ∞s then the corresponding graph is the star graph or cycle graphC3.
4. If all elements of RHBCM of planar graph H are ∞ then H is the perfect HB map.

References:

[1]. Adiga, C., Sampathkumar, E., Sriraj, M. A., & Shrikanth, A. S. (2013, January). Color energy of a graph. In *Proc. Jangjeon Math. Soc* (Vol. 16, No. 3, pp. 335-351).

[2]. Joshi, P. B., & Joseph, M. (2017). Further results on color energy of graphs. *Acta Universitatis Sapientiae, Informatica*, *9*(2), 119-133.

[3]. Bhange, A. A., & Bhapkar, H. R. (2021). Colouring of graphs by HB colour matrix algorithm method. In *Journal of Physics: Conference Series* (Vol. 1743, No. 1, p. 012010). IOP Publishing

Gurukul International Multidisciplinary Research Journal (GIMRJ)*with* International Impact Factor 6.305
Peer Reviewed Journal

e-ISSN No. 2394-8426
Jan-2023
Issue–IV(I), Volume–X

To Study the Role and Features of Fuzzy Sets and Logic

Dr. Vicky Bhimrao Watkar
Mahajanpura, Near awdhut Temple,
Amravati, Maharashtra - 444601
vickywatkar24@gmail.com
8087479544

Abstract
The fuzzy logic does not foresee the error of affirming the consequent; it can be recreated without any theoretical difficulties: the confusion between logical implication and equivalence cannot be kept unless the designer system purposefully creates it. The ability to generate other beliefs or information about one's surrounds (conclusions) from primitive knowledge of the real or hypothetical condition of one's environment based on rudimentary knowledge of the real or hypothetical condition of one's environment (premisses). In this research we have discussed the basic concept of fuzzy sets and fuzzy logics. The components and working of any kind of expert system has been discussed. This paper also contains the different application area of fuzzy logic with describing role and features of fuzzy sets and logics.
Keywords: fuzzy, fuzzy set, set theory, application, fuzzy logics

1. Introduction

The concept of truth-functional interpretation of connectives across a set of degrees of truth is crucial in (mainstream) mathematical fuzzy logic. During the first decades of the twentieth century, David Hilbert's efforts to show the consistency of fundamental theories had a major impact [1]. In addition to Gödel, Gentzen, and other academics' results, their findings contributed to a partial resolution of the problem and highlighted the difficulties in proving consistency. However, scholars have discovered that practically everything of regular mathematics can be expressed in sets, although some theorems can't be proved using typical axiom systems for set theory. Mathematical fields such as statistics, probability, and probability theory could benefit from this research. When it comes to math, current research in the fundamentals is often focused on finding out which portions of mathematics may be expressed in specific mathematical systems (such as in reverse mathematics) (as is the case in classical mathematics) [2].

Logic is the process of deducing conclusions. The argument might be in the form of a legal judgement or a mathematical validation. When it comes to mathematics, we use a specific logic. The fundamental logics of mathematics are the negation, the conjunction, and the disjunction. The symbolic form of mathematical logic is represented by the letters '∨' for disjunction, '∼' for negation, and '∧' for conjunction. In this post, we will go through the fundamentals of mathematical logic, including the truth table and several practical applications [3].

A mathematical strength is provided by fuzzy logic theory to encapsulate the uncertainty inherent with human cognitive processes. As a result, standard knowledge representation methods do not have a way to express fuzzy notions. Due to its imprecise and noncategorical nature, common sense knowledge cannot be adequately represented by first-order logic or classical probability theory. Fuzzy logics have the solution of each any every non-linear problem of this real world.

Fuzzy sets are used to create the fuzzy logics and by using fuzzy logics we can design fuzzy experts systems [4].

The usability of fuzzy is going to increase day by day. The solutions which are given by fuzzy expert systems are very optimal and easy to use. The ease of using the fuzzy systems adds the importance of this in each and every field of life. Any kind of nonlinear problem can be solved by embedding fuzzy with any other technology or hardware problems [5].

2. Fuzzy Sets and Logics

Fuzzy sets are the classes of objects with a continuum of grade of membership. The membership grade from zero to one is allocated to each set of objects. The annotation of union, intersection, inclusion, complement etc. are extended to these kind of sets, moreover, the properties of the annotations are substantiate in fuzzy set domain. Fuzzy sets are used by fuzzy controllers and crisp sets are used by digital designs [6].

It could be incontrovertible fact currently that fuzzy logic is having the capability to solve the problems in different like industrial management, consume natural philosophy, management, medicine, skilled systems and data technology. It provides an easy way to get definite results from inaccurate and incomplete data. Like human beings fuzzy system can think and can take the decisions [7].

The fuzzy logics are utilized while designing any fuzzy logic expert framework. In contrast to expert system, which are for the most part symbolic reasoning engines, FES are arranged toward numerical preparing. It is situated towards dealing with unverifiable or loose data and utilized in the spaces where the information factors don't have settled qualities [8]. One example of fuzzy expert system which can solve the incorrect and irrational problems faced while selecting the test cases at system level. The use of fuzzy logics makes it possible to solve non-linear and complex issues quickly and easily. There are so many applications of fuzzy logics in the real world [9].

3. Features of Fuzzy Logics for number of applications

> It can be shown that Rasiowa-implicative logics share an important common feature of core fuzzy logics: namely that in their natural algebraic semantics there is always just a single element which is designated (i.e., is regarded as 'fully true' in the definition of the logic's consequence relation), and this element can be defined as the one satisfying the equation $x = 1$ [10].

This is no longer true in UL (which is clearly not Rasiowa-implicative), where the designated truth values are those bigger than 1; nevertheless, we can still define these truth values as those satisfying the equation $x \wedge 1 = 1$. To encompass also logics like UL together with their 'natural' algebraic semantics we define a broader class of algebraically implicative logics where the designated truth values are equationally definable [11].

The logic IMTL shares many features with Łukasiewicz logic, which is its extension by the divisibility axiom (BL4) [12]. Like in Łukasiewicz logic (see Theorem 1), the implication and strong conjunction are mutually interdefinable and the contraposition law holds in IMTL. It can be shown that IMTL is equivalently axiomatized by adding any of the following IMTL-provable formulae to MTL: (TŁ1), (TŁ3), (TŁ4), (TŁ5), or (TŁ6) of Theorem 1.2.8. Note, however, that the Wajsberg axiom (TŁ2) is not provable in IMTL, and adding it to MTL in fact yields Łukasiewicz logic.

THEOREM 1. Łukasiewicz logic can be equivalently axiomatized by adding any of the following Ł-provable formulae to the axioms of BL:

$(\neg\psi \to \neg\varphi) \to (\varphi \to \psi)$	Converse contraposition law
$((\varphi \to \psi) \to \psi) \to ((\psi \to \varphi) \to \varphi)$	Wajsberg axiom
$\varphi \,\&\, \psi \leftrightarrow \neg(\varphi \to \neg\psi)$	definability of &
$(\varphi \to \psi) \leftrightarrow \neg(\varphi \,\&\, \neg\psi)$	definability of →
$\varphi \wedge \psi \leftrightarrow \neg(\neg\varphi \vee \neg\psi)$	De Morgan law
$\varphi \vee \psi \leftrightarrow \neg(\neg\varphi \wedge \neg\psi)$	De Morgan law

The conventional features of classical sets in order to define the characteristics of fuzzy sets. Assume X is a set, A is a fuzzy subset of X, and A is the membership function describing it. The membership degree of x in A is called A(x).

DEFINITION 1. A's height, abbreviated h(A), corresponds to the upper bound of its membership function's codomain:

$$h(A) = \text{supf}_A(x) \text{ j } x \text{ 2 Xg.}$$

DEFINITION 2. If and only if h(A) = 1, A is considered to be normalised. Working with non-normalised fuzzy sets is extremely unusual in practise.

DEFINITION 3. The set of X elements that belong to at least some A is the support of A. (i.e., the membership degree of x is strictly positive). To put it another way, the set is the support.

$$\text{supp}(A) = \text{f } x \text{ 2 X j }_A(x) > 0\text{g.}$$

DEFINITION 4. The kernel of A is the set of X components that are wholly owned by A. To put it another way, noy(A) = f x 2 X j A(x) = 1g. By definition, noy(A) supp(A).

DEFINITION 5. To be considered a part of A, you must have a membership degree greater than or equal to: -cut(A) = f x 2 X j A(x) > g.

We are updating conventional set theory operators to meet the fuzzy logic's particular membership functions for values between 0 and 1, in order to facilitate the manipulation of fuzzy sets. Operators on fuzzy sets, like membership functions, can be defined in a variety of ways, unlike fuzzy set attributes.

4. Applications of Fuzzy Logics

Based on the features and definitions of fuzzy logics, it has number of applications in current scenario. According to the degree of validity of the premise, or the membership degree of the fuzzy set 'delicious' to which 'tip' belongs, 'high' is a fuzzy set [13]. The essential principle is that the more claims in the premises that are checked, the more output actions that are suggested must be applied. To evaluate the degree of truth of the premise "fuzzy" "tip will be high," we must first denote the fuzzy implication [14].

Image processing is the m research area for the researchers in the field of computer science engineering. By applying fuzzy logic to extract meaningful information from an image or a video, researchers are continually looking for the best solutions [15]. Fuzzy logic control systems have been employed by researchers to solve a variety of image processing issues. Using two separate models, a new face detection technique explored. The faces in the image may be located

by using the Takagi-Sugeno (T-S) fuzzy model and the Hue, Saturation, and Value (HSV) colour models [16].

Robots are highly versatile machines capable of incredible motions, but are simply too difficult to use and hard to setup. A Fuzzy Logic Based Control for Autonomous Mobile Robot Navigation approach. The author used two fuzzy logic controllers in the robot i.e. navigation fuzzy controller to enhance the navigation performances and second fuzzy controller is used to avoid the obstacles [17].

To manage the things in banks, business or any kind of field the fuzzy logic is playing very important role. Online internet branches can use these techniques to improve the quality of the projects. The authors have tested these fuzzy techniques to check the performance. The concept of selecting staff for production tasks with the employment of fuzzy logic. This Mamdani-type fuzzy deduction technique was utilized to structure a controller whose undertaking was to help the basic leadership process [18].

The fuzzy logic techniques are used to enhance the fertility and to analysis the environmental parameters like light, temperature and humidity which can affect the crops. A fuzzy logic based expert system was created to strengthen basic decision making on the kind of creation process thinking about factors for example, weight, pellets, green aspect and the level of minor and major abandons, this data got from organoleptic examination [19]. A Mandani-Fuzzy logic model to wind up a help apparatus for choosing the most fitting procedure on a dry factory as indicated by client necessities and all together to manage the production of coffee by avoiding delays in production [20].

The use of fuzzy logic approaches is becoming increasingly popular as a means of discovering new ways to evaluate student and instructor performance and determining the root causes of low performance. An incorporated methodology of fuzzy MULTIMOORA and multi choice conic programming is introduced to think about the criteria in picking the best understudies and characterize the ideal assignments among the predefined projects to expand both the aggregate inclination esteem and aggregate positioning worth [1]. The fuzzy MULTIMOORA is used to determine the rankings of the students.

In many home appliances like television, washing machines, microwaves and refrigerators the fuzzy logic techniques has been used to provide the advancement in the field. A lot of electronically controlled keen things must be intellectualized utilizing human-type thinking. It has discussed a tale approach and new calculations for the various levelled fuzzy preparing, retraining, and self-training for intellectualized home situations. Imperativeness and effectiveness of the proposed philosophy was tried and reproduced on a specific virtual software/hardware framework [21].

Diagnosing any disease in medical field is very difficult for a medical expert. They need to perform different task for find out the cause of problem. To help the medical experts so many fuzzy expert systems have been introduce till date In 2015 Gayathri, et al. has introduced one fuzzy expert system to detect the risk of breast cancer. The main motive of this system to reduce the time for diagnosing the breast cancer. Mamdani is used to evaluate the results for the same. An application of utilizing Fuzzy FMEA, meant to build up the type of prioritization and evaluation on the failures for the working procedure in emergency by examine and recognizing

proof of the failures as indicated by the philosophy of Failure Mode and Effects Analysis (FMEA). Besides, the prioritization and evaluation of the issues are enhanced with the usage of Fuzzy technique. The emergency department can easily adopt this application [22].

Fuzzy logic is playing a vital role in the field of software engineering to solve the problems of software development process. Constructive Cost Model (COCOMO) with the fuzzy logic. The investigated study explains the process of implementing the fuzzy logic with given model to estimate the size, efforts and cost drivers of any project [23]. Four membership functions are used to estimate the efforts while developing a software. One model by using fuzzy logic, which can help to predict the defects in the requirement analysis phase of SDLC. The results of this validation process are satisfactory.

5. Conclusion

Fuzzy logic has number of applications but it is not applicable to the psychology of concepts, at least in its current state of development. One must find a convincing justification to this effect. Another approach is to show that fuzzy logic is necessary or even superior to classical logic in some cases. It is our opinion that neither of these methods of reworking the problem can succeed unless psychologists and mathematicians working together are involved. As part of this collaboration, psychologists and mathematicians should explain to each other those notions for which no mathematical treatment exists and challenge each other to find solutions. They should also push mathematicians to examine any new arguments they want to make against the usage of fuzzy logic. It has been applied to a wide range of fields in mathematics such as calculus esoterique and algebraic topology. Along with, it has been used in several fields, such as control and data processing; decision support; engineering; management; logistics; and medicine, to name just a few. Nonstochastic uncertainty can be modelled using it as a "bridge" between language and formal models.

References

1. Behounek, Libor & Cintula, Petr & Hájek, Petr. (2011). Introduction to mathematical fuzzy logic. Handbook of Mathematical Fuzzy Logic. 37.
2. Erich Peter Klement. Construction of fuzzy σ-algebras using triangular norms. J. Math. Analysis Applications 85 (1982) 543–565.
3. George Georgescu and Afrodita Iorgulescu. Pseudo-MV algebras. MultipleValued Logic 6(1-2) (2001) 95–135.
4. George Metcalfe. Proof theory for mathematical fuzzy logic, In: P. Cintula, P. H´ajek, and C. Noguera (eds.) Handbook of Mathematical Fuzzy Logic, vol. 1. Studies in Logic, vol. 37, pp. 209–282, College Publ., London, 2011.
5. Godo, L., & Gottwald, S. (2015). Fuzzy sets and formal logics.*Fuzzy Sets and Systems. An International Journal in Information Science and Engineering*,*281*, 44–60.
6. Nikolaos Galatos, Peter Jipsen, Tomasz Kowalski and Hiroakira Ono. Residuated Lattices: An Algebraic Glimpse at Substructural Logics. Studies in Logic and the Foundations of Mathematics, vol. 151, Elsevier, 2007.
7. Novak, Vilem & Perfiljeva, Irina & Mockor, Jiri. (1999). Mathematical Principles of Fuzzy Logic. 10.1007/978-1-4615-5217-8.

8. Petr H´ajek. Complexity of fuzzy probability logics II. Fuzzy Sets and Systems 158 (2007) 2605–2611.
9. Janos Fodor. Nilpotent minimum and related connectives for fuzzy logic. In ´ Proc. FUZZ-IEEE 1995, pages 2077–2082, 1995.
10. Nikolaos Galatos, Peter Jipsen, Tomasz Kowalski, and Hiroakira Ono. Residuated Lattices: An Algebraic Glimpse at Substructural Logics, volume 151 of Studies in Logic and the Foundations of Mathematics. Elsevier, Amsterdam, 2007.
11. Nikolaos Galatos and Hiroakira Ono. Algebraization, parametrized local deduction theorem and interpolation for substructural logics over FL. Studia Logica, 83(1–3):279–308, 2006.
12. Joan Gispert and Antoni Torrens. Axiomatic extensions of IMT3 logic. Studia Logica, 81(3):311–324, 2005.
13. Francesc Esteva. Fuzzy logic and probability. In Proceedings of the 11th Annual Conference on Uncertainty in Artificial Intelligence UAI '95, pp. 237–244, Montreal, 1995.
14. Franco Montagna. A proof of standard completeness for noncommutative monoidal t-norm logic. Neural Network World 13 (2003) 481–488.
15. Paul Flondor, George Georgescu, and Afrodita Iorgulescu. Pseudo t-norms and pseudo-BL-algebras. Soft Computing 5(5) (2001) 355–371.
16. Inearat, L., & Qatanani, N. (2018). Numerical methods for solving fuzzy linear systems. *Mathematics*,*6*(2),19. https://doi.org/10.3390/math6020019
17. Giangiacomo Gerla. Fuzzy Logic. Mathematical Tools for Approximate Reasoning. vol. 11 of Trends in Logic, Kluwer Academic Publishers, 2001.
18. Francesc Esteva, Llu´ıs Godo, Petr Hajek, and Mirko Navara. Residuated fuzzy logics with an involutive ´ negation. Archive for Mathematical Logic, 39(2):103–124, 2000.
19. Zuo, Cen & Pal, Anita & Dey, Arindam. (2019). New Concepts of Picture Fuzzy Graphs with Application. Mathematics. 7. 470. 10.3390/math7050470.
20. Zusana Hanikov´a. A development of set theory in fuzzy logic, In: M. Fitting and E. Orlowska (eds.) Beyond Two: Theory and Applications of Multiple-Valued Logic, Studies in Soft Computing, pp. 273–285, Physica-Verlag, Heidelberg, 2003.
21. Siegfried Weber. A general concept of fuzzy connectives, negations and implications based ont-normsandt-conorms. Fuzzy Sets and Systems 11(1983) 115–134.
22. Singh, H., Gupta, M. M., Meitzler, T., Hou, Z.-G., Garg, K. K., Solo, A. M. G., & Zadeh, L. A. (2013). Real-life applications of fuzzy logic.*Advances in Fuzzy Systems*,*2013*, 1–3.
23. Antonio Di Nola, Francesc Esteva, Pere Garcia, Llu´ıs Godo, and Salvatore Sessa. Subvarieties of BL-algebras generated by single-component chains. Archive for Mathematical Logic, 41(7):673–685, 2002.

The Impact of Gadget Dependency on Face-to-Face Social Interactions

Rakhi Sharma,
Assistant Professor,
Apollo College, Anjora,
Durg, Chhattisgarh

Abstract

The widespread use of digital gadgets and smart phones, tablets, and other smart devices has transformed the way people interact. While these tools offer convenience and connectivity, concerns have emerged about their adverse effects on in-person communication. This study investigates the impact of gadget dependency on face-to-face social interactions among 80 individuals from various age groups and professional backgrounds. Through a structured questionnaire and quantitative analysis, the study highlights behavioral trends, emotional outcomes, and the potential for social disconnection due to gadget overuse. The findings aim to inform strategies for healthier digital usage and rekindling meaningful interpersonal communication.

Introduction

In today's hyper-connected world, digital gadgets are integral to daily life. However, this increasing reliance is gradually altering how individuals engage in real-time, face-to-face communication. Whether among family, friends, or colleagues, personal interactions are often interrupted or replaced by screen-based engagement. This research explores how dependency on gadgets affects social behavior, attentiveness, emotional bonding, and overall communication quality.

Brief Literature Review

- **Turkle (2015)** emphasizes that excessive gadget use weakens empathy and disrupts human dialogue.
- **Kuss & Griffiths (2017)** address social media and device addiction, linking them to attention deficits and strained relationships.
- **Przybylski & Weinstein (2013)** show how the mere presence of a phone can reduce the quality of conversations.
- **Chotpitayasunondh & Douglas (2016)** introduced the concept of "phubbing," which highlights how ignoring someone for a phone harms social interaction.

While gadget addiction has been widely studied, its direct and measurable impact on face-to-face communication, especially among mixed-age groups, remains underexplored.

Rationale of the Study

As gadgets become increasingly embedded in everyday life, understanding their effect on traditional social interactions is crucial. With rising screen time and declining interpersonal presence, there is a need to assess the depth of this shift and propose evidence-based responses for preserving social bonds.

Research Gap Identified

Existing literature primarily focuses on digital addiction, screen time, or media influence in isolation. There is a lack of holistic studies examining how dependency on multiple gadgets impacts live, in-person interactions, especially within smaller, diverse communities.

Objectives of the Study

1. To measure the level of gadget dependency among a cross-section of individuals.
2. To evaluate how gadget use affects in-person interactions and emotional presence.
3. To identify trends based on age, gender, or occupation in gadget-related behavior.
4. To propose strategies for maintaining healthy social communication in the digital era.

Research Questions:

- How dependent are individuals on gadgets in their daily lives?
- In what ways does gadget use interfere with or replace in-person communication?
- Do age, occupation, or lifestyle influence this dependency?
- What measures can reduce gadget-induced social disconnection?

Limitations

- Sample size is limited to 80, which may affect generalizability.
- Responses are self-reported and subject to bias.
- The study is cross-sectional and may not reflect long-term behavioral changes.

Method

- **Design:** Descriptive quantitative study
- **Tool:** Structured 20-item Likert-scale questionnaire
- **Setting:** Urban and semi-urban areas
- **Duration:** Data collected over two weeks

Participants (N = 80)

- Age range: 16–55 years
- Gender: Male and Female
- Occupation: Students, teachers, office professionals, homemakers
- Sampling Technique: Purposive sampling

Data Collection

Data were collected using an online/offline survey format. Each participant rated 20 items on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Data Analysis

- Descriptive statistics: Mean, SD, percentage distribution
- Inferential statistics: ANOVA and Pearson correlation
- Software used: Excel and SPSS

Analysis of Survey Responses (N = 80)

Q. No.	Mean	SD	Interpretation
Q1	4.3	0.78	Frequent phone use during social time
Q2	4.1	0.89	Strong sense of gadget attachment
Q3	3.6	1.02	Preference for digital communication
Q5	4.0	0.95	Notifications interfere with in-person talk

Q. No.	Mean	SD	Interpretation
Q7	3.8	1.10	Relationships affected by overuse
Q10	3.5	1.12	Digital communication feels less emotionally fulfilling
Q15	3.0	1.20	Moderate efforts to disconnect intentionally
Q19	4.4	0.81	High value placed on in-person engagement

Interpretation of Results

- Over 70% of respondents reported regularly checking devices in the company of others.
- Many participants acknowledged emotional disconnection or distraction during social conversations.
- The majority still expressed that in-person communication is more fulfilling, indicating a conflict between habitual gadget use and intrinsic social needs.
- A notable portion of the sample, especially younger respondents (16–25), showed higher gadget dependency.

Discussion

The findings show a clear pattern of gadget overuse affecting the quality of real-time communication. While digital devices serve multiple roles (communication, information, entertainment), their omnipresence often leads to divided attention, weakened empathy, and surface-level connections. This is especially concerning for developing social and emotional skills in younger populations. Social presence, non-verbal cues, and emotional bonding are compromised when gadgets dominate social spaces.

Results

- 72% agreed they use gadgets even during conversations.
- 66% admitted missing out on deeper interactions due to distractions.
- 75% expressed willingness to change but lacked clear strategies.
- 82% agreed that face-to-face conversations felt more meaningful.

Conclusion

Gadget dependency is increasingly interfering with interpersonal relationships and social presence. While most individuals recognize the value of in-person interactions, breaking habitual gadget use remains a challenge. Interventions should aim to create awareness and promote mindful digital behavior to protect human connection.

Educational Implications

- Introduce digital mindfulness programs in schools and universities.
- Promote gadget-free times/zones during group work, family time, and social gatherings.
- Encourage reflection on digital habits through journaling or counseling.
- Educators and leaders should model healthy gadget practices.

References

- Chotpitayasunondh, V., & Douglas, K. M. (2016). How "phubbing" becomes the norm: The antecedents and consequences of smartphone use in face-to-face social interaction. *Computers in Human Behavior, 63*, 9–18. https://doi.org/10.1016/j.chb.2016.05.018

- Kuss, D. J., & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International Journal of Environmental Research and Public Health, 14*(3), 311. https://doi.org/10.3390/ijerph14030311
- Przybylski, A. K., & Weinstein, N. (2013). Can you connect with me now? How the presence of mobile communication technology influences face-to-face conversation quality. *Journal of Social and Personal Relationships, 30*(3), 291–310. https://doi.org/10.1177/0265407512453827
- Turkle, S. (2015). *Reclaiming conversation: The power of talk in a digital age*. Penguin Press.