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(An International Biannual Journal for Multidisciplinary fully referred Journal)

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# BHARAT JOURNAL OF SCIENCE TECHNOLOGY AND HUMANITIES

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# शिवानी की कहानियों में निहित– नारी चरित्र चित्रण

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## शोध – सारांश

**शिवानी जी के कहानियॉ साहित्य में स्वाभाविक वातावरण चरित्र चित्रण तथा सहज अभिव्यक्ति कहानियों की विशेषतायें है,शिवानी नारी मन की बसुर बिसेरी है,इसलिए उनकी अधिकतर रचनाये नारी को आधार मान कर बनाई गई है। नारी के सामाजिक बन्धनों ,पारिवारिक जीवन की विलष्टताओं और परंपरागत रूढ़िवो के कारण उस पर आरोपित यातनाओ का निरूपण शिवानी के कहानियो में देखने को मिलता है। नारी के अलग अलग रूपों को शिवानी ने कहानियों के माध्यम से बहुत ही सहज रूप में प्रेषित किया है। नारी से सम्बंधित कई समस्याओं सामाजिक धरातल पर शिवानी की कहानियों में दृष्टिगत होती है जैसे नारी जाग्रति समस्या,तलाक की समस्या उच्च एवं निम्न वर्ग की नारी की समस्या, विधवा नारी जीवन, इत्यादि ऐसी समस्या है जो नारी जीवन का चरित्र चित्रण करती है। शिवानी जी की कहानियों में नारी पात्र अनेक समस्याओं से संघर्ष करती है, जो समाज में आमतौर पर प्रत्येक नारी को संघर्ष करना पढता है, इनकी कहानी साहित्य में कुमांऊ आंचलिक समाज से लेकर छोटे–बड़े नगर और महानगरों तक नारी चरित्र चित्रण का विस्तार है।**

**शब्द संकेत– "श्राप", विधवा, आंचलिक, एकांकी, आत्महत्या, शोकाकुल।**

## I. समस्या पर चर्चा और सैद्धांतिक पृष्ठभूमि

### ● शिवानी जी का जीवन परिचय

शिवानी जी हिंदी की एक सुप्रसिद्ध कहानीकार एवं उपन्यासकार थी। शिवानी का वास्तविक नाम गौर पन्त पाण्डेय था, किन्तु ये शिवानी नाम से लेखन करती थी। हिंदी साहित्य जगत में शिवानी एक ऐसी शख्शियत रही है, जिनकी कहानिओं में किरदारों का बेमिसाल चरित्र चित्रण देखने को मिलता है, ये महज १२ वर्ष की उम्र से लेखन का कार्य करने लगी है, १२ वर्ष की उम्र में पहली कहानी प्रकाशित होने से लेकर २१ मार्च २००३ को उनके निधन तक उनका लेखन निरंतर चलता रहा [1]।

### ● सैद्धांतिक पृष्ठभूमि

शिवानी की कहानियों में एक विशेषता यह है कि उन्होंने अपनी कहानियों में आधुनिकता एवं परम्परा दोनों को समान्तर चित्रित किया है। इनकी प्रमुख कहानियों में, करिए छिमा,दो बहनें,अपराजिता,जिलाधीश,श्राप,मास्टरनी,रतिविलाप आदि रचनायें है। शिवानी की कहानियों में पर्याप्त विवधता है। साठ और सत्तर के दषक में इनकी लिखित कहानी और उपन्यास हिंदी पाठकों के बीच अत्यधिक लोकप्रिय हुए और आज भी लोग उनकी रचनाओं को बहुत चाव से पढ़ते है।

शिवानी ने तत्कालीन सामाजिक एवं पारिवारिक विषमताओं के साथ अपनी कथाओं के माध्यम से मुखरित किया है। शिवानी जी की कहानियों में यथार्थ व सरलता, सहजता, सादगी के साथ समाज की कुरीतियों एवं मान्यताओं को जैसी थी अर्थत् बाल–विवाह, दहेज प्रथा, तंत्र–मंत्र, जादू–टोना, अन्धविष्वास भय आदि को बहुत अच्छे से समझ जा सकता है। शिवानी जी की कहानियों में अधिकतर पर्वतीय क्षेत्र के समाज से सम्बन्धित समस्याओं, प्रथाओं और मनोभावों का चित्रण मिलता है। साथ ही आप पुरूष व नारी दोनों के ही जीवन्त शब्द चित्रण उभारने में अप्रियतम है। परन्तु देखा जाये तो षिवानी जी का अधिकतर कहानियॉ नारी चरित्र को चित्रित करती अधिक दिखायी देती हैं। इसका मुख्य कारण उनका स्वयं नारी होना [2]।

- **शोध प्रश्न**

शिवानी जी के साहित्य का अध्ययन करने के पष्चात् षोध छात्रा के मन में यह प्रश्न उभरा कि–

- शिवानी जी ने अपनी कहानियों के माध्यम से नारी की किन–किन समस्याओं का वर्णन किया है?
- शिवानी जी ने अपनी कहानियों के माध्यम से नारी के प्रति समाज के दृष्टिकोण को किस प्रकार वर्णित किया है?

## II. शोध पत्र का उद्देश्य

- साहित्यकार शिवानी द्वारा रचित विभिन्न कहानियों में नारी पात्र के चरित्र का अध्ययन करना।

## III. डेटा संग्रह में प्रयुक्त उपकरण

- **शोध** छात्रा द्वारा साहित्यकार शिवानी के द्वारा स्वरचित कहानी संग्रह को लिया जायेगा।

## IV. समस्या वर्णन

साहित्यकार शिवानी जी की कहानियों में नारी जीवन में होने वाली समस्याओं, पारिवारिक विघटन व विघटन के कारण, बिखरे हुये परिवार, सम्बन्धों की हकीकत, नारी व पुरूष दोनों के ही जीवन में आने वाली समस्याएं इत्यादि का वर्णन अपने साहित्य में किया है। उनमें से कुछ कहानियों को आधार लेते हुए षोध छात्रा द्वारा प्रस्तुत षोध पत्र का निर्माण किया गया है। जो निम्नवत् है–

- **शिवानी रचित कहानी "दो बहने" में नारी पात्र जया का चरित्र चित्रण**

हिंदी कहानी साहित्य में शिवानी का नाम बहुत ही आदर के साथ लिया जाता है। उनकी कहानियों में नारी सवेदना को अत्यंत आत्मीयता एवं कलात्मक दृष्टी से चित्रित किया गया है। शिवानी की कहानियों में कई नारियां भारतीय धर्म को निभाने वाली होने के कारण से उन पर परम्परागत आदर्श नारी के रूप में हम रख सकते है। शिवानी की कहानी दो बहनें में आदर्श नारी के रूप में "जया" का चरित्र भी उलेखनीय है। वह एक कामकाजी महिला है,यूनिवर्सिटी में पढ़ाती है,पिता जी के देहांत के बाद उसने अपना पूरा जीवन अपनी छोटी बहन विजया के लिए समर्पित कर,एकांकी रहने का अटल निर्णय लेती है। जया की छोटी बहन विजया ने भी हर प्रकार से प्रयास करके देख लिया था।

"कौन सी ऐसी बूढी हो गई है? छब्बीसवा ही तो लगा है, इस दिसंबर में इस उम्र में तो आजकल लडकियों के दूध के दांत टूटते है" [3]।

जया के पिता की मृत्यु के पश्चात् दोनों बहने अकेले जीवन यापन करती है उनकी बुआ कभी–कभी उनसे मिलने आया करती थी, बुआ ने ही जया के लिए कई रिश्ते लाये जिसे जया टाल देती है,विजया के लिए ही रिश्ते देखने की बात करती,तब बुआ केशव को भेजती है,केशव आता है किन्तु वो "जया" को पसंद कर लेता है और जल्द आने का वादा कर वापस चला जाता है। जया सोचती रहती है जिस केशव के बारे में विजया सपने देख रही है वह उसने उसे पसंद कर लिया है,यह बात कैसे कहूँ यह सोच सोच कर तिलमिला जाती ही।

"विजी" तेरे मन के मीत ने मुझे चुन लिया है,कैसे कह पायेगी वह?"[4]।

कुछ समय पश्चात् बुआ से पता चलता है, केशव ने पेसे के लालच में कही और शादी कर ली और जया को धोखा देदिया।संसार की कोई भी नारी कितनी ही उदार क्यों न हो,किसी पुरुष के उसे धोखा देने के अक्षम्य अपराध के लिए क्षमा नहीं कर सकती है। यहॉ पर नारी की मानसिकता और धोखा खाने के बाद होने वाली मन की उदासीनता को व्यक्त किया गया है [5]।

- **शिवानी रचित कहानी "श्राप" में नारी पात्र दिव्या का चरित्र चित्रण**

शिवानी द्वारा रचित "श्राप" कहानी में दिव्या और उसके माता पिता को बहुत आर्थिक कठिनाइयों का सामना करना पढता है, जिसके चलते उनके माँ–बाप को दिव्या का विवाह एक बदसूरत,गुणहीन एवं प्रौढ़ पुरुष से करना पढता है,सर्वगुण संपन्न होने के बावजूद दहेज के लिए पैसा न होने के कारण समाज में दिव्या को योग्य वर नही मिलता है,अपने माँ–बाप का मान समाज के सामने बनाये रखने

के लिए दिव्या एक अयोग्य वर से विवाह कर लेती है,किन्तु दहेज के लोभियों को सर्वगुण सम्पन्न कन्या दिव्या नही भाती है और कुछ समय पश्यात् दिव्या दहेज के खातिर आत्महत्या कर लेती है।

आज भी हमारे भारतीय समाज में कई ऐसे परिवार बहुत ही आसानी से दिखने को मिलेंगे जिनकी दिव्या जैसी कन्याए प्रतिवर्ष बहुत बड़ी संख्या में दहेज की बलि चढ़ती है [6]।

- **शिवानी रचित कहानी "पिटी हुई गोट" में नारी पात्र चन्दो का चरित्र चित्रण**

"पिटी हुई गोट" की नारी चन्दो के पति को जुए की लत है। वह आत्महत्या कर लेता है।चन्दो पर कैसे विपत्ति का पहाढ़ टूट पढता है। उसका भांजा अपनी मामी (चन्दो) से आकर कहता है। "मामी–मामाजी ताल में कूद गये। मंदिर के पुजारी ने देखा कांटा डाला है,पर लाश नहीं मिली। नाश हो इन जुआरियों का! बेचारे को लुट–पाट कर धर दिया।" स्तब्ध चन्दो द्वारा की चौखट पकड़े ही धम्म से बैठ गई। किसने उसका सिन्दूर पोछा ,किसने चूडियॉ तोड़ी और कौन नोच कर मंगल–सूत्र तोड़ गई, वह कुछ भी नहीं जान पाई। वह पागलो सी बैठी थी"। कहानी में बताया गया हैकि जुआ ने न जाने कितनो घर बर्बाद किये है। पुरुष की विलासिता की बलि हमेशा नारी चढ़ती है [7]।

- **शिवानी रचित कहानी "तीन कन्या" में नारी की व्यथा**

शिवानी कृत "तीन कन्या" कहानी में बेनी की माँ को समाज क्या कहेगा की चिंता है। हिन्दू घर के यहाँ जो रीती चली आ रही है वही तो होगा,बेबी की माँ को समाज के रीती रिवाज की चिंता है। वो समाज के नियम को तोड़ कर कुछ नहीं करना चाहती। बेबी अपने परिवार की सबसे छोटी लड़की है। प्रफूल नाम के युवक से बेबी का प्रेम सम्बन्ध है। सगाई भी हो चुकी है, किन्तु इसके बावजूद भी वह विवाह नहीं कर सकती थी,क्योंकि बेबी की माँ चाहती थी की पहले दो बड़ी बहनों का विवाह हो जाये फिर बेबी का विवाह करेगी,"आहा मेरो आबार की बोले ! सबसे छोटी की कर दू तो दुनिया यही कहेगी की खरा माल तो बिक गया खोटा रह गया। हिन्दू गृहस्थ के यहाँ जो रीति चली आई है तो, होगा"0। कहानी में आज भी बनाये पुराने नियम में नारी को पिसते जूझते दिखाया गया है [8]।

- **शिवानी रचित कहानी "अपराजिता" में नारी पात्र आरती का चरित्र चित्रण**

शिवानी की कहानी अपराजिता में नायिका आरती सर्वगुण संपन्न एवं पुलिस विभाग में उच्च पद पर आसीन होने भी अपने परिवार की विषम परिस्थितियों से तनाव ग्रस्त चित्रित किया गया है। उसके अंतर्मन के तनाव एवं कुंठा को दिखाया गया है। इस बार शोकाकुल आरती की आँखों से अविरल अश्रुधार बहने लगी। पहली बार उसे लगा की उसके बाह्य आवरण के बिच उसकी ऊँची नौकरी उसकी प्रतिभा उसकी ख्याति के बिच केवल पत्नी भाव की ही धारा निरंतर बहती रही थी। वही आज उसके विवेक, सयम,लज्जा बाह्याडम्बर के रोड़े–पथरो को ठेलती फुटकर बहार निकल पड़ी थी "[9]।

कहानी में नायिका उच्च पद पर आसीन होने के बावजूद कैसे समाज द्वारा देने वाले दुःख को झेलती है ,एक नारी को समाज में परिवार में,रिष्ते–नाते,पडोसी, सबके दुःख व सुख का भागीदार बनाना कितना जरुरी है? चित्रित किया गया है।

- **शिवानी रचित कहानी "निर्वाण" में नायिका मनोरमा का चरित्र चित्रण**

शिवानी रचित कहानी निर्वाण में कथाकार शिवानी जी ने कहानी की नायिका मनोरमा की प्रदर्शन प्रियता को दर्शाया है। वो लिखती है, कि "विधाता प्रदत्त नैन नक्श को भी उसने जैसे बड़े दुर्साहस से किसी अद्रश्य स्पर्श से मिटा दिया था। पेंसिल से अंकित दो धनुष्कर भँवे,लिपस्टिक के कलात्मक कपोलो पर 'ब्लश–अनि' की लालिमा और निर्लज्ज धड़ल्लेपन से खुली सोफिया लैरिन की सी मकेलाइन" [10]। इस कहानी की रचयिता शिवानी ने नायिका के द्वारा समाज में उच्च वर्ग की प्रदर्शन प्रियता को व्यक्त किया।

इसी प्रकार से शिवानी की विभिन्न कहानियों में नारी के चरित्र चित्रण को उजागर किया गया हैजैसे उपहार कहानी की नलिनी,सौत कहानी की नीरा,इत्यादि कुछ नारी समाज के दबाव में अपना हित नहीं कर पाती। समाज के द्वारा शोषित होने पर अपना मानसिक संतुलन खो बैठती है और कुछ आत्महत्या कर लेती है। कुछ नारी पात्र रुदन करते चित्रित किये गये है।

## V. निष्कर्ष

शिवानी ने अपनी कहानी में सामाजिक जनजीवन का जीवन्त चित्रण किया है। इनकी रचनाओ में मुख्य पात्र नारी ही रही है,शिवानी जी हजारी प्रसाद और रविंद्रनाथ टैगोर से बहुत प्रभावित थी। शिवानी जी ने अपनी कहानियो के माध्यम से हर जाति की महिला का चरित्र चित्रण किया गया है। इनकी कहानियों में नारी शोषण व नारी अत्याचार को दिखाया गया है,एक तरफ इनकी कहानी में नारी पात्र अपनी मानसिक कुंठा विवशता का कारण लेकर व्यापक संवेदना से युक्त हैऔर एक तरफ नारी स्वाभिमानी पढ़ी लिखी आत्मविश्वास से परिपूर्ण है। नारी जीवन में घटित होने वाली सभी प्रकार की विधा को इनके कहानियों के माध्यम से समझा जा सकता है।

## संदर्भ


[1] सिंह राजेन्द्र, शिवानी (गौरा पंत) के कथा साहित्य में सामाजिक चेतना, शब्द–ब्रह्म (भारतीय भाषाओं की अंतर्राष्ट्रीय मासिक षोध पत्रिका), ISSN- 2320-0871, पृष्ठ संख्या–55, वर्ष–2017।

[2] उपरोक्त।

[3] पाण्डे मृणाल, ''दो बहनें'', शिवानी संपूर्ण कहनियां, राधाकृष्ण प्रकाशन, खण्ड–2, अंक–2, पृष्ठ संख्या–153, वर्ष–2015।

[4] सिंह राजेन्द्र, शिवानी ( गौरा पंत ) के कथा साहित्य में सामाजिक चेतना, शब्द–ब्रह्म (भारतीय भाषाओं की अंतर्राष्ट्रीय मासिक षोध पत्रिका), ISSN- 2320-0871, पृष्ठ संख्या–55, वर्ष–2017।

[5] पाण्डे मृणाल, ''दो बहनें'', षिवानी संपूर्ण कहनियां, राधाकृष्ण प्रकाषन, खण्ड–2, अंक–2, पृष्ठ संख्या–153, वर्ष–2015।

[6]पाण्डे मृणाल, ''श्राप'' (करिए छिमा), शिवानी संपूर्ण कहनियां, राधाकृष्ण प्रकाषन, खण्ड–1, अंक–1, पृष्ठ संख्या–115, वर्ष–2013।

[7] पाण्डे मृणाल, ''पिटी हुई गोट'', षिवानी संपूर्ण कहनियां, राधाकृष्ण प्रकाषन, खण्ड–2, अंक–2, पृष्ठ संख्या–153, वर्ष–2015।

[8] पाण्डे मृणाल, ''तीन कन्या'', षिवानी संपूर्ण कहनियां, राधाकृष्ण प्रकाषन, खण्ड–2, अंक–2, पृष्ठ संख्या–95, वर्ष–2015।

[9] पाण्डे मृणाल, ''अपराजिता'' (स्वयंसिद्धा), षिवानी संपूर्ण कहनियां, राधाकृष्ण प्रकाषन, खण्ड–1, अंक–1, पृष्ठ संख्या–125, वर्ष–2013।

[10] पाण्डे मृणाल, ''निर्वाण (स्वयंसिद्धा)'', षिवानी संपूर्ण कहनियां, राधाकृष्ण प्रकाषन, खण्ड–2, अंक–2, पृष्ठ संख्या–143, वर्ष–2015।

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# A Survey: - Detection and Analysis of Cascading Behavior of Social Media Network

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***Abstract –***
***This chapter elaborates on determining the Cascading Behavioral Pattern of Social Network users. The data available in social media are usually the user-generated content, comprising of images, text, video, and so on, and are unstructured. Social networks users are of various types who use the platform for varied reasons. Here, the influencers are a type of social network users, who influence other users on various backgrounds. The contact generated by users like videos, posts, images, and so on, is the major components used for influencing. The format or pattern of influence may depend on various factors. For profiling the user in social networks, the parameters like user actions, patterns of activities, behavior, posts make a major contribution because these variables characterize the users. Businessmen take various steps to promote their products using the behavioral pattern of users in social networks. The combination of machine learning algorithms and natural language processing together works as a backbone to understand the text content of data and the user behavioral pattern in social media.***
***Index Terms*- Sentiment-Analysis, Emoticons, Social Media, Image, Natural language Processing, Machine Learning**

## I .INTRODUCTION

Facebook and Twitter are the most popular social media platform in India. Millions of users are connected from different countries. Sharing of any kind of post in social media plays an important role to the society. There are mainly two types of post, Positive content post and Negative content post. The negative content post is like a virus in a computer, where it may damages the different parts of computer system like hardware, specific software and important files. In a similar way in a social media the negative content text/media damages or hurt the particular people, particular group and the different community. In last decades the cyber-attack increases exponentially. In this proposed model, the detection and analysis of cascading behavior of the text of social media will be performed. Only new researches have been done on the cascading behavior on a social media. Some of the researcher have been detected the misuse of information by using the cascading techniques. The proposed model will be detect and analyze the different circumstances in a social media, so that the cybercrime and cyber bullying should not happens in the social media

## II .REVIEW OF LITERATURE

Information cascades [4] [12] [19] over diffusion restricted social network data is analyze the embedded webpage of We Chat social media to detect the cascading behavior. They predict the scale of cascade in early stage and finally result suggests the better understanding of viral marketing and rumor detection. Persuasion [15] [17] news sharing and cascades on social networks developed the game theoretical decision model. The model finally make a decision as whether to share the news with their followers or not. The result provide the faster and wider spread of low credibility and false information

on social network. Diffusion and cascading behavior [2] [3] [10] [20] in random network based a model of diffusion is developed where individual behavior of person in analyzed. Analyzed the spread of new cascade behavior in a social network by using empirical distribution. Cascading analysis has been performed by using the empirical distribution. Cascading behavior of both for sparse and dense network have been performed for their experimental work. A model is developed on random walk based to predict [5] [6] [13-14] [16] [18] the similarity of content in a social media on the basis of geographical, race and caste. The model performed well as compared to other cascading model. The machine learning boosting algorithm has been performed for better efficiency. The model finds out that the similar thinking and similar characteristics [7-9] people attracts to each other. The cascading behavior can be detected through the similar thinking and interest on same type of object. The object may be belonging to same class or the object with similar characteristics. The machine learning regression model has been used to find out the cascading behavior. Model is based on the parameter of common pattern and different pattern of different user-user relations graph of network by using K nearest neighbor techniques. Developed an informative based model to share the good ideas [1] and behavior to which people are exposed in larger boundaries of social media. Cascading behavior in complex social technique network is very challenging task to restrict the cyber bullying and cybercrime. Growth as a main route to the formation of complex networks has been studied in great detail. Much less effort has been devoted to the understanding of the complex process of the decline of networks5. In this context the effect of random failures and intentional attacks has been investigated and recently the enhanced vulnerability and cascading breakdown of interdependent networks or k-core percolation were shown. Disintegration of real networks is usually a consequence of interplay between endogenous and exogenous factors and its understanding is of major interest for a series of important questions like the decay of living organisms, the disintegration of social networks or the loss of market share in economic competition. Social contagion like adoption of opinions, behavioral patterns, emotions or innovations can be considered as growth of a network of adopters on the top of an underlying network namely that of social interactions. Under some circumstances this process is surprisingly rapid. Social pressure plays a pivotal role in this context: People are influenced in their decisions by the opinions of their peers. Analyzed the effects of cyber bullying [11] [13] by using machine learning techniques. The effects of cyber bullying may be suicidal opinion, increase in mental health problem and other physical weakness. There are three components in any information diffusion process: the content, the context that facilitate the diffusion and the outcome of the process which is the cascade [5]. The earliest research in this field studied diffusion in the blogosphere; as new platforms have emerged, they have been used to analyses information diffusion dynamics [2-3]. Research in the field of information diffusion varied according to the purpose of study and the diffusion component(s) that is been taken into consideration. Hence, in their survey of information diffusion in online social networks; categorized the research challenges and approaches in the field into three categories:

1) Detecting popular content.
2) Modeling information diffusion.
3) Identifying Influential.

## III. PROBLEM DEFINITION

To understand people's thoughts and feelings based on their proposed text. It gives an overview of the different sentiments classification approaches and tools used for sentiment analysis. The machine learning approach is used for predicating the polarity of sentiments based on trained data sets. In this study automated analysis of social media is accomplished by building predictive model.

## IV. OBJECTIVE OF RESEARCH

In this paper main aim is finding to identify different sentiments of person in different social Medias. There are few objectives of this study, those are as follows:

1. To find the group behavior in social media under uncertain environments
2. To find out the various suggestions by using social media segregation.
3. To predict socially isolated and socially integrated in social network.
4. To analyze knowledge transformation in social media.
5. To detect anomaly in a social media.

## V. PROPOSED METHODOLOGY

The input data is based on any social media from Facebook and twitter. The different community, different educational standard or based on the standard of living on different geographical post are extracted from the social media. Data Pre - Processing is performed on the next step to convert it into the same schema so that detection of text performed easily. The next step is to detect the type of cascading effect of any comment or post of social media. Then the next step is to count the number of positive followers and the number of controversial followers.. The level of cascading effects is analyzed and the last step is to perform the machine learning algorithms to determine the efficiency of the proposed model.

Types of Learning: In general, machine learning algorithms can be classified into three types.

- Supervised learning
- Unsupervised learning
- Reinforcement learning

Supervised learning: A training set of examples with the correct responses (targets) is provided and, based on this training set, the algorithm generalizes to respond correctly to all possible inputs. This is also called learning from exemplars. Supervised learning is the machine learning task of learning a function that maps an input to an output based on example input-output pairs. In supervised learning, each example in the training set is a pair consisting of an input object (typically a vector) and an output value. A supervised learning algorithm analyzes the training data and produces a function, which can be used for mapping new examples. In the optimal case, the function will correctly determine the class labels for unseen instances. Both classification and regression 13 problems are supervised learning problems. A wide range of supervised learning algorithms are available, each with its strengths and weaknesses. There is no single learning algorithm that works best on all supervised learning problems. Supervised learning Remarks A “supervised learning” is so called because the process of an algorithm learning from the training dataset can be thought of as a teacher supervising the learning process. We know the correct answers (that is, the correct outputs), the algorithm iteratively makes predictions on the training data and is corrected by the teacher. Learning stops when the algorithm achieves an acceptable level of performance. Example Consider the following data regarding patients entering a clinic. The data consists of the gender and age of the patients and each patient is labeled as “healthy” or “sick”. Unsupervised learning: Correct responses are not provided, but instead the algorithm tries to identify similarities between the inputs so that inputs that have something in common are categorized together. The statistical approach to unsupervised learning is known as density estimation. Unsupervised learning is a type of machine learning algorithm used to draw inferences from datasets consisting of input data without labeled responses. In unsupervised learning algorithms, a classification or categorization is not included in the observations. There are no output values and so there is no estimation of functions. Since the examples given to the learner are unlabeled, the accuracy of the structure that is output by the algorithm cannot be evaluated. The most common unsupervised learning method is cluster analysis, which is used for exploratory data analysis

to find hidden patterns 14 or grouping in data. Example Consider the following data regarding patients entering a clinic. The data consists of the gender and age of the patients. Based on this data, can we infer anything regarding the patients entering the clinic?

Reinforcement learning: This is somewhere between supervised and unsupervised learning. The algorithm gets told when the answer is wrong, but does not get told how to correct it. It has to explore and try out different possibilities until it works out how to get the answer right. Reinforcement learning is sometime called learning with a critic because of this monitor that scores the answer, but does not suggest improvements. Reinforcement learning is the problem of getting an agent to act in the world so as to maximize its rewards. A learner (the program) is not told what actions to take as in most forms of machine learning, but instead must discover which actions yield the most reward by trying them. In the most interesting and challenging cases, actions may affect not only the immediate reward but also the next situations and, through that, all subsequent rewards. Example Consider teaching a dog a new trick: we cannot tell it what to do, but we can reward/punish it if it does the right/wrong thing. It has to find out what it did that made it get the reward/punishment. We can use a similar method to train computers to do many tasks, such as playing backgammon or chess, scheduling jobs, and controlling robot limbs. Reinforcement learning is different from supervised learning. Supervised learning is learning from examples provided by a knowledgeable expert. Perspectives and Issues in Machine Learning: Perspectives in Machine Learning One useful perspective on machine learning is that it involves searching a very large space of possible hypotheses to determine one that best fits the observed data and any prior knowledge held by the learner. For example, consider the space of hypotheses that could in principle be output by the above checkers learner. This hypothesis space consists of all evaluation functions that can be represented by some choice of values for the weights wo through w6. The learner's task is thus to search through this vast space to locate the hypothesis that is most consistent with the available training examples. The LMS algorithm for fitting weights achieves this goal by iteratively tuning the weights, adding a correction to each weight each time the hypothesized evaluation function predicts a value that differs from the training value. This algorithm works well when the hypothesis representation considered by the learner defines a continuously parameterized space of potential hypotheses.

## VI. APPLICATIONS OF MACHINE LEARNING

Application of machine learning methods to large databases is called data mining. In data mining, a large volume of data is processed to construct a simple model with valuable use, for example, having high predictive accuracy. The following is a list of some of the typical applications of machine learning.

1. In retail business, machine learning is used to study consumer behavior.
2. In finance, banks analyze their past data to build models to use in credit applications, fraud detection, and the stock market.
3. In manufacturing, learning models are used for optimization, control, and troubleshooting.
4. In medicine, learning programs are used for medical diagnosis.
5. In telecommunications, call patterns are analyzed for network optimization and maximizing the quality of service.
6. In science, large amounts of data in physics, astronomy, and biology can only be analyzed fast enough by computers. The World Wide Web is huge; it is constantly growing and searching for relevant information cannot be done manually.
7. In artificial intelligence, it is used to teach a system to learn and adapt to changes so that the system designer need not foresee and provide solutions for all possible situations.
8. It is used to find solutions to many problems in vision, speech recognition, and robotics.

9. Machine learning methods are applied in the design of computer-controlled vehicles to steer correctly when driving on a variety of roads.
10. Machine learning methods have been used to develop programmes for playing games such as chess, backgammon and Go.

## VII. EXPECTED OUTCOMES OF RESEARCH WORK

The model will analyze and detect the behavior of social media data. The various machine learning techniques are used and compared with the existing techniques for the reason of knowledge transformation in a social media. The group behavior and anomaly in the social media will also detect and analyze.

The main motivation behind this research is to define the, we determine if the sentiment is good or negative in this study. In addition to its advantages, it aids in social media monitoring and provides public opinion on particular subjects. The prime outcome will be detection of depression in sentiments caused due to Social media. We will improve the performance of the system in sentiment analysis to detect depression. We will build model for finding the sadness, happiness, customer behavior in sentiment analysis. The result will be obtained in lesser time using proposed method. Proposed work can be beneficial for E-Commerce websites, Social media etc, enhancing the customer satisfaction. Since it can deliver more trustworthy signals and information for a number of data analytics activities using digital platforms for prediction, we believe sentiment categorization on sizable amounts of online user-generated content is advantageous. Because there are many negative memes centered on racism, religion, politics, and terrorism and because a high text score does not always suggest a positive meme, no single model can analyze all genres in a trend.

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## REFERENCE

[1] William Allen, Blinder Scott., "Media Independence through Routine PressState Relations: Immigration and Government Statistics in the British Press." The International Journal of Press/Politics 23 (2): 202–226, 2018.

[2] Chin-Chia Hsu ; Amir Ajorlou and Jadbabaie Ali, Persuasion, News Sharing, and Cascades on Social Networks (April 5, 2022). Available at SSRN: https://ssrn.com/abstract=3934010 or http://dx.doi.org/10.2139/ssrn.3934010

[3] Aruguete Natalia, Ernesto Calvo.. "Time to #Protest: Selective Exposure, Cascading Activation, and Framing in Social Media." Journal of Communication 68 (3): 480–502, 2018.

[4] Mulherin, Peter E., and Benjamin Isakhan. "State–Media Consensus on Going to War? Australian Newspapers, Political Elites, and Fighting the Islamic State." The International Journal of Press/Politics 24 (4): pp.531–550, 2019.

[5] O'Connor, Cliodhna, and Helene Joffe. "Intercoder Reliability in Qualitative Research: Debates and Practical Guidelines." International Journal of Qualitative Methods 19: 160940691989922, 2020.

[6] J. Candia, M. C. Gonzalez, P. Wang, T. Schoenharl, G. Madey, and ´ A.-L. Barabasi, "Uncovering individual and collective human dynamics ´ from mobile phone records," Journal of physics A: mathematical and theoretical, vol. 41, no. 22, p. 224015, 2008.

[7] H. W. Shen, D. Wang, C. Song, and A. Barabasi, "Modeling and ´ predicting popularity dynamics via reinforced poisson processes," in Twenty-Eighth

AAAI Conference on Artificial Intelligence, pp. 291–297, 2014,
[8] Q. Zhao, M. A. Erdogdu, H. Y. He, A. Rajaraman, and J. Leskovec, "Seismic: A selfexciting point process model for predicting tweet popularity," in ACM SIGKDD International Conference on Knowledge Discovery and Data Mining,, pp. 1513–1522. 2015
[9] W. C. Mcgrew, "Culture in nonhuman primates?" Annual Review of Anthropology, vol. 27, no. 1, pp. 301–328, 1998.
[10] J. Lehmann, B. Gonc¸alves, J. J. Ramasco, and C. Cattuto, "Dynamical classes of collective attention in twitter," Computer Science, pp. 251–260, 2011.
[11] L. Tang and H. Liu, "Scalable learning of collective behavior based on sparse social dimensions," in ACM Conference on Information and Knowledge Management, pp. 1107–1116, , 2009.
[12] S. Banerjee and N. Agarwal, "Analyzing collective behavior from blogs using swarm intelligence," Knowledge and Information Systems, vol. 33, no. 3, pp. 523–547, 2012.
[13] R. Cohen, S. Havlin, and D. Ben-Avraham, "Efficient immunization strategies for computer networks and populations," Physical Review Letters, vol. 91, no. 24, p. 247901, 2002.
[14] P. Cui, S. Jin, L. Yu, F. Wang, W. Zhu, and S. Yang, "Cascading outbreak prediction in networks:a data-driven approach," in ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, pp. 901–909, 2013,
[15] J. Cheng, L. Adamic, P. A. Dow, J. M. Kleinberg, and J. Leskovec, "Can cascades be predicted?" pp. 925–936, 2014.
[16] R. Crane and D. Sornette, "Robust dynamic classes revealed by measuring the response function of a social system," Proc Natl Acad Sci U S A, vol. 105, no. 41, pp. 15 649–53, 2008.
[17] L. Yu, P. Cui, F. Wang, C. Song, and S. Yang, "From micro to macro: Uncovering and predicting information cascading process with behavioral dynamics," in IEEE International Conference on Data Mining, pp. 559–568, 2015.
[18] A. P. Dempster, N. M. Laird, and D. B. Rubin, "Maximum likelihood from incomplete data via the em algorithm," Journal of the Royal Statistical Society, vol. 39, no. 1, pp. 1–38, 1977.
[19] J. Bian, Y. Yang, and T. S. Chua, "Predicting trending messages and diffusion participants in microblogging network," pp. 537–546, 2014.
[20] Q. Zhang, Y. Gong, Y. Guo, and X. Huang, "Retweet behavior prediction using hierarchical dirichlet process," in Twenty-Ninth AAAI Conference on Artificial Intelligence, 2015, pp. 403–409.
[21] C. T. Li, Y. J. Lin, and M. Y. Yeh, "Forecasting participants of information diffusion on social networks with its applications," Information Sciences, vol. 422, 2017.

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# Comparative Optical Study of $Ba_2MgSi_2O_7$: $Dy^{3+}$ and $Ba_2ZnSi_2O_7$: $Dy^{3+}$phosphors

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**Abstract:**

**$Dy^{3+}$ doped silicate phosphors have various applications in status lighting, plasma display panels, LCD instructions, and long afterglow. In this study, we have prepared long-lasting $Ba_2ZnSi_2O_7$ (BZS) phosphor and $Ba_2MgSi_2O_7$ (BMS) phosphors doped with dysprosium rare earth through the Advanced Combustion Synthesis method. The optical spectrum PL and decline arc of these phosphors were measured. For$Ba_2MgSi_2O_7$:$Dy^{3+}$ phosphor, the emission wavelengths are observed at 465 nm (blue) and 578 nm (yellow), and 638nm(red) when excited at 346 nm. On the other hand, $Ba_2ZnSi_2O_7$: $Dy^{3+}$ phosphor exhibits different emission peaks of 487 and 584 nm when excited at 362 nm. Decay constants were calculated for both phosphors.**

***Index Terms*** **– Phosphor, Thermo luminescence, Afterglow, Dosimetry.**

## Introduction

Luminescence that persists after excitation is removed is called afterglow or sustained phosphorescence. The first mention of a permanent phosphorescent material dates back to AD and dates back to the Chinese Song Dynasty (11th century AD). The indifferent notes of the monk's song, the name Xiang-Shan Ye-Lu has a long history—phosphorescent paint. The painting shows cows eating grass outside during the day, but at night, I am resting there. The ink absorbs light and remains visible in the dark for a while. Long-lasting phosphorescent material [1]. These long-lasting phosphors are attracting attention as new functional materials because the market for road traffic applications continues to grow. They have become increasingly popular in recent years. Alkaline earth metal silicates as next-generation durable fluorescent materials for signs, emergency signs, clocks, textile printing, etc. Aluminates doped with lanthanide ions result in significantly better properties such as longer shelf life, Phosphorescence time, higher brightness, and better chemical stability than the traditional material previously used with sulfides [2]. The formation of akermanite structures using Alkaline silicate doping with $Eu^{2+}$ and $Dy^{3+}$. $R_2MgSi_2O_7$ (C = Ca, Sr, Ba) co-coated $Eu^{2+}$ and $Dy^{3+}$. Jiang et al. created $CaMgSi_2O_6$: Eu, Dy, Nd, and $CaMgSiO_7$ phosphors that have afterglow characteristics due to their activation by $Eu^{2+}$, $Dy^{3+}$, or $Nd^{3+}$ by solid-state reaction in a diminishing environment. The melilite structure of $Ce^{3+}$-doped $Ca_2Al_2SiO_7$ has exhibited long-persistence Phosphorescence, as reported by Kodama et al. The list of phosphors includes $BaMgSi_2O_7$: $Eu^{2+}$, $Mn^{2+}$ [7], $CdSiO_3$: $Mn^{2+}$: RE (RE = Lanthenides) [8], R1PgGiSo2 O8: $Eu^{2+}$, $Dy^{3+(}$R) [9], and $CaAl_2.Cd_6$. This research investigates the long-lasting qualities of $Ba_2MgSi_2O_7$: $Eu^{2+}$ and $Ba_2ZnSi_2O_7$ phosphors.

## Experiment

In this study, phosphorus is manufactured by a low-temperature combustion method. The components used: Ba $(NO_3)_2$, Mg $(NO_3)_2$, ZnO, Dy $(NO_3)_2$, and $(SiO_2.xH_2O)$. Urea was employed as a combustible agent while ammonium nitrate served as an oxidizing compound. The typical molar ratios used in phosphorus manufacturing are shown in Table 1. All components with the indicated ratios. The propellant components, comprising the fuel and oxidizer, were amalgamated, followed by the incorporation of a minimal quantity of double distilled water. Subsequently, the resultant mixture is meticulously

pulverized and subjected to thermal processing in an oven that has been preheated to a temperature of 600°C. The expedited heating process induces the volatilization and combustion of the mixture, resulting in the formation of a white compound. The entirety of this procedure is finalized within a matter of minutes. The powder thus obtained is annealed in a closed crucible at 900°C in a reducing atmosphere generated by burning coal. The photoluminescence spectrum is obtained utilizing a Hitachi F-4000 spectrofluorometer, featuring a spectral slit width of 1.5 nm, across the wavelength range of 300-700 nm. The decay curves were recorded using a photomultiplier tube and a conventional current recording system.

Table 1: Details about the initial substances employed in the synthesis of diverse silicates, contingent upon the combustion methodology utilized.

| S.N. | Compound | Starting materials | | | | |
|---|---|---|---|---|---|---|
| 1 | $Ba_2MgSi_2O_7$: $Dy^{3+}$ | Ba $(NO_3)_2$ Mg $(NO_3)_2$ | $SiO_2$.x $H_2O$ | Dy $(NO_3)_2$ | $NH_4NO_3$ | Urea |
| | Molar ratio: | 1.97, 1 | 2 | 0.03 | 35 | 35 |
| 2 | $Ba_2ZnSi_2O_7$ : $Dy^{3+}$ | Ba $(NO_3)_2$, ZnO | $SiO_2$.x $H_2O$ | Dy $(NO_3)_2$ | $NH_4NO_3$ | Urea |
| | Molar ratio: | 1.97, 1 | 2 | 0.03 | 35 | 35 |

**Result and Discussion**

Figure I represents the crystal-clear structure of $Ba_2MgSi_2O_7$:$Dy^{3+}$Emission peaks are observed at 465 nm (blue) and 578 nm (yellow), 638 nm (red) (Figure II) for excitation at 346 nm. The photoluminescence spectrum shows that under bright (UV) excitation at 346 nm, the white emission originates from a mixture of three emissions: the characteristic $Dy^{3+}$ emission, a 468 nm blue flux ($4F_{9/2} \rightarrow 6H_{15/2}$), a 578 nm yellow flux ($4F_{9/2} \rightarrow 6H_{13/2}$) and a 638 nm red flux ($4F_{9/2} \rightarrow 6H_{11/2}$). Because of the shielding effect of the outer orbit, the 4f electrons of $Dy^{3+}$ are insensitive to the charge field intensity, but the electrons are situated in a 5d shell readily detached by this effect. The maximum scattering point in the mobility region varies explosively depending on the characteristics of the $Dy^{3+}$ environment. Therefore, $Dy^{3+}$ ions exhibited various emissions in the visible region. Various silicate hosts have colorful products surrounded by $Dy^{3+}$ ions. (13) Similar to $M_2SiO_4$, $M_2MgSi_2O_7$ and $M_3MgSi_2O_8$ hosts. Abe et al. (7) observed the emigration of $Ba_2MgSi_2O_7$:$Eu^{2+}$ Phosphor in violet light at 400 nm. Blasse et al. (14) observed the photoluminescence emigration diapason at 500 nm.

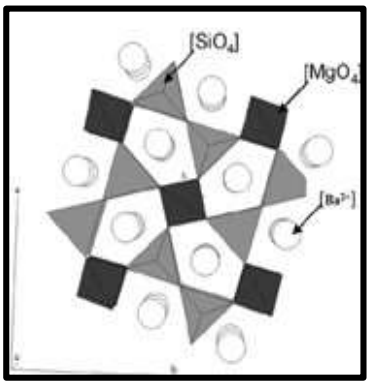


Fig.I, Crystal structure of $Ba_2MgSi_2O_7$

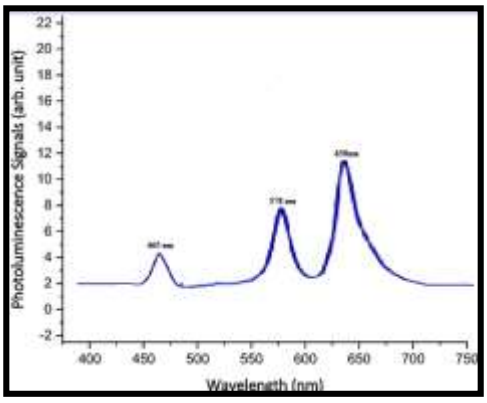


Fig.II, Photoluminescence (PL) spectra of $Ba_2MgSi_2O_7$: $Dy^{3+}$

The compounds were exposed to ultraviolet (UV) radiation (unfiltered emission from the Hg lamp). The decay curves were recorded using a photomultiplier tube and a routine current recording system. Upon exposure to ultraviolet radiation, electrons residing within the valence band are elevated to the conduction band, resulting in the generation of free electrons and holes within the sample matrix. These holes or electrons may become localized within defect sites and are subsequently released when thermal energy is applied at ambient temperature, leading to

recombination with either electrons or holes present in alternative defect locations. Some electrons after excitation return to the radiation-free electron traps and are stored in electron traps created during the synthesis process at high temperatures. The phosphor exhibited arc decline using 255 nm light at room temperature for 10 minutes, as shown in Figure III. The decline is not exponential. At least 3 components may be visible with decay constants 454.40, 1453.51 and 2611.68 seconds.

Decay instances may be studied through a curve-becoming approach found totally on the below relation:

$$I=B_1e^{(-t/\tau 1)} + B_2e^{(-t/\tau 2)} + B_3e^{(-t/\tau 3)}$$

Here I represent the intensity of phosphorescence;

$B_1$, $B_2$, and $B_3$ are arbitrary constants;

t is time;

The decline periods for the exponential components are represented by $\tau_1$, $\tau_2$, $\tau_3$respectively. The phosphor $Ba_2ZnSi_2O_7$: $Dy^{3+}$ exhibited a Phosphoresced spectrum as see in Fig.VI. The wavelengths of emission spectra of $Ba_2ZnSi_2O_7$: $Dy^{3+}$ are at 487 nm, 584 nm, and 362 nm. excitation radiation. The prepared phosphor indicates efficient blue and yellow emission under UV excitation. The decline arc of the phosphor illuminated by 255 nm light for 10 minutes at room temperature is shown. The decline arc shows no exponential in Figure V. At least two components can be seen with decline coefficients of 312.6 and 719.19 s.

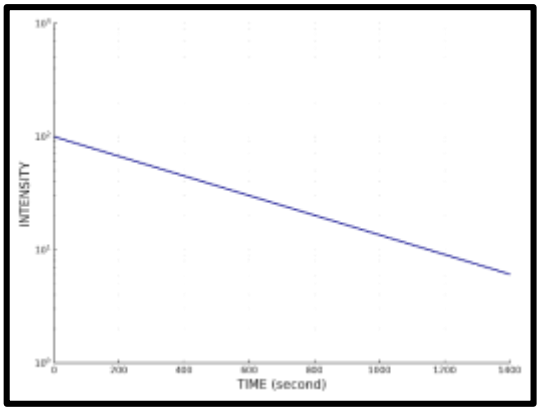


Fig.III, Long-lasting decline-arc of $Ba_2MgSi_2O_7$: $Dy^{3+}$

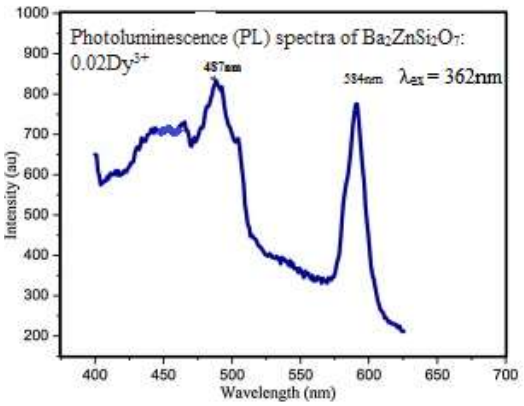


Fig.IV, Photoluminescence (PL) spectra of $Ba_2ZnSi_2O_7$: $0.02Dy^{3+}$

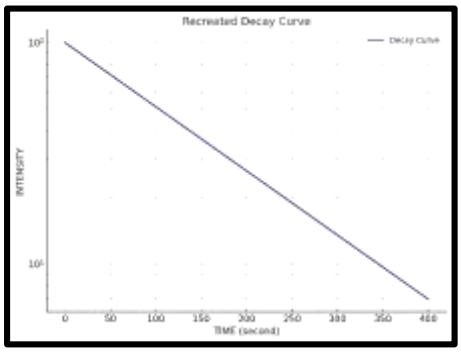


Fig.V, Long-lasting decline-arc of $Ba_2ZnSi_2O_7$: $Dy^{3+}$

## Conclusion

Silicates, mainly based on long-lived phosphorus, are readily organized by the low-temperature combustion method. Measurement of photoluminescence spectra and long-lived decay arcs is studied. The intense, long-lasting emissions and PL spectra are located. The parameters, like excitation and emission maxima, and decay constant, are in correct agreement with the literature.

REFERENCES

[1] Kang C.C., Liu R.S., Chang J.C., and Lee B.J., "Synthesis and Luminescence Properties of a new Yellowish Orange Afterglow Phosphor $Y_2O_2S$: Ti, Mg" Chemistry of Materials, Vol. 15(21), pp.3966-3968, 2003.https://doi.org/10.1021/cm0344212

[2] Chen Y., Liu B., Kim M., Qi Z., Shi C., True M., Vielhauer S., &Zimmerer G."Luminescent properties

of blue-emitting long afterglow phosphors $Sr_{2-x}Ca_xMgSi_2O_7:Eu^{2+}$, $Dy^{3+}$", Journal of Luminescence, Vol 118(1), pp.70–78, 2006. https://doi.org/10.1016/j.jlumin.2005.05.011

[3] Murayama Y., Synthesis and Luminescent Properties of a New Yellowish-Orange Afterglow Phosphor $Ca_2O_2S$:Ti,Mg",Nikkei Sci., Vol. 26, pp.20-27, 1996.

[4] Jiang L., Chang C., and Mao D,"Luminescent properties of CaMgSi2O6 and $Ca_2MgSi_2O_7$ phosphors activated by $Eu^{2+}$, $Dy^{3+}$and $Nd^{3+}$", Journal of Alloys and Compounds, Vol.360(1–2), pp.193–197, 2003. https://doi.org/10.1016/S0925-8388(03)00361-X

[5] Kodama N., Takahashi T., Yamaga M., Tanii Y., Qiu J., and Hirao K.,"Long-lasting phosphorescence in $Ce^{3+}$doped $Ca_2Al_2SiO_7$ and $CaYAl_3O_7$ crystals", Applied Physics Letters, Vol.75(12), pp.1715–1717, 1999. https://doi.org/10.1063/1.124799

[6] Kodama N., Tanii Y., and Yamaga M.,"An Overview of Strontium Aluminate Photochromic for

Anti-counterFeiting Applications", Journal of Luminescence, Vol. 1076, pp.87–89, 2000.

[7] Abe S., Uematsu K., Toda K., and Sato M., "Luminescent properties of red long persistence phosphors, $BaMg_2Si_2O_7$: $Eu^{2+}$, $Mn^{2+}$",Journal of Alloys and Compounds, Vol. 408,pp.11-20, 2006.

[8]Kuang J., Liu Y., and Lei B.,"Effect of $RE^{3+}$ as a co-dopant in long-lasting phosphorescence $CdSiO_3:Mn^{2+}$ (RE=Y, La, Gd, Lu). Journal of Luminescence",Vol.118(1), pp.33–38, 2006. https://doi.org/10.1016/j.jlumin.2005.06.005

[9] Lin Y., Tang Z., Zhang Z., and Nan C. W.,"Luminescence of $Eu^{2+}$ and $Dy^{3+}$ activated $R_3MgSi_2O_8$-based (R=Ca, Sr, Ba) phosphors", Journal of Alloys and Compounds, Vol.348 (1–2), pp.76–79, 2003. https://doi.org/10.1016/S0925-8388(02)00796-X

[10] Jiang L., Chang C., Mao D., and Zhang B.,"A new long persistent blue-emitting $Sr_2ZnSi_2O_7:Eu^{2+}$, $Dy^{3+}$ prepared by sol-gel method", Materials Letters,Vol. 58(12–13), pp.1825–1829, 2004. https://doi.org/10.1016/j.matlet.2003.11.014

[11] Wang Y., Wang Z., Zhang P., Hong Z., Fan X., and Qian G., "Preparation of $Eu^{2+}$ and $Dy^{3+}$ co-activated $CaAl_2Si_2O_8$-based phosphor and its optical properties", Materials Letters, Vol.58(26), pp.3308–3311,2004.
https://doi.org/10.1016/j.matlet.2004.06.024

[12]Aitasalo T., Hreniak D.J. H. T.,Laamanen M., LastusaariJ., Niittykoski F., Pelle Wi., and Strek M.,"Persistent luminescence phenomena in materials doped with rare earth ions",Journal of Solid State Chemistry, Vol.171( 1-2), pp. 114-122.2003.

[13] Lin Y., Nan C.-W., Zhou X., Wu J., Wang H., Chen D., and XucMateri S., "To Study optical behavior of silicate-based phosphors",energy andenvironment science, Vol. 82, pp.860-872,2003.

[14]Blasse G., Wanmaker W. L., Vrugt J. W., and Bril Phil A.,"On the Nature of the $Eu^{2+}$Luminescence",basic solid state physics Vol.23,pp. 189-204, 1968.

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# डॉ. अजय पाठक के नवगीतों में पर्यावरण चेतना : 'जंगल एक गीत है' के संदर्भ में

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**शोध–सारांश**

**सनातन धर्म में क्षिति, जल, पावक, गगन और वायु को पंचभूत कहा गया है, ये सभी प्रकृति या पर्यावरण के अंग है। औद्योगिकीकरण और वैश्वीकरण के युग में मनुष्य पर्यावरण को प्रदूषित करता गया जिससे समस्त जैव तथा अजैव प्रत्यक्ष या अप्रत्यक्ष रूप से प्रभावित होते है। अतः पर्यावरण के प्रति चेतना आवश्यक है जो समकालीन नवगीतों में अभिव्यक्त होती है। डॉ. अजय पाठक का नवगीत संग्रह 'जंगल एक गीत है' पर्यावरण एवं जंगल के प्रति समर्पित है। जंगल हमारे लिए वरदान है इसलिए उसे कटने से बचाएँ तथा उसका सीमित वैज्ञानिक दोहन करे। जंगल प्रकृति का प्रतिबिंब है तथा सभी प्राणियों के जीवन का आधार है। डॉ. अजय पाठक का प्रकृति–प्रेम उनके इस संग्रह में स्पष्ट रूप से झलकता है।**

**शब्द संकेत– पंचभूत, रससिक्त, खग वृंद, स्पंदन आदि।**

## I. प्रस्तावना

हमारी भारतीय संस्कृति में प्रकृति और पर्यावरण को ईश्वर का अंश माना गया है। भारतीय वाङ्मय वेद, उपनिषद्, रामायण, गीता आदि ग्रंथों में इसे अत्याधिक महत्व दिया गया है। पृथ्वी को धरती माता या धारिणी कहा गया है क्योंकि यह समस्त जीव–जन्तुओं, वनस्पतियों, पर्वत, नदियों को धारण तथा भरण पोषण करती है। पृथ्वी प्रकृति या पर्यावरण का अंश है तथा इससे ही संपूर्ण जैव–अजैव, चर–अचर, जड़–चेतन, स्थावर–जंगम का परिपालन होता है। ऋग्वेद को विश्व का सबसे प्राचीन ग्रंथ होने का गौरव प्राप्त है, जिसमें प्रकृति के पांच अवयवों को देवता निरूपित किया गया है। यह पांच तत्व सूर्य, अग्नि, चन्द्रमा, विद्युत और मारूत है। कालांतर में सनातन धर्म में पंचभूतों के

**छिति जल पावक गगन समीरा।**
**पंच रचित अति अधम सरीरा।।** [1]

भगवद्गीता में श्रीकृष्ण ने भी कहा है –

**भूमिरापोऽनलों वायुः खं मनो बुद्धिरेव च्।**
**अहङ्कार इतीयं मे भिन्ना प्रकृतिरष्टधा।**

**अपरेयमितस्त्वन्यां प्रकृतिं विद्धि मे पराम्।**
**जीवभूतां महाबाहो ययेदं धार्यते जगत्।** [2]

भगवद्गीता के सातवें अध्याय ज्ञान विज्ञान योग के चौथे और पाँचवे श्लोक में यह उद्धृत है। भगवान श्री कृष्ण कहते है कि पृथ्वी, जल, अग्नि, वायु, आकाश, मन, बुद्धि और अहंकार ये आठ मेरी प्रकृति है और ये सभी जड़ प्रकृति के है तथा दूसरे समस्त जीव–रूप चेतन स्वरूप में है।

अथर्ववेद के बारहवें मंडल में एक मंत्र उद्धृत है –

**माता भूमिः पुत्रो अहं पृथिव्याः पर्जन्य पिता**
**स उ नः पिपर्तु।।** [3]

यहाँ भूमि को माता और मेघ को पिता कहा गया है।

ऋग्वेद में अग्नि, वरूण और यहाँ तक कि वनस्पति को भी देवता के रूप में चिन्हांकित कर स्तुति की गई है –

**अव सृजा वनस्पते देव देवेभ्यो हविः।**

**प्र दातुरस्तु चेतनम्।।** [4]

जल की स्तुति के लिए यह मंत्र उद्धृत है –

**अप्स्वन्तरमृतमप्सु भेषजमपामुत प्रशस्तये।**

**देवा भवत वाजिनः।।** [5]

### पर्यावरण प्रदूषण

प्रकृति में जितने भी जैविक, अजैविक और भौतिक तत्व है वह सभी पर्यावरण के तत्व है। यदि हम प्राचीन मानवीय संस्कृति एवं सभ्यता पर दृष्टि डाले तो स्पष्ट होता है कि अतीत में लोग पर्यावरण के प्रति अत्यंत सचेत थे। वह पर्यावरण के महत्व को समझते थे, उनका सिद्धांत प्रकृति के संसाधनों का उपयोग करना था न कि आज के लोगो की तरह उसका विनाश करना था। भारतीय प्राचीन साहित्य में प्रदूषण शब्द का उल्लेख नहीं मिलता है क्योंकि वह प्रकृति को देवतुल्य मानकर उसके प्रति समादर व्यवहार करते थे। उन्होने कभी प्रकृति को नष्ट कर उसके अवयवों के संतुलन को नहीं बिगाड़ा।

धीरे–धीरे मनुष्य विकास की तरफ उन्मुख हुआ। औद्योगिकीकरण और वैश्वीकरण युग में प्रकृति से दुराव करता गया। भौतिक सुख–सुविधा एवं उपभोग की प्रकृति ने मनुष्य को स्वार्थी बना दिया वह प्रकृति और पर्यावरण का दोहन करता गया। परिणाम हम सबके सामने विनाशकारी प्राकृतिक प्रदूषण के रूप में है। मनुष्य ने स्वार्थवश नदियों, पहाड़ो, जंगलों को भी नही छोड़ा है। उद्योग धंधो का विकास, शहरीकरण, वनों के विनाश से प्रकृति का मनमाना दोहन किया है।

वर्तमान परिप्रेक्ष्य में जहाँ–जहाँ पर्यावरण शब्द उपयोग होता है वहाँ पर अनायास रूप से प्रदूषण शब्द आ ही जाता है और ऐसा अचानक नही हुआ है। मनुष्य की परिकल्पना में पर्यावरण और प्रदूषण दोनों शब्द व्यापक आयाम लिये हुए है। प्रदूषण का सामान्य अर्थ है दूषित, गंदा या अपवित्र होना। पर्यावरण प्रदूषण में वायु, जल, मिट्टी आदि का अशुद्ध होना या दूषित होना शामिल है जो कि समस्त जैव तथा अजैव कारकों को प्रत्यक्ष और अप्रत्यक्ष रूप से प्रभावित करते है।

## II. डॉ. अजय पाठक के नवगीतों में पर्यावरण चेतना

आज का मनुष्य इस दूषित हवा, पानी, मिट्टी में किस प्रकार जीवन व्यतीत करे यह एक विचारणीय विषय है। इस समस्या भरे वातावरण में किसी न किसी व्यक्ति या समाज को इसके बारे में सोचना तो पड़ेगा कि पर्यावरण की सुरक्षा या संरक्षण किस प्रकार किया जाए। तो इन परिस्थितियों में समकालीन कविताओं की ओर ध्यान आकृष्ट होता है चूंकि समकालीन कविता का मूल स्वर ही युगबोध और यथार्थ से सम्बन्धित है। इन कविताओं में समसामयिक चेतना तथा समस्याओं के प्रति संवेदना निहित होती है। अतः पर्यावरण के प्रति चिंता इन कविताओं में स्पष्ट रूप से नजर आती है।

समकालीन नवगीतकारों में पर्यावरण के प्रति संवेदनशीलता का पर्याय बन चुके डॉ. अजय पाठक का नाम इसमें अग्रगण्य है। इनका जन्म छत्तीसगढ़ के बलौदाबाजार जिले में 14 जनवरी 1960 को हुआ था। वह अपने जीवन में सरकारी सेवा के दौरान वन उप परिक्षेत्र अधिकारी नियुक्त हुए। जिससे वह जंगल और प्रकृति को काफी नजदीक से देख पाये और यही से उनकी पर्यावरण के प्रति प्रेम और संवेदना जागृत हुई और धीरे–धीरे उनके मन मस्तिष्क में प्रकृति के प्रति अनुराग उत्पन्न होता गया। कालांतर में साहित्य एवं गीतों के माध्यम से इनकी प्रकृति एवं पर्यावरण के प्रति प्रेम की अभिव्यक्ति प्रस्फूटित हुई। इनकी पन्द्रह से अधिक प्रकाशित गीत संकलन है जिनमें विभिन्न अन्य सामयिक चिंताओं के साथ–साथ भावों की

रचनाएं हैं तथा प्रकृति एवं पर्यावरण के पक्ष में भी अनेक रचनाएँ है।

डॉ. अजय पाठक की प्रकृति–प्रेम की महाकाव्यात्मक रचना 'जंगल एक गीत है' जोकि सन् 2007 में प्रकाशित हुई थी। भारत सरकार के वन तथा पर्यावरण मंत्रालय द्वारा इस कृति को "मेदिनी पुरस्कार (2009)" से पुरस्कृत भी किया जा चुका है। जंगल के प्रति डॉ. अजय पाठक का अगाध प्रेम और अनुराग इस रचना में स्पष्ट रूप से परिलक्षित होता है। पाठक जी स्वयं स्वीकार करते है कि 'जंगल एक गीत है' उनके जीवन के पर्यावरण संबंधी अनुभव एवं चिंताओं का एक दस्तावेज है जो कि प्रकृति और जंगल के प्रति है। इस संग्रह की प्रत्येक कविता जंगल, प्रकृति और पर्यावरण को समर्पित है।

जंगल हमारा जीवन निर्धारित करती है। जंगल से विलग होकर प्रकृति अधुरी है। इससे ही हमें जल मिलता है वह बादलों को आकर्षित करते हैं। पेड़–पौधे हमारे जीवन के प्रमुख आधार, प्राण–वायु अर्थात् ऑक्सीजन प्रदान करते हैं वह वातावरण के कार्बन डाई ऑक्साइड को ग्रहण करके प्रकृति को शुद्ध बनाये रखते हैं। 'वन से जल है' शीर्षक से डॉ. अजय पाठक यही कहते है –

**वन से जल है**
**जल से जीवन,**
**साँसो के है ताने–बाने**
**प्राणों के आधार यही है,**
**जंगल की महत्ता पहचानें।"** [6]

एक वृक्ष सौ चिड़ियों का घर होता है, उसकी शीतल छाया जीव–जन्तुओं के लिये आनंददायी होती है। उर्जा के भंडार के रूप में पूरा वृक्ष किसी वरदान से कम नही है। सर्दी, गर्मी और बरसात सभी मौसम में वह हमें देने का ही काम करते हैं। इतना महत्वपूर्ण होते हुए भी लोग वृक्ष को काट रहे हैं जंगल उजाड़ रहे है। जंगलों के विनाश होने से धीरे–धीरे पूरे मानव समाज का सर्वनाश हो रहा है, यह अटल सत्य है। मनुष्य इस स्थिति को समझे इसी में उसकी भलाई है अन्यथा इसके दूरगामी परिणाम भोगने पड़ेंगे। डॉ. अजय पाठक जी ने वनों के विनाश को रोकने के साथ–साथ उसके भयावह परिणाम की तरफ ध्यान केन्द्रित किया है –

**"पर्यावरण का क्षरण हुआ है,**
**जहाँ–जहाँ धरती पर**
**एक बीज भी नही उगा है**
**बंजर उस धरती पर**
**वृक्ष विहीन धरा हो जाती**
**भीषण रेगिस्तान है।"** [7]

पर्यावरण अपनी नैसर्गिक अवस्था में होता है। तो शुद्ध एवं पवित्र होता है परन्तु जब उसमें मानवीय क्रियाकलापों की कृत्रिमता प्रवेश करती है तब धीरे–धीरे उसमें अशुद्धि भी प्रवेश करती है। जंगल प्राकृतिक रूप से ही अस्तित्व में है मनुष्य ने अपनी स्वार्थ सिद्धि एवं भोग–विलास के लिए इसका दोहन करना शुरू कर दिया। अतः अब इसका संरक्षण एवं परिवर्धन दोनों की महती आवश्यकता है। आज हमारा कर्तव्य है कि जंगलों को काटने से बचाएं तथा उसका सीमित वैज्ञानिक दोहन ही करे। यही संदेश डॉ. अजय पाठक इस गीत में देते है –

**"जंगल को जंगल रहने दो !**

**सड़को के मत जाल बिछाओ,**
**मत उसमें भंडार बनाओ।**
**पशुओं को रोको चरने से,**
**पौधे रोपो और बचाओ।**
**पत्ते झरते हैं झरने दो।**
**तरूवर ढहते हैं ढहने दो।।** [8]

प्रकृति के सुन्दर और मनोरम दृश्य सभी के मन को भाते है। प्रकृति आनंद और सुखदायक होती है, और इस आनंद की अनुभूति कवि मन को अधिक भावविभोर करता है। उसकी कल्पना लौकिक से परे होकर तात्विक तथा आध्यात्मिक हो

जाती है। वह प्रकृति से रससिक्त होकर पूरे मानव समाज को इस रस से सींच देता है। सावन माह में वर्षा का आगमन प्रकृति को हरियाली और धरती को महक का उपहार देती है। 'मेघ' शीर्षक का यह नवगीत समस्त चराचर को आह्लादित करती है –

**" पुलकित मेघ झमाझम बरसे।**

**सावन माह, सुखद अंबर पद,**
**अखिल चराचर तरूवर गदगद्**
**सरिता नीर सहित परिपूर्णा,**
**दादूर के स्वर गुंजित अनहद्**

**शीतल मंद अनल सुखवर्धक,**
**रोम–रोम हरषे। "** [9]

अनेकता में एकता ही भारत की विशेषता रही है इसी प्रकार जैव विविधता के मामले में भी यह देश सर्वोपरि है। यहाँ विभिन्न प्रकार के वनस्पति तथा जीव–जन्तु पाये जाते है कही ऊंचे ऊंचे पर्वत है तो कही पठार और मैदान। नदियों से आपूरित हमारा भारत अन्नपूर्णा की भूमि है।

हमारे देश के जंगलों में विभिन्न प्रकार की औषधि पायी जाती है जोकि विभिन्न प्रकार के रोगों के उपचार के लिये रामबाण का कार्य करती है, ये असाध्य रोगो के लिए संजीवनी है। यहाँ की प्रकृति ने प्रत्येक प्रकार के बीमारियों के लिए औषधि उत्पन्न की है। आरण्यक संस्कृति का वाहक हमारा देश आयुर्वेद का जनक है। डॉ. अजय पाठक ने औषधियों के महत्व को दोहे के माध्यम से व्यक्त किया है –

**" हर्र, बहेड़ा, आंवला, अर्जुन, पीपल, नीम,**
**औषधियों की खान है, पूरे वैद हकीम।**

**अमाशय में शोथ हो, या होवे अतिसार**
**दूधी का सेवन करें, खाये रोज अनार।**

**बैरी सा मधुमेह है, घातक इसका खेल,**
**खाली पेट चबाइये, नियमित उठकर बेल। "** [10]

स्पष्ट है कि वनस्पतियों से प्राप्त ये औषधियाँ उपचार में अत्यंत कारगर है और वह बहुत ही सुलभ है और सर्वत्र उपलब्ध है। उल्लेखनीय है कि इन औषधियों का शरीर पर कोई अतिरिक्त नकारात्मक प्रभाव भी नही पड़ता और रोग जड़ से खत्म भी हो जाता है।

प्रकृति और पर्यावरण को संतुलित बनाये रखने में प्राणी जगत के छोटे–बड़े जीवों का अपना महत्व है। जीव–जन्तु जिस स्थान में निवास करते है भोजन करते है तथा अपना वंश बढ़ाते है वह उनका आवास कहलाता है। सुरक्षित रहवास के न होने से जीवन का विकास–क्रम बाधित होता है तथा जीवों के लिए प्रतिकूल स्थिति उत्पन्न होती है। जीव विलुप्ति के कगार पर आ जाते है इससे जैव विविधता प्रभावित होती है जो कि पर्यावरण के लिए हानिकारक है। इससे पर्यावरणीय असंतुलन पैदा हो जाता है जो जीव–जगत तथा मानव समाज के लिए विनाशकारी होता है। जंगल से लगभग विस्थापित कर दिये गये बंदरो के लिये डॉ. अजय पाठक संवदेना के गीत गाते है –

**" थकी हुई सेना को लेकर**
**बैठा हुआ सिकन्दर**
**ऐसे लगते है सर्दी में**
**धूप सेंकते बंदर।**

**जंगल में अब शेष नही कुछ**
**क्या पीयें, क्या खायें ?**
**प्रश्न विकट है उनके सम्मुख,**
**कैसे प्राण बचाये ? "** [11]

छत्तीसगढ़ प्रांत के जंगल हाथियों की बहुतायत के लिए विख्यात है। हाथियों पर हो रहे अत्याचार के लिये मनुष्य ही जिम्मेदार है, स्थिति यह है कि आज हमने उनका जंगल ले लिया, उनके आवास पर कब्जा कर लिया। वह मूक प्राणी भूखे–प्यासे भटक रहे हैं। 'गजराज' शीर्षक से हाथियों का बेघर होना दिखाया गया है –

**" हमने उनका घर छीना है,**
**छीना है आजादी**
**उनकी दुनिया में ही जैसे,**
**हमने आग लगा दी**

**यायावर बन कर फिरता है,**
**उनका सकल समाज। "** [12]

जंगल में रहने वाले जीवधारी भी अपने स्तर पर विभिन्न प्रकार की समस्याओं से ग्रस्त होते है जैसे बीमारी, भूख, निर्जलीकरण, प्राकृतिक आपदा, अन्य जानवरों के द्वारा शिकार। यह सब नैसर्गिक होता है लेकिन जब मानव द्वारा इनका शिकार या क्षति होती है तो यह और भी भयावह हो जाता है। इन सबके कारण जंगली जानवरों की संख्या दिन–प्रतिदिन घटती जा रही है। कई जंतु तो विलुप्ति के कगार पर है इससे खाद्य श्रृंखला भी प्रभावित होती है जिसके कारण पर्यावरण में असंतुलन पैदा होता है। मानव अपने स्वार्थ में इतना अंधा है कि वह भूल जाता है कि जंतुओं में प्राण होता है। उनकी भी संवेदना है उन्हें भी दुख और पीड़ा होती है। मूक और निरीह प्राणी की संवेदना को व्यक्त करती ये पंक्तियाँ दृष्टव्य है –

**" मांस काटने लगा शिकारी**
**पहले उसने खाल उतारी**
**पल में ही बोटी में बदला**
**हिरणी का तन सारा**
**कौआ का दल देख रहा था।**
**बैठा वहीं नजारा।**

**चीख चीख कर जंगल रोया**
**जैसे उसने सब कुछ खोया?**
**वनदेवी ने अस्फुट स्वर से**
**जैसे कहीं पुकारा**
**ओ ! आखेटक पापी मुझ तक**
**आना नही दुबारा। "** [13]

मनुष्य की अनंत इच्छा और भोगवादी प्रवृत्ति के कारण ही आज पर्यावरण और प्रकृति का विनाश हो रहा है। वह सब कुछ प्रदूषित करने में लगा है। जल, वायु, मिट्टी सभी अशुद्ध हो गये है जिसके चलते हमें भोजन भी शुद्ध नही मिल पा रहा है। महानगरों की स्थिति तो बद से बदतर हो गई है। चारों तरफ धुएँ का गुवार उठता रहता है, सड़क में धूल का कहर है। कारखानों से निकलने वाले गंदा पानी नदियों को प्रदूषित कर रहा है। नालियों में कचरा व प्लास्टिक जमे हुए है जो कि अनेक बीमारियों को न्यौता देते है। वही गाँव भी इससे अछूता नही है। खेतो मे विभिन्न प्रकार के रासायनिक खाद व कीटनाशक फसलों और सब्जियों को विषाक्त बना रहे है जो कि मनुष्य के साथ–साथ जीव–जन्तुओं के लिए तथा पर्यावरण के लिए घातक है यह प्रत्यक्ष एवं परोक्ष रूप से प्रभावित कर रहा है। प्रदूषण के दूरगामी परिणाम के प्रति आगाह करती यह पंक्तियाँ –

**" चौबीस घंटे कल की चिमनी,**
**ऊगले केवल धुआँ**
**चुल्लू भर पानी को तरसे,**
**बहुत पुराना कुआँ**
**संकट गहराता है लेकिन,**
**किसको है आभास ? "** [14]

आजकल विशेष प्रकार के महत्वपूर्ण पेड़–पौधे नष्ट हो रहे है और विलुप्त हो रहे है। पलाश के वृक्ष भी अब कम नजर आ रहे है, जिसका कारण मानव समाज है। पलाश वृक्ष को बचाने के लिए प्रकृति एवं जंगल प्रेमियों ने पूरे छत्तीसगढ़ में 1 मार्च को पलाश दिवस मनाने का निर्णय लिया है, जो कि सराहनीय एवं अनुकरणीय है। अजय पाठक ने 'यह कैसा मधुमास' में लिखा है –

**" सूखी टहनी, खड़े ठूँठ पर**
**गिद्धो का उल्लास**
**रोता सेमल, आहत ईमली,**
**घायल हुआ पलाश।**

**चुप्पी साधे बैठी कोयल,**
**यह कैसा मधुमास ? "** [15]

वहीं 'झरते फूल पलाश' के शीर्षक से भी नवगीतकार ने धरोहर रूपी वनस्पतियों को संरक्षित करने के लिये लोगों को जागरूक किया है –

**" लिये उदासी दिन बैठे है,**
**मौसम के मधुमास के**
**नही दिखाई दिये कहीं भी,**
**झरते फूल पलाश के । "** [16]

स्वर, लय, पद और छंद से बनी रचना गीत होती है। यदि गीत के अविर्भाव की ओर दृष्टि करें तो स्पष्ट होता है कि प्रकृति से ही इसका जन्म हुआ है, नदियों की कल–कल, झरनों के झर–झर, खगवृंदो के कंठ स्वर, वायु की सर–सराहट ने मनुष्य के लिये गीत की पृष्ठभूमि तैयार की। प्रकृति के हर स्पन्दन में लय और स्वर समाहित है। गीत मूलतः हृदय के भावों की रागात्मक अभिव्यक्ति होती है जो हमें आनंदित और नयी ऊर्जा से भर देती है। डॉ. अजय पाठक ने अपनी रागात्मक अनुभूतियों को साहित्य के स्वर देकर 'जंगल एक गीत है' की रचना की जो कि वास्तव में सत्य है। जंगल प्रकृति का प्रतिबिंब है यह प्रकृति के सभी अर्थों को पुष्ट करती है। गीत की पूरी संरचना जंगल पर आधारित है। अपने नवगीत संग्रह के शीर्षक को सत्य सिद्ध करता हुआ यह नवगीत दृष्टव्य है –

**" स्वर पत्तों के,**
**लय नदियों के,**
**बादल का संगीत !**
**पंछी के है बोल रसीले,**
**भँवरों के नवगीत !**

**कोयल के है कंठ समाहित,**
**जंगल ! पूरा गीत। "** [17]

मनुष्यों के समान ही पेड़–पौधों में चेतना और संवेदना होती है। ऐसे में उन्हें हम मनुष्यों का प्रेम एवं संरक्षण जरूरी है ताकि वनस्पतियों के साथ जीव–जगत की भी वृद्धि एवं विकास हो सके। नवगीत की विशेषताओं में वेदना और व्यथा मुख्य रूप से शामिल है। पेड़–पौधे और जंगल की संवेदना को यह नवगीत मार्मिक अभिव्यक्ति प्रदान करता है –

**" जंगल रोता है पतझर में,**
**मैने उसकी पीड़ा देखी,**
**आँसू देखे है तरूवर में,**
**जंगल रोता है पतझर में।**

**छोड़ रहे थे साथ पाव,**
**अब उसका धीरे–धीरे**
**लगी चिढ़ाने मुँह विचकाकर,**
**चंचल तेज समीरें**

**हरी भरी सब दृश्यावलियाँ,**
**परिवर्तित होती धूसर में । "** [18]

## III. निष्कर्ष

उपरोक्त बातों से स्पष्ट है 'जंगल एक गीत है' में पर्यावरण चेतना को लेकर एक बहुपयोगी संदेश समाज को देने का प्रयास किया गया है, जिसकी आज सबसे ज्यादा आवश्यकता है। यही कारण है हमें जीव–जगत और पर्यावरण संबंधी संसाधनों के सीमित वैज्ञानिक दोहन की आवश्यकता है नहीं तो आने वाली स्थितियाँ बड़ी भयावह होगी। विश्वस्तर पर जो ग्लोबल वार्मिंग है और अलग–अलग स्थानों पर एक ही बार में अतिवृष्टि और सूखे का जो भयावह दृश्य हमारे सामने आता है यह उसी पर्यावरणीय असंतुलन का परिणाम है और यदि हम आज भी सचेत नही हुए तो कल आने वाली दिनों में हमें गंभीर परिणाम भोगने होंगे। अतः 'जंगल एक गीत है' शीर्षक से प्रकाशित इस काव्यकृति के गीतों में हमारे लिए जो संदेश कवि ने दिया है उस पर गंभीरता से चिंतन और मनन करने की आवश्यकता है। यह कृति पर्यावरणीय चेतना के सभी धरातल और मानक बिंदुओं पर खरा उतरती है।

## संदर्भ


[1] पोद्दार हनुमान प्रसाद, "रामचरित मानस", गीताप्रेस गोरखपुर, पृष्ठ–693, संवत् 2071।

[2] पाठक डॉ. अजय, "सुनो धनंजय", विजया बुक्स दिल्ली, पृष्ठ–120, 2022।

[3] आचार्य श्रीराम शर्मा, "अथर्ववेद संहिता भाग–2", युग निर्माण प्रेस मथुरा, पृष्ठ–3, 2010।

[4] आचार्य श्रीराम शर्मा, "ऋग्वेद संहिता", युग निर्माण प्रेस मथुरा, पृष्ठ–15, 2010।

[5] आचार्य श्रीराम शर्मा, "ऋग्वेद संहिता", युग निर्माण प्रेस मथुरा, पृष्ठ–28, 2010।

[6] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–11, 2022।

[7] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–13, 2022।

[8] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–16, 2022।

[9] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–17, 2022।

[10] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–18, 2022।

[11] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–22, 2022।

[12] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–63, 2022।

[13] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–51, 2022।

[14] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–60, 2022।

[15] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–60, 2022।

[16] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–75, 2022।

[17] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–69, 2022।

[18] पाठक डॉ. अजय, "जंगल एक गीत है" द्वितीय संस्करण, बुक्स क्लिनिक पब्लिशिंग बिलासपुर छत्तीसगढ़ , पृष्ठ–45, 2022।

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# Student Academic Performance Analysis Through Machine Learning Models

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## Abstract

**The atmosphere has entirely altered these days, and people are now in competition with one another to advance in all fields. An increasingly effective method of analysis is data mining.**

**Main motive of educational data mining to empower the learning outcome from analyzing data that are collected in the teaching process. This process is very helpful for student to understand behaviours, learning pattern. Through this we get more personalized and efficient teaching methods.**

**Data mining that is known as machine learning, an algorithm is a collection of rules and formulas that are used for creating a model. Through algorithm analyze the data to find specific pattern and trends to create a model. Through number of iteration process, it used the analysis results to find best parameter to construction the mining model.**

**Today's world places a high value on higher education, not only for the advancement of the nation and society but also for the intellectual growth of the individual.**

**The proposed method analyzes student performance based on test-taking strategy, lunch choice, learning activities, parental education level, math, reading, and writing scores, as well as grade.**

**The suggested method makes use of a classification algorithm to direct them by showing them the areas in which they still need to improve in order to support a student's overall development. Every student will have access to all the necessary data through the proposed method.**

**In this paper, we create a model using the ensemble learning technique that is used to enhance the accuracy in order to we divide the students into groups according to their grades. It will also be helpful to enhance the results.**

***Index Terms*:- Orange, Ensemble, Student Performance analysis, Data Mining, Machine Learning Algorithms.**

## I. INTRODUCTION

Higher education has great significance in today's world, not only for the benefit of the country and society but also for the academic growth of the individual student. Data mining and its techniques are very useful to analysis and to enhance the student performance in different areas[1].

In simple terms student performance specify to how well students get their short-term and long term educational goals.

Through various perspective like final grade, grade point average (GPA) and future job opportunities educators assess student success.

The proposed method determines the performance of the students. Academic information includes learning activities, lunch preference, test-

taking tactics, math, reading, and writing scores, as well as grades. The collected data will be analyzed using data mining classification algorithms such as KNN, SVM, ANN, and Naive Bayes. The classification algorithm's output will be recognized as a grade. We can monitor student's strengths and weaknesses with the use of this grade, as well as identify areas where they can improve [2].

Ultimately, the most obvious ways to determine a student's performance are through their parental education level, learning activities, lunch choice, test-taking strategy, math score, reading score, writing score, and grade. In this research paper we used ensamble learning technique for developing precision so that we can classify the students on the basis of their grades.

**B.**

Machine learning is a part of artificial intelligence and computer science. Its main purpose is building a system that learn automatically from givan data and make decision according to data. Data mining and machine learning are intimately connected.

**B. Ensemble Machine Learning Technique:**

To enhance the prediction accuracy this study employs ensemble technique which uses multiple classifier's strengths and combine them instead of single classifier to more accurate classification result. This technique achieve better result than any individual model alone [3].

**C. Orange tool:**

Orange is a open source machine learning tool it gives visual programming interface for analysing data, data visualization and data modelling. Different type of widgets are available in orange such as data processing, machine learning, evaluation, add-ons that gives a respectable user experience.

## II. OBJECTIVE

- To create a more accurate model.
- To reduce the machine learning error rate.
- Successfully classifying students according to their grades.
- Developing precision using ensembling learning technique.
- To analysis of student academic performance
- Effect on student performance.
- What is machine learning?
- What is algorithm?
- What is Orange tool?
- To find the final result

## III. RELATED WORK

**A. Machine learning:**

**D. Algorithm:**

K- nearesrt neighbours(KNN) is a instance based algorithm that learns by comparing test data t 27 nearby tuple examples from given training set and it is used their labels for label prediction of new point.

**E. Support vector machine (SVM):**

SVM is a machine learning algorithm in data mining. It is a superwised learning method. It is find the best decision boundary for distributing the classes. It is used for classification and regration tasks [4].

**F. Neural networks:**

Neural Networks are powerful machine learning model for modelling complex relationship and gives accurate prediction. It is inspired from human brain structure and

function. It contain the inter connected node or neurons which process and transmit information.

**G. Adaboost:**

Adaboost( Adaptive Boosting) is a machine learning algorithm. This algorithm integrate multiple weak classifier into a single strong classifier. initialization

**H. Stacking:**

Stacking is a ensemble machine learning technique. It is also known as stacked generalization. It combines the multiple model strength for improving the prediction accuracy and reduce errors. Stacking is used for classification , regression, time series forecasting [5].

## IV. PROPOSED METHODOLOGY

In this research paper we used data set from kaggle.com this data set contain the student performance including their mathematics grade, demographical information. In this Data set include different type of column like gender, race/ethnicity, parental level of education, lunch, reading score, writing score etc.

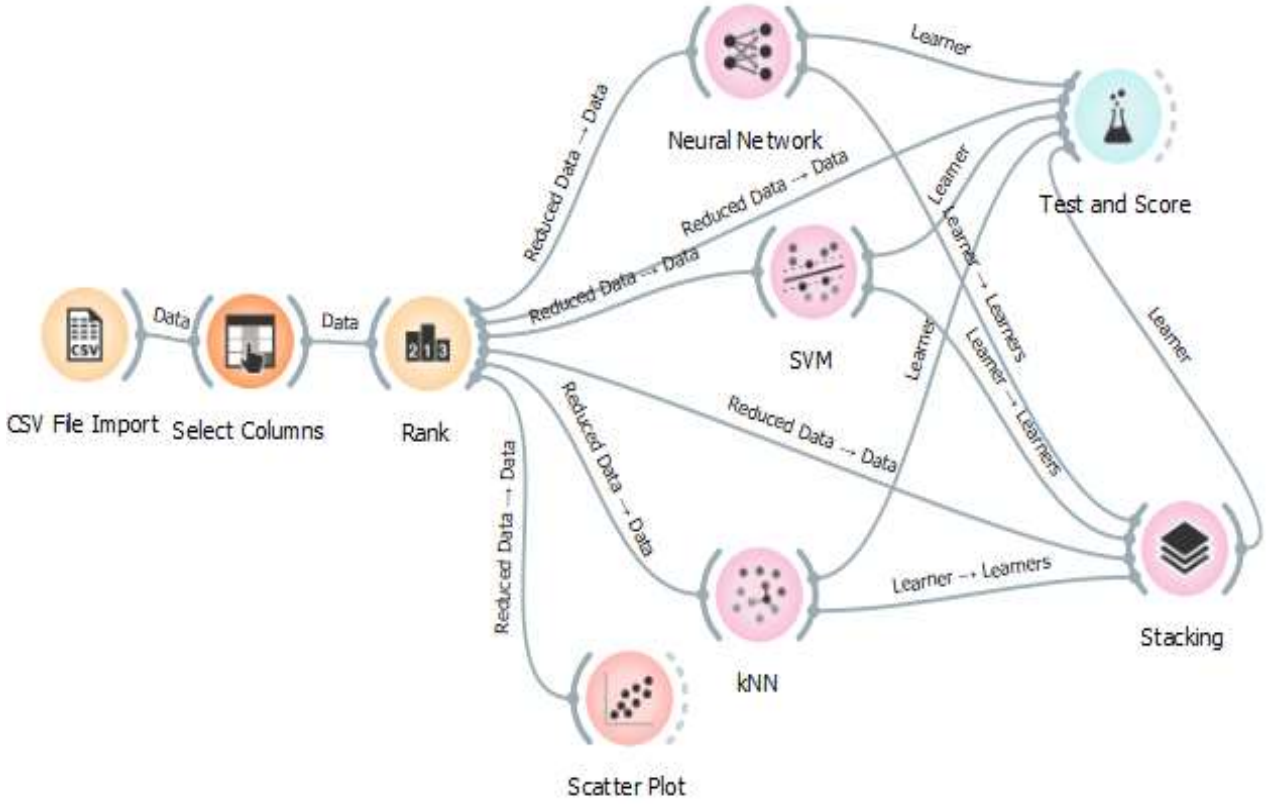


Figure I

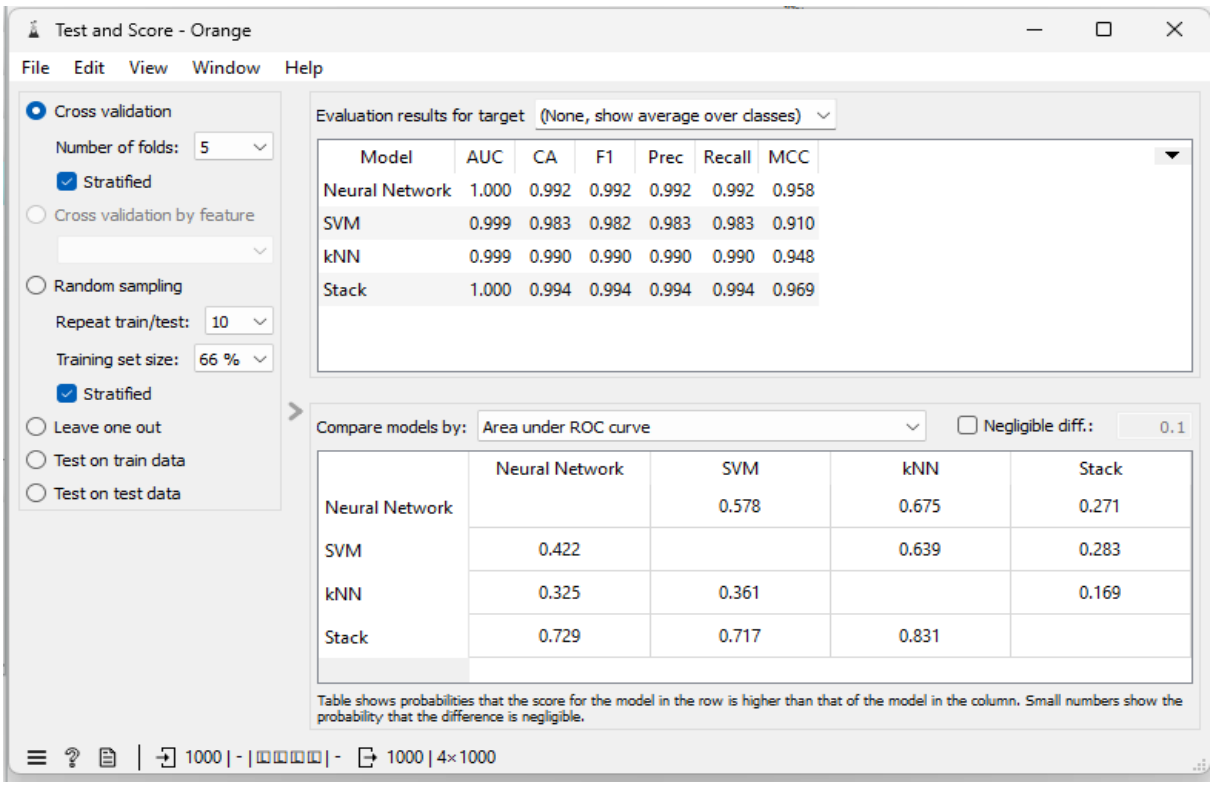


Table I

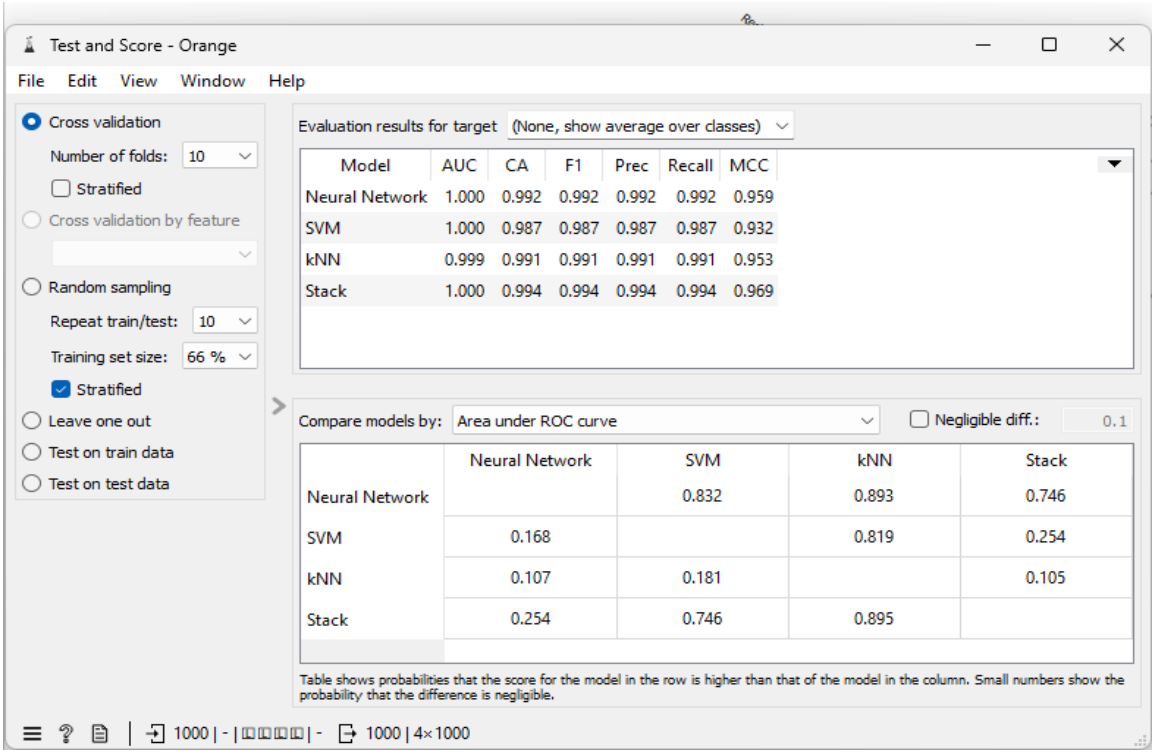


Table II

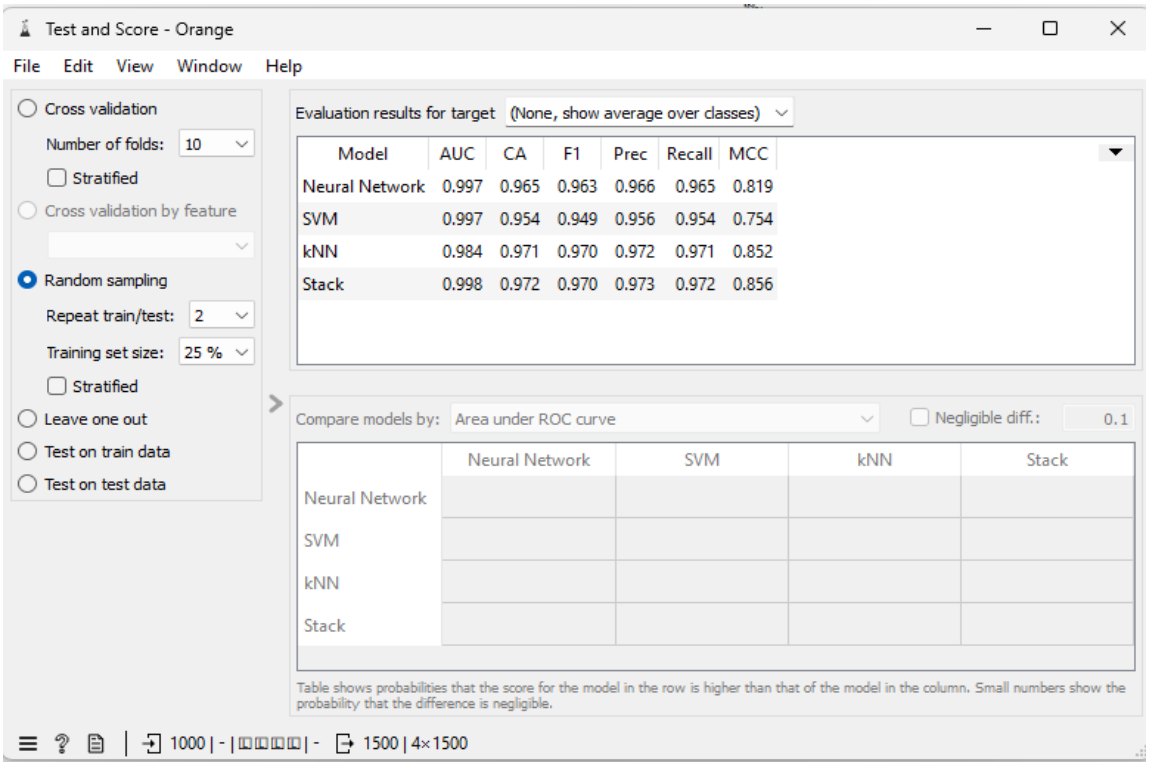


Table III

## V. RESULT ANALYSIS:

| Classifier | Cross validation | | Random sampling |
|---|---|---|---|
| | 5 fold | 10 fold | 2/25 |
| ANN | 0.992 | 0.992 | 0.966 |
| SVM | 0.983 | 0.987 | 0.956 |
| KNN | 0.990 | 0.991 | 0.972 |
| STACKING | 0.994 | 0.994 | 0.973 |

Table IV

## VI. CONCLUSION:-

We have got the highest percentage of accuracy while using stacking method of ensemble learning. In stacking we have stacked all the three model ANN, SVM, and KNN which giving respective accuracy percentages in 5 fold cross validation- 0.992, 0.983, 0.990, in 10 fold cross validation- 0.992, 0.987, 0.991, in Random sampling of 2/25 -0.966, 0.956, 0.972 and after stacking the stacked model gives in 5 fold cross validation- 0.994 and in 10 fold cross validation- 0.994 in Random sampling of 2/25 - 0.973 which is the highest among all.

## REFERENCES

[1] Zohair, L.M.A "Prediction of student's performance by modelling small dataset size." Int. J. Educ. Technol. High. Educ. Pp. 16- 27, 2019.

[2] Hellas, A., Ihantola, P., Petersen, A., Ajanovski, V.V., Gutica, M., Hynninen, T., Knutas A., Leinonen, J., Messom, C., Liao, S.N. "Predicting academic performance: A systematic literature review."

Conference on Innovation and Technology in Computer Science Education, Larnaca, Cyprus, pp.175-199, 2018.

[3] Ashraf M., Zaman M., and Ahmed M., “An Intelligent Prediction System for Educational Data Mining Based on Ensemble and Filtering approaches,” Procedia Comput. Sci., vol. 167-2020, pp. 1471–1483, 2020 .

[4] Chui K. T., Fung D. C. L., Lytras M. D. and Lam T. M., “Predicting at-risk university students in a virtual learning environment via a machine learning algorithm,” Comput. Human Behav, pp.105-112, 2018.

[5] Lynn N. D. Emanuel A W R, “Using Data Mining Techniques to Predict Students' Performance. a Review” Magister Informatika, Universitas Atma Jaya Yogyakarta, Indonesia, IOP Conf. Series: Materials Science and Engineering Vol.1096, 2021.

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# CFD Analysis of Fluid Flow and Heat Transfer in Microchannel Heat Sink for Electronic Application

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***Abstract*— In this research, a detailed computational analysis has been carried out to understand the behavior of heat transfer and fluid flow in microchannel heat sinks equipped with external micro inserts. These micro inserts are used to create artificial roughness, which helps in improving the thermal performance by enhancing turbulence. Over the years, several studies—both theoretical and experimental—have been conducted to develop efficient models for analyzing the hydraulic and thermal characteristics of fluid flow in microchannels. In recent times, the use of advanced fluids like nanofluids and hybrid heat sinks has become increasingly popular due to their improved heat transfer capabilities. In the present work, numerical simulations were conducted by taking into account key parameters such as the type of working fluid, the material of the heater, the arrangement of the test section, and the number of mini-channels. The simulation outcomes were carefully analyzed to identify which factors had the most significant impact on improving heat transfer. The simulations considered different volume fractions of nanoparticles, ranging from 1% to 5%. Key performance indicators such as the heat transfer coefficient, Nusselt number, pressure drop, Darcy friction factor, and thermal resistance were studied in the context of electronic cooling applications. The study was carried out using ANSYS FLUENT (version 19.2), where a finite volume method was applied. The flow conditions were assumed to be single-phase, laminar, incompressible, and steady, and the SIMPLE algorithm was used for solving the equations.**

***Index Terms* - *Hybrid heat sink, CFD modeling, Heat transfer.***

## I. INTRODUCTION

Heat sinks are one of the most commonly used solutions for managing heat in electronic systems. They help control the temperature of electronic parts, assemblies, and modules by increasing the surface area through the use of fins or pins. Over the past few decades, the use of pin fin heat sinks has grown rapidly due to rising heat generation in compact electronic devices. As modern electronics continue to become smaller and more powerful, they also produce more heat in limited spaces, which makes efficient cooling more important than ever. This has pushed engineers to explore more advanced and compact cooling options. One such innovation is hybrid heat sink technology, which has proven to be highly effective in cooling high-performance and space-constrained electronic components.

Hybrid heat sinks are now available in many sizes, designs, and materials to suit various needs. They usually consist of vertically placed round pins made from copper or aluminum, which stand out compared to the flat-fin designs of traditional heat sinks. The rounded, aerodynamic pins and their all-directional arrangement allow these heat sinks to dissipate heat more effectively into the surrounding environment. Because of their efficient heat transfer, hybrid heat sinks are now widely used in industries where managing high temperatures is a challenge.

Although hybrid heat sinks already offer excellent cooling, certain high-power applications still demand even better thermal management. To meet these needs,

advanced versions of hybrid designs have been developed. These newer models combine round pin structures with conventional pin fin heat sinks, and due to their enhanced materials and structure, they deliver even higher cooling performance.

Splayed hybrid heat sinks are a more recent advancement in the evolution of pin fin heat sink designs. Unlike traditional hybrid heat sinks that feature vertically straight pins, the pins in a splayed hybrid configuration gently bend outward. This outward bending increases the spacing between the pins, which helps the surrounding air to move in and out of the pin array more smoothly. This design allows better airflow without reducing the overall surface area available for heat dissipation. The benefit of wider pin spacing becomes especially noticeable at lower airspeeds, as weak air currents struggle to move through tightly packed pins. Thus, the improved airflow in splayed designs enhances performance under such conditions.

Hybrid pin fin heat sinks still use the same overall structure as standard pin fin models but differ in the choice of materials used for the base. In many standard hybrid versions, the base is made from aluminum or copper, often with a copper plate added through a reflow process. This mixed material base helps in better thermal conduction. In situations where airflow is limited, such as in natural convection or low-speed fan environments, the increased spacing between splayed pins can reduce thermal resistance by as much as thirty percent. Therefore, splayed pin configurations are particularly suitable for low or moderate airflow settings and applications relying on passive cooling.

As the need for compact and efficient cooling systems grows, hybrid technologies are gaining popularity among engineers and designers. These heat sinks are often placed directly on the heat-generating component to make the best use of the limited space available. For a hybrid heat sink to work effectively, it must spread the heat quickly and evenly across its base. If this doesn't happen, the areas farther from the heat source won't contribute to cooling at all. Compared to heat sinks made entirely of copper, hybrid models can offer almost the same heat dissipation capabilities while being much lighter. This is because copper is around 3.2 times heavier than aluminum. As a result, depending on the design, hybrid heat sinks can be significantly lighter than full copper models of the same size.

Hybrid heat sinks are especially useful for devices that have compact and highly localized heat sources. These types of components need larger heat sinks than their own size to manage the thermal load properly. Additionally, hybrid heat sinks are ideal for multi-device cooling setups, where one heat sink is used to cool several modules at once. This makes them a versatile and efficient choice for many modern electronic applications.

## II. State of the Art

Ameur carried out experimental studies to examine how well a pin-fin fan-sink system can manage heat. In their research, they tested pin-fins with different cross-sectional shapes—cylindrical, square, and diamond. Their findings showed that cylindrical pin-fins delivered the most effective overall performance in the fan-sink setup. Additionally, it was observed that as the pressure or fan power increases, or as the height of the fins increases, the thermal resistance of the heat sink decreases, which results in better cooling efficiency [1].

Anandan and Ramalingam performed a detailed review of existing literature related to high heat flux cooling methods used in electronic devices and components. They categorized the different cooling techniques into six main types: air-based cooling, liquid cooling, heat pipes, refrigeration-based cooling, thermoelectric systems, and cooling using phase change materials. This classification helps in understanding which method is more suitable for a particular application depending on the heat generation and space constraints [2].

Huang and colleagues conducted experimental work focused on horizontally oriented pin-fin structures. Their study explored how variations in pin-fin shapes and spacing affected heat transfer. They were able to identify an optimal pin-fin spacing arrangement that allowed air to flow effectively through the heat sink, maximizing the cooling rate. Their analysis also provided useful design guidelines that engineers can follow for better thermal performance [3].

Ismail and his research team used numerical simulations to understand how heat is transferred in heat sinks when cooled by air impingement, especially under turbulent flow conditions. They applied a standard turbulence model to estimate Reynolds stress accurately. Their results revealed that turbulent airflows significantly improve the heat dissipation capacity of the heat sink, confirming that turbulence can be a key factor in achieving efficient cooling in high-performance applications [4].

Lee et al. carried out a numerical study focusing on bubble formation and heat transfer during flow boiling inside a microchannel equipped with fins. Their research examined how different fin parameters—such as fin height, spacing, and length—affected the boiling process within the microchannel. The simulation results revealed

that when the contact area among liquid, vapor, and solid surfaces increased due to the addition of fins, there was a noticeable rise in boiling heat flux, enhancing the overall thermal performance of the system [5].

Maciejewska et al. performed experimental tests comparing the thermal efficiency of various fin types, including straight fins and pin fins with different cross-sectional shapes such as circular, square, and elliptical [6]. To ensure a fair comparison, the tests were conducted under the same average airflow velocity and pressure drop conditions. Based on thermal resistance outcomes, they recommended the use of elliptical pin-fin heat sinks for high-velocity situations, while circular pin-fin heat sinks were considered more efficient at medium airflow speeds [7].

Piasecka et al. contributed significantly by comparing heat transfer characteristics based on the positioning of heat sinks—horizontal versus vertical. Their numerical results showed that circular pin-fin heat sinks generally offered better heat transfer than square ones, while elliptical fins outperformed traditional flat plate fins in all tested orientations [8]. They further observed that elliptical fins were more effective in low-pressure-drop conditions, where minimal pumping power was required, whereas circular pin-fins performed best when operating at higher pressure drops and pumping energy [9].

In another study, Piasecka et al. explored how a corrugated baffle placed inside a rectangular channel heat exchanger influences the flow of fluid and heat distribution. The researchers analyzed the geometric layout of the system and applied computational tools to assess the outcomes. Trefftz Functions, along with ADINA software, were utilized to calculate the heat transfer coefficients and study the thermal patterns within the exchanger setup [10].

Vlachou et al. conducted a review of different channel heights and active methods that help improve heat transfer efficiency in microchannels. Their work highlighted how certain geometric designs, like offset fan-shaped and triangular-shaped re-entrant cavities, can significantly enhance the rate of heat transfer. This review drew the interest of many researchers toward exploring thermal behavior in microchannel systems [11].

Wajs et al. carried out experimental research on a single-phase fluid flow inside a single microchannel. Their results showed that the measured friction factor closely matched the theoretical values. However, when similar experiments were performed on multiple microchannels, the outcomes did not always align with the expected theoretical results regarding both flow transition and friction factor. It was also found that the heat transfer and fluid flow characteristics were strongly influenced by the shape and design of the microchannel inlet. Inlets with shapes such as rectangular, triangular, or trapezoidal, and even those with re-entrant cavities, affected the internal flow behavior and heat dissipation capability of the microchannels [12].

In another study, Zhuan and Wang used numerical simulations to investigate boiling flow in a circular microchannel using two refrigerants—R-134a and R-22. They employed the Volume of Fluid (VOF) method to track the liquid-vapor interface throughout the boiling process. Their simulation outcomes, including the flow pattern at the outlet of the microchannel, showed good agreement with what had been observed in experimental studies. Additionally, the shape and peak of the bubble frequency distribution at the outlet predicted through the simulations closely resembled those found in actual experiments, thus validating their numerical model [13].

## III. Methodology

The structural design of the in-line hybrid heat sink is illustrated in Figure 1, where the direction of airflow moves along the x-axis. In this setup, the base plate receives a constant heat flux, while the top surfaces of the pins are treated as adiabatic, meaning no heat is lost from them. The average temperature measured along the surface of the pin at any position x is denoted by Tw(x). The base of the heat sink, which comes in direct contact with the heat-generating component, is modeled to receive a continuous and uniform heat input across its surface. The temperature of the heat source at the bottom of the base plate is referred to as Ts.

To analyze this thermal and flow behavior accurately, time-independent (steady-state) fluid flow equations that incorporate the effects of turbulence are used. Since the focus is on heat and fluid transfer, and not on the conversion of mechanical energy to heat within the fluid, the viscous dissipation term is ignored in the calculations. As a result, the fundamental equations that describe fluid flow—originally represented as Equations 1 to 6—are adjusted accordingly to reflect these simplifications and to align with the specific conditions of this hybrid heat sink model.

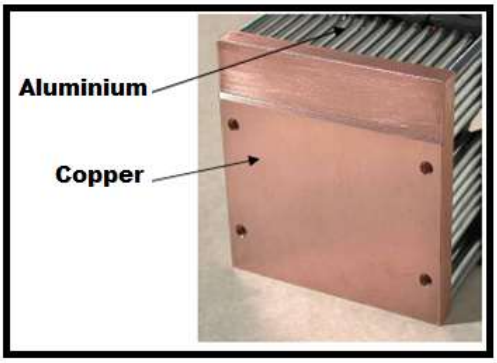


Fig : I Hybrid Heat Sink

*X* axis-momentum

$$\nabla.(\rho xV) = -\frac{\delta p}{\delta x} + \frac{\delta \tau_{xx}}{\delta x} + \frac{\delta \tau_{yx}}{\delta x} + \frac{\delta \tau_{zx}}{\delta x} + S_{Mx} \quad \ldots 1$$

Y axis-momentum

$$\nabla.(\rho xV) = -\frac{\delta p}{\delta y} + \frac{\delta \tau_{xy}}{\delta y} + \frac{\delta \tau_{yy}}{\delta y} + \frac{\delta \tau_{zy}}{\delta y} + S_{My} \quad \ldots 2$$

*Z* axis-momentum

$$\nabla.(\rho xV) = -\frac{\delta p}{\delta z} + \frac{\delta \tau_{xz}}{\delta z} + \frac{\delta \tau_{yz}}{\delta z} + \frac{\delta \tau_{zz}}{\delta z} + S_{Mz} \quad \ldots 3$$

Mass

$$\nabla.(\rho V) = 0 \quad \ldots 4$$

Energy

$$\nabla.(\rho hV) = -p\nabla.V + \nabla.(k_{eff}\nabla T) + S_h \quad \ldots 5$$

Equation of state

$$p = \rho RT \quad \ldots 6$$

## IV. CFD ANALYSIS

In this study, a fully three-dimensional, incompressible, and steady-state model was developed to analyze the performance of a hybrid heat sink made of aluminum and copper, using water-based hybrid nanofluid as the working fluid. For numerical simulations, ANSYS FLUENT 19.2—a widely used computational fluid dynamics (CFD) tool—was employed. The simulation process began with the pre-processing stage, during which a computational mesh was created using tetrahedral elements. In order to accurately capture the thermal and velocity gradients in critical regions, the mesh was carefully refined and expanded in high-gradient areas.

A discrete scheme based on the SIMPLE (Semi-Implicit Method for Pressure-Linked Equations) algorithm was applied, incorporating a first-order upwind method for solving the flow equations. Depending on the geometry used, a fine mesh with up to 346,824 elements was generated to ensure solution accuracy. To determine the temperature distribution and velocity field, the governing momentum and energy equations were solved iteratively. Initially, low values for relaxation factors were applied to maintain numerical stability, and these were gradually increased to accelerate the convergence of the solution.

The simulation results were grid-independent, well-structured, and reliable. To validate the numerical convergence, two separate tolerance levels were compared, based on the decrease in residual values. The solver was run until the residuals were reduced by an additional order of magnitude, allowing a higher number of iterations to improve solution quality. This ensured that the computed results remained unchanged in further iterations, confirming numerical convergence.

A standard practice followed during simulation was to track scalar properties, such as temperature, along with residual plots. When these scalar values remained constant over successive iterations, it was concluded that the solution had reached convergence, as shown in Figure 2. Furthermore, the cooling performance graph displayed in Figure 3 clearly indicated that the hybrid heat sink operated efficiently, successfully maintaining effective electronic cooling through the use of water-based hybrid nanofluids and optimized heat sink geometry.

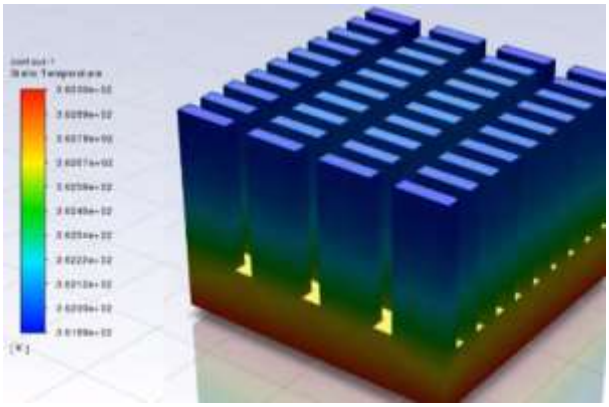

Fig :II Simulation of Cooling in hybrid sink

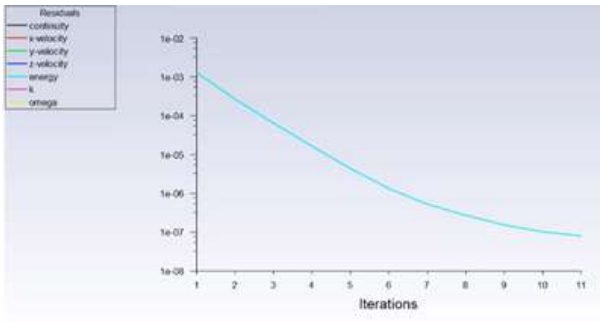


Fig b: III Simulation of Energy level during cooling

## V. FINDINGS AND ANALYSIS

The findings obtained through CFD simulations, as illustrated in Figures 2 and 3, clearly highlighted the superior thermal performance of the aluminum-copper hybrid heat sink. This hybrid design exhibited lower thermal resistance and enhanced heat dissipation capabilities, making it a strong candidate for applications that demand efficient thermal management. In high-performance systems where extreme cooling is necessary, the hybrid heat sink structure proved to be highly effective in minimizing thermal resistance.

Another important use-case for this type of heat sink is in applications where the heat sink is significantly larger than the component generating the heat. In such cases, the high thermal conductivity of copper becomes essential, particularly for transferring heat rapidly from the base plate to the fins, enabling fans placed further from the heat source to function efficiently. However, a notable limitation of using copper pin-fin heat sinks is their relatively higher cost and heavier weight in comparison to aluminum alternatives.

To address this issue, hybrid heat sinks provide an excellent compromise. As shown in Table 1, comparative temperature readings for aluminum, copper, and hybrid heat sinks—tested with both standard and splayed structures—demonstrated that hybrid models delivered performance close to that of copper, but with the added benefit of being lighter in weight. This makes them a more practical and cost-effective solution, combining the thermal efficiency of copper with the lightweight nature of aluminum. Thus, hybrid heat sinks emerge as a balanced and reliable option for advanced electronic cooling applications.

Table 1 Comparative Temperature Cooling

| | Al | CU | Hybrid |
|---|---|---|---|
| Standard | 338 | 329 | 321 |
| Splayed | 331 | 318 | 314 |

## VI. CONCLUSION

The concept of a hybrid heat sink, which integrates a plate-fin design with immersion-based electronic cooling, has been explored to enhance thermal management performance. A detailed computational study was carried out to assess its efficiency, taking into account the role of natural convection within the surrounding fluid medium. This rigorous analysis was also compared with simplified models to evaluate differences in accuracy and effectiveness. One of the primary focuses of the study was to understand how well the hybrid heat sink performs under changing thermal load conditions over time. The results indicated that it is capable of functioning reliably even when cooling requirements vary. Based on the computational findings, practical and easy-to-follow design guidelines were formulated. These guidelines offer recommendations concerning the optimal geometry and material properties required to achieve the best cooling performance using a hybrid heat sink approach. This makes the concept not only technically effective but also convenient for practical engineering applications.

## VII. REFERENCES


[1] Ameur H.,“Effect of corrugated baffles on the flow and thermal fields in a channel heat exchanger”, J. Appl. Comput. Mech., Vol. 6, pp. 209–218,2020.

[2] Anandan S. S., Ramalingam V.,“Thermal management of electronics: A review of literature”, Therm. Sci. Vol. 12, pp. 5–25, 2008.

[3] Huang H., Borhani N., Thome J.R.,“Experimental investigation on flow boiling pressure drop and heat transfer of R1233zd(E) in a multi-microchannel evaporator”, Int. J. Heat Mass Transf., Vol. 98, pp.596–610, 2016.

[4] Ismail M., Fotowat S., Fartaj A.,“Effect of Channel Size on Heat Transfer and Pressure Drop in Thin Slabs Minichannel Heat Exchanger”, Int. J. Mech. Eng. Mechatronics, Vol. 2, pp. 33–42, 2014.

[5] Lee W., Son G., Yoon H.Y.,“Direct numerical simulation of flow boiling in a finned microchannel. Int. Commun”, Heat Mass Transf., Vol. 39, pp. 1460–1466, 2012.

[6] Maciejewska B., Łabędzki P., Piasecki A., Piasecka M.,“Comparison of FEM calculated heat transfer coefficient in a minichannel using two approaches: Trefftz base functions and ADINA software”, EPJ Web Conf., Vol. 143, pp. 02-7, 2017.

[7] Maciejewska B., Piasecka M., Piasecki A.,“The Study of the Onset of Flow Boiling in Minichannels Time-Dependent Heat Transfer Results”, Heat Transf. Eng., Vol. 43, pp. 1–15, 2021.

[8] Piasecka M., Strąk K., Maciejewska B.,“Heat transfer characteristics during flow along horizontal and vertical minichannels”, Int. J. Multiph. Flow, Vol. 137, 2021.

[9] Piasecka M., Strąk K.,“Characteristics of Refrigerant Boiling Heat Transfer in Rectangular Mini-Channels during Various Flow

Orientations", Energies, Vol. 14, pp. 48-51, 2021.
[10] Piasecka M., Maciejewska B., Łabędzki P.,"Heat Transfer Coefficient Determination during FC-72 Flow in a Minichannel Heat Sink Using the Trefftz Functions and ADINA Software", Energies, Vol. 13, pp. 664-667, 2020.
[11] Vlachou M. C., Lioumbas J. S., David K., Chasapis D., Karapantsios T.D.,"Effect of channel height and mass flux on highly subcooled horizontal flow boiling", Exp. Therm. Fluid Sci., Vol. 83, pp. 157–168,2017.
[12] Wajs J., Kura T., Mikielewicz D., Fornalik-Wajs E.,Mikielewicz J.,"Numerical analysis of high temperature minichannel heat exchanger for recuperative microturbine system", Energy, Vol. 238, 2022.
[13] Zhuan R., Wang W.,"Flow pattern of boiling in micro-channel by numerical simulation", Int. J. Heat Mass Transf., Vol. 55, pp. 1741–1753, 2012.

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# भीष्म साहनी के उपन्यास और भाषा विधान

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## सारांश

**स्वातंयोत्तर साहित्यकारों में भीष्म साहनी का विशिष्ट स्थान रहा है एक रचनाकार के रूप में उत्कृष्ट भाषा चयन ही इनके रचनात्मक कौशल को दर्शाता है। इनके अधिकतर कथानक देश की आजादी के आसपास की कहानी को लेकर बुना गया है । अतः तात्कालिक परिवेश को ध्यान में रखते हुएं इन्होनें भाषा का विधान किया है। साहित्यकार के रूप में किसी व्यक्ति के लिए आवष्यक है कि वह पात्र, चरित्र एवं कहानी के परिदृश्यों के अनुरूप भाषा का प्रयोग करे। क्यों कि भाषायी प्रस्तुती ही कथ्य को सजीव बनाकर भावात्मक रूप से प्रेरित करता है। भाषा ही वह माध्यम है जो पाठक के मानसिक पटल पर अपनी अमिट छाप छोड़ जाता है। चूंकि भीष्म जी ने बचपन से ही अनेक भाषाओं में शिक्षा प्राप्त की एवं घर में पंजाबी भाषा का प्रभाव रहा जो उन्हे आगे चलकर बहुभाषाविद् लेखक की श्रेणी में खड़ा करता है।भाषायी अनुशासन ही कथ्य को सरस ,सुबोध प्रभावशाली बनाता है, जो भीष्म जी की रचनाओं सहज ही दृष्टिगत होते है। प्रस्तुत शोध पत्र में भीष्म साहनी के उपन्यास और भाषा विधान पर विचार किया गया है।**

**मूलशब्दः– भीष्म साहनी, भाषा विधान,**

## I.प्रस्तावनाः–

भाषा मनुष्य की भावना को अभिव्यक्त करने का सशक्त माध्यम है। भाषा के बिना साहित्य रचना की कल्पना संभव नहीं हैं, जबकि शैली उसे प्रस्तुत करने का तरीका है। कथाकार अपने भावों

एवं विचारों को भाषा के माध्यम से संप्रेशित करता है। एक सकल कथाकार के रूप में भीष्म साहनी ने सदैव ध्यान रखा की भाषा ऐसी सरल हो कि उनके भावाभिव्यक्ति पाठक को हृदयंगम हो सके। भारतीय जीवन का कंठहार बन सके। वे प्रेमचंद की परम्परा को आगे बढ़ाने वाले उपन्यासकार रहे है। उन्हें स्वातंत्रयोत्तर काल का प्रेमचंद माना जाता है। भीष्म साहनी ने अपने उपन्यासों में पात्र अनुकूल भाषा के विविध रूपो तथा बोलियों का प्रयोग किया है, जो रचना कि स्वभाविकता को बनाए रखने के लिए आवश्क होता है। उन्होनें हिन्दी ,उर्दू, अंग्रेजी, संस्कृत के साथ तत्सम, तद्भव और ग्रामीण शब्दो का बखूबी प्रयोग किया है।

## II.विविध भाषाओं का प्रयोग

एक साहित्यकार पर उसके परिवेश का प्रभाव स्पष्ट झलकता है जो उसकी रचनाओं में सहज ही दृष्टिगत होते है, भीष्म जी के परिवेश की भाषा पंजाबी कम उर्दू ज्यादा थी इसलिए उन्होने अपने उपन्यासों में उर्दू का प्रयोग अधिक किया है मय्यादास की माड़ी का उदाहरण दृष्टव्य है " अमलदारी बदल जाने का अर्थ होता है कल तक जो दुश्मन थे,वे दोस्त बन जाते है। कल जो भगोड़े थे, वे सिपहसालार बन जाते है। जो काला था वह उजला लगने लगता है, और सैनिक ? सैनिक नहीं बदलता, वह केवल लड़ता है, मरता है, जान हथेली पर रखकर जंग के मैदान में उतरता है, अपने जौहर दिखाता है, क्योकि वह अपने सालार के हुक्म पर मर मिटने की कसम खाए होता है "[1]। भीष्म साहनी ने तमस में भी उर्दू, पंजाबी शब्दो का सजीव प्रयोग किया है "हमारा अंग्रेज ने क्या बिगाड़ा है ओए ? हिन्दु मुसलमान की अदावत पुराने जमाने से चली आ रही है। काफिर –काफिर है और जब तक दीन पर ईमान नहीं लाएगा, वह दुश्मन है। काफिर को मारना सवाब है "[2]। जे जिन्दगी रही तॉ तेरा एहसान", "मै के जाना भैड़, अपना–अपना नसीबा। चहवाँ पासे आग लगी है

"[3]। साहित्यकार के विविध विचारो, भावों और संवेदना की अभिव्यक्ति के क्रम में भाषा का रूप भी बदल जाता है। कुंतो में रामनाथ जयदेव को सीख देते हुए संस्कृत का श्लोक सुनाता है–

"शुरोऽसि कृत विद्योऽसि दर्शनीयोऽसि पुत्रक,
यास्मिन कुले त्वमुत्पन्नः सिंहस्तत्र न हन्यते" [4]।

इस तरह उन्होनें कही चुटीली शैली का प्रयोग किया, जो मजाक के हद तक पहुंच जाता है। भाषा को संप्रेषणीय सरल एवं मनोरंजक बनाने के लिए उन्होनें काव्यात्मक भाषा तो कभी गीतो की पंक्तियोंका सहारा लिया है। इनके लगभग सभी उपन्यासों में गीत की पंक्तियां मिलती है।

1–''किधरो आइयां नी बेड़िया,सौदागर रांझा
किधरो आए मल्लाह, नी हीरे !
पूरवो आइयां नी बेड़िया, सौदागर रांझा
पच्छमो आए मल्लाह ,नी हीरे" [5]।

2–फुलो में हम आते है आते है
ठड़ी मौसम में, ठंडी मौसम में" [6]।

3–सुनो हिन्द के रहने वालो
सुनो, सुनो
ये किन बच्चों की चीखे है,
किस दुखिया मां की आंखे है" [7]।

भीष्म साहनी के उपन्यासों की भाषा में कहीं संजीदगी तो कही अल्हणपन दिखाई देता है। बसंती का "तो क्या बीबी जी" कहकर हंसना उसे मुक्त करता है, हर चिंता और दुस्वप्न से। इस प्रकार उनके सादगी में भी कलात्मक वक्रता और गतिशील तरलता देखने को मिलता है। उन्होनें उर्दू मिश्रित हिन्दी एवं देशज शब्दो का भी प्रयोग किया है" चूरन बेचते है तभी थोडा देश का काम भी कर पाते है, सहदेव बाबू, अठ्न्नी रोज मिल जाती है, आटा–दाल की जुगत हो जाती है।पर ससुरा गला बैठ जाता है। किसी जलसे, जुलूस की मुनादी घंटो करते रहो, गला नहीं बैठता। सारा शहर घूम आओ, गला नहीं बैठता। पर यह दो जगह चूरन की हंक लगाओ तो ससुरी गले में खर्र–खर्र होने लगती है" [8]।

कहानी की वास्तविक चित्रांकन के लिए इन्होनें अंग्रेजी के शब्दों का भी प्रयोग किया है, जो पात्र के चरित्र चित्रण में सहायक हो, तमस में लीजा कहती है " टेक आफ यूअर कोट बाबू " शो मी यूवर थ्रेड" [9]। वही निम्नवर्गीय विडम्बना को उजागर करते भाषा का स्वरूप दृष्टव्य है।" हमारे भाग खोटे थे, हम मिस्त्री–मजूर बने, पर भाई, बोलो तो मीठा" [10]। जिस रचना में भाव एवं भाषा सटीक बैठता हो वह रचना श्रेष्ठ मानी जाती है। कड़िया उपन्यास में प्रमिला का यह कथन " तुम पप्पु को मुझे दे दो। मै जंहा कहोगे चली जाउंगी, मेरा साया भी तुम्हारे घर पर नहीं पडेगा,सौगंध खाकर कहती हूं। मैं तुमसे कुछ मांगूगी भी नहीं" [11]। प्रमिला के गहरे वात्सल्य भाव को उजागर करते है। तो कही व्यंग का सहारा लेते है। नाटा महेन्द्र से कहता है,तू तो नई रोशनी का आदमी है ना, कहकर रूढ़ीवादी धारणा को व्यक्त करते है। इनके उपन्यासों में ग्रामीण एवं नगरीय जीवन दोनों को ही समान रूप से स्थान दिया गया है। जहां शहरी शिक्षित पात्रो कि भाषा हिन्दी, अंग्रेजी मिश्रित रहीं है, वही ग्रामीण जीवन में सादगी पूर्ण भाषा के दर्शन होते है।

"यही तो ताल था बहूरानी!गड्ढ़ा खुदा है ना ? और किनारो पर जो कटाई नजर आती है ना, वे सीढियां बनने वाली थी। बन जाता तो, खूब लम्बा –चौड़ा सरोवर होता । मालकीन के दिल की साध दिल में ही रह गई" [12]।

भीष्म साहनी के ज्यादातर उपन्यास में मध्यम वर्गीय परिवार की त्रास और विडम्बनाओं के ईर्द–गिर्द घूमती है, सामान्य वर्ग की भाषा सीधी –साधी होती है, न ही इनकी भाषा सौन्दर्य बोधक होती है, न व्यंग्य परक। इसी परिप्रेक्ष्य में इन्होनें मुहावरे एवं सुक्तियों का प्रयोग किया है, जो पाठक को बोधगम्यता तक पहुचाने में सहायक होता है। और कहानी की स्वभाविकता बनी रहती है। कौवे का कांव –कांव करना जो किसी के आने का संदेश देता है। तो सांस्कृतिक बदलाव एवं बदलते परिवेश को" नई पौध की हवा लगना" के रूप में निरूपित करता है जंहा कहानी में पात्र को संवेदना के धरातल पर खड़ा करते है वंहा सुक्तियों को आधार बनाकर व्यंग्य का निरूपण आवश्यक हो जाता है। यहा कुछ सुक्तियों के उदाहरण देखने योग्य है– तुम्हारे भाग्य अच्छे थे, न तो सलीका न तमीज ,

औरत ही औरत की दुश्मन होती है, प्रतिभा के सामने संभावनाओं के द्वार खुले रहते है।

भाषा अपने अंदर काफी कुछ संजोए होती है, भाव कला और भाषा का संबंध अटूट होता है इसलिए वह भाषा कभी शिथिल नहीं हो सकती, जो भावात्मक धरणी पर चलती हो। अतः सार्थक साहित्यिक भाषा वही है जो उसे जीवंत बनाएं और भावात्मक प्रक्रिया में ढली होने के बाद भी जन सामाज की उपज हो और उसे अपना स्रोत सूचित ही न करता हो, बल्कि घनिष्ठता पूर्वक संबंधित हो। मय्यादास की माड़ी का वाक्य विन्यास दृष्टव्य है–

"आओं रामदास सुबह – सवेरे कैसे आना हुआ।

"मंडी की तरफ जा रहा था। मैने सोचा दीवान जी के दर्शन करता चलूं। सब सुख सांद है ना ? [13]।

## III. बिम्ब एवं प्रतीक योजना

साहित्य में लेखक जिस परिस्थिति को अपनी कहानी का आधार बनाता हैं उसकी प्रतीति पाठको का होना आवश्यक होता हैं, नही तो भाषा का महत्व ही क्या है ? तमस में जहां सांप्रादायिकता एवं धर्मांधता के तले जल रहे देश के वातावरण में तामसिक शब्दो का भंडार है, तो मध्यवर्गीय चेतना के प्रतीक कुंतो है। इसमें मध्यम वर्गीय लोगो की जीवन शैली के तहत् प्रोफेस्साब की शैली में दार्शनिकता के पुट दिखाई पड़ते है। इसके साथ ही भीष्म साहनी ने भावो को चित्रवत् प्रकट करने के लिए उपमानो के माध्यम से बिम्बो का विधान भी किए तो कही प्रतीक योजना का।

बिम्ब का उदाहरण दृष्टव्य है–

"निर्जन सपाट मैदान में लहलहाते उद्यान जैसा।"

"कभी वहजल से फेकी हुई महली जैसी महसूस करती।"

"कभी लगता जैसे नये कोपले फूट रहे थे।"

प्रतीक योजना का उदाहरण दृष्टव्य है–

"उसके शरीर में तड़पती मछली की तरह लहर दौड गया।"

"बडे भाई पांचो भाइयों में धर्मराज युधिष्ठिर थे।"

"सभी भाई भद्र समाज के स्तम्भ नजर आ रहे थे।"

इस प्रकार उन्होने अपनी रचना में युनीन संदर्भ को ध्यान में रखते हुए देश, काल, चरित्र के अनुरूप भाषा का प्रयोग किया है, और कहानी की रसात्मक को बनाए रखकर बोझिल होने नहीं दिया। इनकी यहीं विशेशता इन्हे उपन्यासकारों की श्रेणी में पृथक पहचान देती है।

## IV. निष्कर्ष

भीष्म जी के उपन्यास सामाजिक यथार्थ को प्रस्तुत करने वाले कालजयी उपन्यास है" जहां उन्होने विभिन्न सामाजिक परिवेश को मूर्तता प्रदान की है, किसी भी परिवेश के चित्रण में भाषा विधान ही, उसे कलात्मक ढंग से पाठक के मनोभाव में स्थापित करता है। भीष्म साहनी की कहानी सीधी सपाट रेखा पर दौड़ती है, उनकी भाषा शब्दाडम्बर से दूर रहती है, परन्तु कथ्य की स्वभाविकता को बनाएं रखने के लिए उन्होने विविध भाषा शैली का सहारा लिया है। वे सदैव ही अपने उपन्यास में पात्रानुकूल, प्रसंगानुकूल भावानुकूल भाषा का चयन किया, जो उनके कथ्य सजीवता प्रदान करता है। इसके लिए उन्होन हिन्दी, उर्दू, पंजाबी, संस्कृत, देशज,तत्सम्–तद्भव आदि अनेक भाषाओ की तहरीज दी है। सारांश यह कि इन्हीं विशेषताओं के कारण भीष्म साहनी की भाषा सरल, सुबोध, स्पष्ट, भावाभिव्यंजक होकर लोकप्रिय बन सकी, जो इन्हें श्रेष्ठ रचनाकार के रूप में प्रतिष्ठित करता हैं।

## संदर्भ


[1] साहनी भीष्म, ''मय्यादास की माड़ी'' दूसरा संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ136,2015।

[2] साहनी भीष्म, ''तमस'' सैतीसवां संस्करण, राजकमल प्रकाशन नई दिल्ली, पृष्ठ–217, 2020।

[3] साहनी भीष्म, ''तमस''सैतीसवां संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ–242, 2020।

[4] साहनी भीष्म,''कुंतो'' तीसरा संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ–32,2016।

[5] साहनी भीष्म, ''मय्यादास की माड़ी''दूसरा संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ–274,2015।

[6] साहनी भीष्म, ''झरोखे'' सातवां संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ–11,2016।

[7] साहनी भीष्म, ''कुंतो''तीसरा संस्करण,राजकमल प्रकाशन नई दिल्ली,पृष्ठ–306, 2016।

[8] साहनी भीष्म, ''कुंतो''तीसरा संस्करण, राजकमल प्रकाशन नई दिल्ली, पृष्ठ–266, 2016।

[9] साहनी भीष्म, ''तमस''सैतीसवां संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ–104,2020।

[10] साहनी भीष्म,''बंसती'' तेरहवां संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ–9,2021।

[11] साहनी भीष्म,''कड़िया'' चौथा संस्करण, राजकमल प्रकाशन नई दिल्ली,पृष्ठ–125,2016।

[12] साहनी भीष्म, ''मय्यादास की माड़ी''दूसरा संस्करण, राजकमल प्रकाशन नई दिल्ली, पृष्ठ–89, 2015।

[13] साहनी भीष्म, ''मय्यादास की माड़ी''दूसरा संस्करण, राजकमल प्रकाशन नई दिल्ली, पृष्ठ–19–20, 2015।

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# The Impact of Early Education on Student Entrepreneurship: From Classroom to Startup

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***Abstract*** **In the quickly changing economic and technical environment of today, encouraging entrepreneurial skills from an early age is seen to be crucial for innovation and long-term success. This study looks at how kids' development of entrepreneurial abilities and aspirations is impacted by early educational exposure and classroom-based entrepreneurial activities. Based on data gathered from 100 students in Bilaspur using descriptive analysis, linear regression, and Pearson correlation, the results show no connection between entrepreneurial skills and early education. Nonetheless, it was found that students' entrepreneurial ambitions were significantly impacted by classroom-based entrepreneurial activities. The study provides information about successful teaching strategies that might motivate aspiring business owners.**

**Index terms-Entrepreneurial Education, Early Learning, Innovation, Student Entrepreneurship, Classroom Activities, Skill Development.**

## I. INTRODUCTION

In a time of swift technological progress and changing economic conditions, entrepreneurship has become a vital force behind innovation, job creation, and sustainable growth. In light of this, educators and legislators are placing a greater emphasis on incorporating entrepreneurship education into the curriculum from an early age. The cognitive, social and emotional abilities needed for entrepreneurial thinking—such as creativity, critical thinking, problem-solving, risk-taking and resilience—are shaped in large part by early education.

The study "The Impact of Early Education on Student Entrepreneurship: From Classroom to Startup" aims to investigate how students' development of entrepreneurial abilities and aspirations is influenced by their exposure to entrepreneurial concepts and activities during their primary and secondary school years. It looks into the relationship between early educational interventions and likelihood that students will start their own business in the future. The study aims to uncover best practices and barriers in fostering an innovative culture from an early age by looking at curriculum frameworks, instructional strategies, and school environments that support entrepreneurship.

The research's importance stems from its capacity to influence educational policy and practice, motivating establishments to create learning opportunities that transcend conventional academics and equip students to become future entrepreneurs and change agents.

## II. Literature Review

Fayolle and Gailly (2015) highlights how favorable attitudes and aspirations for entrepreneurship are fostered by early entrepreneurial education. According to the study, pupils who were exposed to entrepreneurship earlier in life were more inclined to think of it as a feasible career path.[1]

Jones and Iredale (2010)demonstrates how project-based learning and curriculum that emphasizes creativity may help elementary schools develop the fundamental entrepreneurial mindsets that students need to succeed.[2]

Mwasalwiba (2010)examined a number of entrepreneurial programs and discovered that introducing entrepreneurship into early childhood education aids in the development of soft skills such as risk assessment, leadership, and decision-making. [3]

Rae (2006) argues that experiential and reflective learning approaches are the most effective, and examines how the educational environment in schools greatly influences the development of entrepreneurial competencies. [4]

Craft (2005) contends that fostering creativity at a young age through educational methods that promote curiosity and varied thinking is essential to entrepreneurship. [5]

Lüthjeand Franke (2003) Students' entrepreneurial tendencies are greatly impacted by early parental and teacher support, particularly when it is connected to official curriculum. [6]

Neck and Greene (2011) stress that from the very beginning of school, entrepreneurship should be taught as a dynamic, action-oriented activity integrated into real-world problem-solving rather than as a static subject. [7]

Nabi et al. (2017)demonstrates that kids who were taught about entrepreneurship in their early school years exhibited more entrepreneurial behavior as adults. [8]

## III. Objectives Of The Study

1. To investigate how early educational interventions influence the development ofchildren’s entrepreneurial abilities.
2. To examine the connection between students desire to pursue entrepreneurship as a career and classroom-based entrepreneurial activity.

## IV. Hypotheses

1. H01: Students' development of entrepreneurial skills and early educational exposure do not significantly correlate.
2. H02: Students' intention to become future entrepreneurs is not substantially impacted by classroom-based entrepreneurial activities

## V. Methodology

This study examined the impact of early childhood education on the development of entrepreneurial skills and attitudes among students in the Bilaspur area using descriptive research approach.

Students from junior colleges and upper primary and secondary schools in the Bilaspur district make up the target population. Using an initial random sampling technique, a sample size of 100 students was selected to ensure representation actoss: Public and private educational institutions. .Both urban and rural areas Secondary (Classes 9–10), Higher Secondary (Classes 11–12), and Primary (Classes 6–8)

A structured questionnaire with a 5-point Likert scale (Strongly Agree to Strongly Disagree) was used to collect primary data.

## VI. Data Analysis and Interpretation

| Demographic Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 52 | 52.00% |
| | Female | 48 | 48.00% |
| **Age Group** | 10–12 | 20 | 20.00% |
| | 13–15 | 45 | 45.00% |
| | 16–18 | 35 | 35.00% |
| **Education Level** | Primary School (Grade 5–7) | 18 | 18.00% |
| | Middle School (Grade 8–10) | 42 | 42.00% |
| | Higher Secondary (Grade 11–12) | 40 | 40.00% |
| **School Type** | Government School | 58 | 58.00% |
| | Private School | 42 | 42.00% |
| **Background** | Urban | 63 | 63.00% |
| | Rural | 37 | 37.00% |
| **Parents' Occupation** | Business | 22 | 22.00% |
| | Service (Govt./Private) | 41 | 41.00% |
| | Agriculture/Labor | 25 | 25.00% |
| | Others | 12 | 12.00% |
| **Exposure to Entrepreneurship** | Yes (via school curriculum/activities) | 61 | 61.00% |
| | No | 39 | 39.00% |

Table I. Demographic Profile

The demographic profile of the respondents is shown in the above table. It was discovered that a sample size of 100 was chosen for data analysis and interpretation, and 130 questionnaires were given to the target respondents in order to meet this need.

**H01:** Students' development of entrepreneurial skills and early educational exposure do not significantly correlate.

**Correlations**

| | | Activities that encourage creativity, innovation, and business thinking are part of my school's curriculum. | Classroom training has taught me about entrepreneurship, including how to run a business and come up with concepts. | Because of everything I've studied in school, I am confident in my ability to see opportunities and resolve issues. | My entrepreneurial thinking has improved as a result of my involvement in school initiatives and contests. | My early exposure to entrepreneurial subjects has inspired me to think about launching my own business someday |
|---|---|---|---|---|---|---|
| Activities that encourage creativity, innovation, and business thinking are part of my school's curriculum. | Pearson Correlation | 1 | | | | |
| | Sig. (2-tailed) | | | | | |
| | N | 96 | | | | |
| Classroom training has taught me about entrepreneurship, including how to run a business and come up with concepts. | Pearson Correlation | .146 | 1 | | | |
| | Sig. (2-tailed) | .157 | | | | |
| | N | 96 | 96 | | | |
| Because of everything I've studied in school, I am confident in my ability to see opportunities and resolve issues. | Pearson Correlation | .356** | .225* | 1 | | |
| | Sig. (2-tailed) | .000 | .027 | | | |
| | N | 96 | 96 | 96 | | |
| My entrepreneurial thinking has improved as a result of my involvement in school initiatives and contests. | Pearson Correlation | .219* | .297** | .158 | 1 | |
| | Sig. (2-tailed) | .032 | .003 | .124 | | |
| | N | 96 | 96 | 96 | 96 | |
| My early exposure to entrepreneurial subjects has inspired me to think about launching my own business someday | Pearson Correlation | .044 | .042 | .176 | .270** | 1 |
| | Sig. (2-tailed) | .671 | .684 | .086 | .080 | |
| | N | 96 | 96 | 96 | 96 | 96 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table II. Pearson Correlation

Table II Explore the facts extracted from Pearson Correlation by finding out the connection between entrepreneurial skills and early educational exposure and it was found that the sig. 2 tailed value from all the variables found more than commonly accepted alpha value .05, therefore, in this condition, null hypothesis found accepted and conclude that Students' development of entrepreneurial skills and early educational exposure do not significantly correlate.

**H02:** Students' intention to become future entrepreneurs is not substantially impacted by classroom-based entrepreneurial activities.

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .372[a] | .138 | .090 | 3.14189 |

Table III. Linear Regression

a. Predictors: (Constant), My involvement in entrepreneurial classroom activities has increased my confidence I my decision to pursue entrepreneurship as a career, My desire to start my own business has grown as a result of class discussions about startups and business, Projects and tasks pertaining to entrepreneurship have made it easier for me to envision myself running my own company in the future, I lve been inspired to explore entrepreneurship by class activities like startup simulations and business proposal competitions, lve been inspired to consider starting a business by the guest lectures or workshops given by business owners at my school.

**Anova[a]**

| Model | Sum of Square | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| 1 Regression<br>Residual<br>Total | 142.527<br>888.432<br>1030.958 | 5<br>90<br>95 | 28.505<br>9.871 | 2.888 | .018[b] |

Table IV. ANOVA

a. Dependent Variable: Per Sum
b. Predictors: (Constant), My involvement in entrepreneurial classroom activities has increased my confidence I my decision to pursue entrepreneurship as a career, My desire to start my own business has grown as a result of class discussions about startups and business, Projects and tasks pertaining to entrepreneurship have made it easier for me to envision myself running my own company in the future, I lve been inspired to explore entrepreneurship by class activities like startup simulations and business proposal competitions, lve been inspired to consider starting a business by the guest lectures or workshops given by business owners at my school.

Table III. Linear Regression

Table III and IV explore the outcome released from the linear regression model in SPSS which explain that the sig. value found less than commonly accepted alpha value .05, in this case null hypothesis found rejected and conclude that students' intention to become future entrepreneurs is substantially impacted by classroom-based entrepreneurial activities.

## I. Result

The results of the Pearson Correlation analysis, which sought to study the connection between early education and entrepreneurial skills, are shown in Table II. The findings showed that all variables' significance (2-tailed) values above the generally recognized alpha threshold of 0.05. As a result, the null hypothesis was accepted, and it was shown that there is no statistically significant relationship between students' early educational experience and the development of entrepreneurial skills. On the other hand, the findings of a linear regression model in SPSS that evaluated the effect of classroom-based entrepreneurial activities on students' ambition to become future entrepreneurs are shown in Tables III and IV. A statistically significant link was indicated by the analysis, which showed that the significance values were less than 0.05. Consequently, the null hypothesis was disproved, and it was determined that students' entrepreneurial ambitions are significantly influenced by classroom-based entrepreneurial activities.

## II. Conclusion

Two important insights into how early education affects student entrepreneurship are provided by the analysis. First off, as all significance values were higher than the 0.05 cutoff, the Pearson Correlation results show no statistically significant association between the development of entrepreneurial skills and general early educational exposure. As a sequel, the null hypothesis was avowed, indicating that kids' entrepreneurial skills might not be directly fostered by early schooling alone. The results of the linear regression analysis, however, show a different picture. With significance values less than 0.05, it shows that classroom-based entrepreneurial activities have a statistically significant effect on students' willingness to pursue entrepreneurship. This results in the null hypothesis being rejected, proving that focused classroom entrepreneurial interventions have a beneficial impact on students' aspirations to start their own business in the future. Collectively, these results demonstrate how crucial hands-on, activity-based entrepreneurial education is in fostering children' entrepreneurial mindsets more so than conventional early education.

## REFERENCES

[1] Fayolle, A., Gailly, B. “The impact of entrepreneurship education on entrepreneurial attitudes and intention: Hysteresis and persistence. Journal of Small Business Management”, 53(1), pp: 75–93. https://doi.org/10.1111/jsbm.12065, 2015.

[2] Jones, B., Iredale, N. “Enterprise education as pedagogy. Education + Training”, 52(1), pp: 7–19. https://doi.org/10.1108/00400911011017654 , 2010.

[3] Mwasalwiba, E. S. Entrepreneurship education: “A review of its objectives, teaching methods, and impact indicators. Education + Training”, 52(1), pp: 20–47, 2010.

[4] Rae D. “Entrepreneurial learning: A conceptual framework for technology-based enterprise. Technology Analysis & Strategic Management”, 18(1), pp: 39–56, 2006.

[5] Craft A.,” Creativity in schools: Tensions and dilemmas. Routledge. https://doi.org/10.4324/9780203357965”, 2005.

[6] Lüthje C., Franke, N. “The ‘making’ of an entrepreneur: Testing a model of entrepreneurial intent among engineering students at MIT. R&D Management”, 33(2), pp: 135–147, 2003.

[7] Neck, H. M., Greene, P. G. “Entrepreneurship education: Known worlds and new frontiers. Journal of Small Business Management”, 49(1), pp: 55–70, 2011.

[8] Nabi G., Walmsley A., Liñán F., Akhtar I., Neame C., “Does entrepreneurship education in the first year of higher education develop entrepreneurial intentions? The role of learning and inspiration. Studies in Higher Education”, 43(3), pp: 452–46,2017.

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# Exploring Reinforcement Learning Algorithms for Autonomous Robotics: A REVIEW

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***Abstract*: Autonomous robotics has emerged as a rapidly growing field, driven by advancements in artificial intelligence, sensing technologies, and computing power. Robots are increasingly being deployed in various domains, such as manufacturing, healthcare, agriculture, and exploration, to perform tasks that are challenging, dangerous, or impractical for humans. The ultimate goal of autonomous robotics is to create intelligent machines that can perceive, reason, and act independently in complex and dynamic environments, without the need for constant human intervention. One of the key challenges in autonomous robotics is enabling robots to learn and adapt to their environment through experience. Traditional approaches to robot control often rely on pre-programmed behaviors or require extensive manual tuning, which can be time-consuming and limit the robot's adaptability to new situations. Reinforcement learning (RL) has emerged as a promising approach to address this challenge by allowing robots to learn optimal behaviors through trial and error interactions with their environment.**

***Index Terms* - Artificial Intelligence, Reinforcement learning, Algorithms, Autonomous Robotics.**

## I. INTRODUCTION

Reinforcement learning is a subfield of machine learning that focuses on learning through interaction. In RL, an agent (in this case, a robot) learns to make decisions by receiving rewards or penalties based on its actions in an environment. The goal of the agent is to learn a policy, which maps states to actions, that maximizes the expected cumulative reward over time.[11] RL has been successfully applied to a wide range of problems, including game playing . [9] robotics and autonomous navigation .[6] [14]

The application of reinforcement learning in autonomous robotics has gained significant attention in recent years. RL provides a framework for robots to learn complex behaviors through interaction with their environment, without the need for explicit programming [6] By exploring the environment and receiving feedback in the form of rewards or penalties, robots can learn to make intelligent decisions and adapt to changing conditions .[12]

Deep reinforcement learning, which combines RL with deep neural networks, has further advanced the capabilities of autonomous robots.[1] Deep neural networks enable robots to learn complex representations of their environment from high-dimensional sensory inputs, such as images or sensor readings.[9] This has led to the development of powerful RL algorithms, such as Deep Q-Networks (DQN), Trust Region Policy Optimization (TRPO) and Proximal Policy Optimization (PPO) ,which

have achieved remarkable results in various robotic tasks.[9][10]

However, the application of reinforcement learning in autonomous robotics also poses several challenges. One major challenge is the high-dimensional state and action spaces encountered in robotic systems.[6] Robots often have many degrees of freedom and operate in complex environments, making it difficult to learn effective policies. Additionally, RL algorithms typically require a large number of interactions with the environment to learn optimal behaviours, which can be time-consuming and costly in real-world robotics applications. [2]

Another challenge is ensuring safe exploration during the learning process. Robots learning through trial and error may take actions that lead to collisions, damage, or unsafe situation. [8] Balancing exploration and exploitation is crucial to enable robots to learn effectively while minimizing risks. Safe exploration techniques, such as constrained RL Achiam, Held, and risk-aware RL. [1][2] Have been proposed to address this challenge.

Sample efficiency is also a critical consideration in autonomous robotics. Learning from real-world interactions can be expensive and time-consuming, making it desirable to minimize the number of samples required for teach.[6] Model-based RL approaches, such as Probabilistic Inference for Learning Control (PILCO) and Gaussian Process Dynamics Models (GPDMs) have been explored to improve sample efficiency by learning a model of the environment's dynamics.[3] These approaches allow robots to plan and make decisions based on the learned model, reducing the need for extensive real-world interactions.

Despite the challenges, reinforcement learning has shown great promise in advancing the capabilities of autonomous robots. Successful applications of RL in robotics include robotic manipulation , and autonomous navigation .[7] [5] [14] RL has enabled robots to learn complex skills, such as grasping objects, walking on uneven terrains, and navigating in dynamic environments, without explicit programming.

The integration of reinforcement learning with other AI techniques, such as computer vision and natural language processing, has further expanded the possibilities for autonomous robots.[12] For example, combining RL with computer vision enables robots to learn visual representations and make decisions based on visual inputs. [7] Similarly, integrating RL with natural language processing allows robots to learn from human instructions and feedback.

In conclusion, reinforcement learning has emerged as a powerful approach for enabling autonomous robots to learn and adapt to their environment. By learning through interaction and feedback, robots can acquire complex behaviors and make intelligent decisions in real-world scenarios. However, challenges such as high-dimensional state and action spaces, safe exploration, and sample efficiency need to be addressed to fully realize the potential of RL in autonomous robotics. Ongoing research efforts aim to develop novel RL algorithms and techniques that can overcome these challenges and advance the field of autonomous robotics.

This research proposal aims to contribute to the advancement of reinforcement learning algorithms for autonomous robotics. By exploring novel RL algorithms and extensions that address the challenges of sample efficiency and safe exploration, this study seeks to enhance the capabilities of autonomous robots in various domains. The successful application of RL in robotics has the potential to revolutionize industries, improve human-robot interaction, and enable the deployment of intelligent robots in complex real-world environments.

## II. PROBLEM STATEMENT

Despite significant advancements in autonomous robotics, challenges remain in enabling robots to learn and adapt to complex and dynamic environments effectively. Traditional approaches to robot control often rely on pre-programmed behaviours or require extensive manual tuning, which can be time-consuming and limit the robot's adaptability to new situations. These approaches may work well in structured and predictable environments but struggle in more unstructured and uncertain scenarios.

Reinforcement learning (RL) has emerged as a promising approach to address the limitations of traditional robot control methods. By allowing robots to learn through trial and error interactions with their environment, RL enables robots to acquire complex behaviors and make intelligent decisions without explicit programming. However, the application of RL in autonomous robotics faces several challenges that need to be addressed.

One major challenge is the high-dimensional state and action spaces encountered in robotic systems. Robots often have many degrees of freedom and operate in complex environments, making it difficult to learn effective policies. The curse of dimensionality poses a significant hurdle in applying RL algorithms to real-world robotic tasks, as the learning process becomes computationally expensive and requires a large number of samples.

Another challenge is the need for safe exploration during the learning process. As robots learn through trial and error, they may take actions that lead to collisions, damage, or unsafe situations. Ensuring that robots can explore their environment safely while still learning effectively is a critical concern. Balancing exploration and exploitation is crucial to enable robots to discover optimal behaviours without compromising safety.

Sample efficiency is also a major challenge in applying RL to autonomous robotics. Learning from real-world interactions can be expensive and time-consuming, as robots may require a large number of trials to learn effective policies. In many real-world scenarios, it is impractical or infeasible to perform extensive training in the physical environment. Improving sample efficiency is essential to make RL practical for real-world robotic applications.

Furthermore, the scalability and generalization of learned policies to new tasks and environments are important considerations. Robots should be able to adapt and transfer their learned knowledge to novel situations without requiring extensive retraining. Developing RL algorithms that can learn robust and transferable policies is crucial for the practical deployment of autonomous robots in real-world settings.

Addressing these challenges requires the development of novel RL algorithms and techniques specifically tailored for autonomous robotics. These algorithms should be able to handle high-dimensional state and action spaces, ensure safe exploration, improve sample efficiency, and enable the learning of robust and transferable policies. By overcoming these challenges, RL has the potential to revolutionize the field of autonomous robotics and enable the deployment of intelligent robots in a wide range of applications.

This research proposal aims to explore and develop reinforcement learning algorithms that address the challenges of sample efficiency and safe exploration in autonomous robotics. By advancing the state-of-the-art in RL for robotics, this study seeks to contribute to the development of more efficient, adaptable, and robust autonomous robots capable of learning and operating in complex real-world environments.

## III. LITERATURE REVIEW

Reinforcement learning (RL) has gained significant attention in the field of autonomous robotics due to its potential to enable robots to learn and adapt to complex environments through trial and error. This literature review explores the current state-of-the-art in RL for robotics, focusing on key algorithms, challenges, and recent advancements.

One of the seminal works in RL for robotics is the paper "Reinforcement Learning in Robotics: A Survey" .[6] This comprehensive survey provides an overview of RL techniques applied to robotics, including model-based and model-free approaches, policy search methods, and value function approximation. The authors discuss the challenges specific to robotics, such as high-dimensional state and action spaces, sample inefficiency, and the need for safe exploration. They highlight the potential of RL for enabling robots to learn complex behaviors and adapt to changing environments.

Deep reinforcement learning (DRL) has emerged as a powerful approach for tackling high-dimensional control problems in robotics. The work demonstrates the effectiveness of DRL for end-to-end learning of visuomotor policies. [7] They propose a guided policy search method that combines trajectory optimization with supervised learning to train deep neural networks for robotic manipulation tasks. Their approach achieves impressive results on tasks such as screwing a cap onto a bottle and inserting a block into a shape sorting cube.

The Deep Q-Network (DQN) algorithm.[9] has been successfully applied to various robotic tasks. DQN combines Q-learning with deep neural networks to learn policies directly from high-dimensional sensory inputs. [4] Extend DQN to continuous action spaces, proposing the Normalized Advantage Function (NAF) algorithm. They demonstrate the effectiveness of NAF on robotic manipulation tasks, such as door opening and pick-and-place.

Policy gradient methods have also shown promise in robotic control tasks. Trust Region Policy Optimization (TRPO) and Proximal Policy Optimization (PPO). [10] are two popular policy gradient algorithms that have been applied to robotics. These algorithms aim to optimize the policy directly while ensuring stable and safe updates. [5] Propose the Soft Actor-Critic (SAC) algorithm, which combines the benefits of off-policy learning and maximum entropy RL. SAC has been shown to achieve state-of-the-art performance on various robotic control tasks, including locomotion and manipulation.

Sample efficiency is a critical challenge in RL for robotics, as learning from real-world interactions can be expensive and time-consuming. Model-based RL approaches aim to address this challenge by learning a model of the environment's dynamics and using it for planning and decision-making. Propose the PILCO (Probabilistic Inference for Learning Control) algorithm, which learns a Gaussian process model of the dynamics and uses it for policy optimization. [3] PILCO has been shown to achieve high sample efficiency on various robotic control tasks.

Another approach to improve sample efficiency is to leverage prior knowledge or demonstrations. Imitation learning, also known as learning from demonstrations, involves learning a policy from expert demonstrations.[5] propose the Deep Q-learning from Demonstrations (DQfD) algorithm, which combines imitation learning with RL. DQfD initializes the policy with demonstrations and then fine-tunes it using RL, resulting in improved sample efficiency and performance.

Transfer learning and meta-learning has also been explored to improve sample efficiency and generalization in RL for robotics. Transfer

learning aims to leverage knowledge learned from one task to improve learning on another related task. [4] Propose the Model-Agnostic Meta-Learning (MAML) algorithm, which learns an initialization for the policy parameters that can quickly adapt to new tasks with a few gradient steps. MAML has been applied to various robotic tasks, demonstrating its ability to learn new skills with minimal training data.

Safe exploration is another important consideration in RL for robotics. Ensuring that robots can explore their environment safely while learning is crucial to prevent damage or harm.[4] provide a comprehensive survey of safe RL techniques, including risk-sensitive RL, constrained RL, and safe exploration strategies.[1] propose the Constrained Policy Optimization (CPO) algorithm, which incorporates safety constraints into the policy optimization process. CPO ensures that the learned policy satisfies the specified constraints, enabling safe exploration during learning.

Sim-to-real transfer is a promising approach to address the challenge of sample efficiency and safe exploration in real-world robotics. Sim-to-real transfer involves training policies in simulation and then transferring them to real robots.[13] However, the sim-to-real gap, caused by differences between the simulated and real environments, can hinder the successful transfer of learned policies. Domain randomization and domain adaptation techniques have been proposed to bridge the sim-to-real gap and improve the transferability of learned policies.

Recent advancements in RL for robotics have also focused on learning from sparse rewards and handling long-horizon tasks. Sparse reward settings, where the agent receives infrequent or delayed rewards, pose challenges for traditional RL algorithms. [1] Propose the Hindsight Experience Replay (HER) algorithm, which allows the agent to learn from failed attempts by relabeling the desired goal in hindsight. HER has been shown to improve learning efficiency in sparse reward settings.

Long-horizon tasks, where the agent needs to perform a sequence of actions to achieve a goal, are common in robotics. Hierarchical RL approaches, such as the Options framework [12] and the Feudal Networks architecture. [13] Have been proposed to address the challenges of long-horizon tasks. These approaches learn a hierarchy of policies or subgoals, enabling the agent to break down complex tasks into simpler sub problems.

Despite the progress made in RL for robotics, several challenges and open problems remain. Interpretability and explainability of learned policies are important considerations for the practical deployment of RL in robotics. [12] Developing RL algorithms that can provide human-understandable explanations of their decision-making process is an active area of research.

Another challenge is the integration of RL with other perception and reasoning modules in robotic systems. Combining RL with computer vision, natural language processing, and planning techniques can enable more intelligent and adaptive robotic behaviours. [12] Research efforts are ongoing to develop integrated systems that can perceive, reason, and act in complex environments.

## IV. **CONCLUSIONS**

Despite the significant progress made in reinforcement learning for autonomous robotics, several research gaps and challenges remain to be addressed. One major gap is the sample efficiency of RL algorithms when applied to real-world robotic systems. Many RL algorithms require a large number of interactions with the environment to learn effective policies, which can be impractical and costly in real-world settings. Robots operating in physical environments have limited time and

resources for exploration, making it crucial to develop sample-efficient RL algorithms that can learn from a small number of interactions.

Another research gap lies in the safe exploration of RL agents in robotic systems. As robots learn through trial and error, they may take actions that lead to collisions, damage, or unsafe situations. Ensuring safe exploration while still allowing the robot to learn effectively is a challenging problem. Existing safe RL approaches often impose strict constraints on the exploration process, which can hinder the learning of optimal policies. Developing RL algorithms that can balance safety and exploration in a more flexible and adaptive manner is an important research direction.

The generalization and transfer of learned policies to new tasks and environments is another area that requires further research. Robots deployed in real-world applications often encounter variations in their tasks and operating conditions. RL algorithms that can learn policies that are robust and adaptable to these variations are essential for practical deployment. While some progress has been made in transfer learning and meta-learning for robotics, there is still a need for more effective techniques that can enable rapid adaptation to new tasks with minimal retraining.The interpretability and explainability of learned policies are also important research gaps in RL for robotics. As robots become more autonomous and are entrusted with critical tasks, it is crucial to understand the decision-making process of the learned policies. However, many RL algorithms, particularly those based on deep neural networks, produce policies that are difficult to interpret and explain. Developing RL algorithms that can provide human-understandable explanations of their actions and decisions is an active area of research that requires further exploration.

The integration of RL with other perception and reasoning modules in robotic systems is another challenge that needs to be addressed. Robots operating in real-world environments often require a combination of perception, planning, and control capabilities. Integrating RL with computer vision, natural language processing, and symbolic reasoning techniques can enable more intelligent and adaptive robotic behaviors. However, the integration of these different modules poses challenges in terms of communication, synchronization, and decision-making. Further research is needed to develop frameworks and architectures that can seamlessly integrate RL with other robotic subsystems.

Scalability is another research gap in RL for robotics. Many RL algorithms have been demonstrated on relatively simple robotic tasks and environments. However, scaling these algorithms to more complex and high-dimensional tasks remains a challenge. Developing RL algorithms that can handle the increased complexity and computational requirements of real-world robotic systems is an important research direction. This includes techniques for efficient exploration, hierarchical learning, and parallel computing.

Finally, the evaluation and benchmarking of RL algorithms in robotic systems is an area that requires further standardization. While there are some commonly used benchmarks and simulation environments, there is a lack of comprehensive and standardized evaluation protocols for RL in robotics. Establishing well-defined benchmarks and evaluation metrics can facilitate the comparison and assessment of different RL algorithms and promote reproducibility in the field.

Addressing these research gaps is crucial for advancing the field of RL in autonomous robotics and realizing its full potential in real-world applications. Researchers and practitioners need to develop novel algorithms, frameworks, and evaluation methodologies that can tackle these challenges and enable the deployment of intelligent and adaptive robotic systems in various domains.

## REFERENCES


1. Arulkumaran K., Deisenroth M. P., Brundage M., Bharath A. A. "Deep reinforcement learning: A brief survey. IEEE Signal Processing Magazine", 34(6), pp:26-38, 2017.
2. Cheng C. A., Yan X., Wagener N., Boots B., "Fast policy learning through imitation and reinforcement. In Proceedings of the 34th Conference on Uncertainty in Artificial Intelligence (UAI)"2018.
3. Deisenroth M. P., Neumann G., Peters J. ," A survey on policy search for robotics. Foundations and Trends in Robotics", 2(1-2), pp:1-142. 2013.
4. Gu S., Holly, E Lillicrap., T., Levine S., "Deep reinforcement learning for robotic manipulation with asynchronous off-policy updates. In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)", 3389-3396, 2017.
5. Haarnoja, T., Zhou, A., Abbeel, P., & Levine, S. "Soft actor-critic: Off-policy maximum entropy deep reinforcement learning with a stochastic actor. In Proceedings of the 35th International Conference on Machine Learning (ICML)", 2018.
6. Kober J., Bagnell, J. A., Peters J., "Reinforcement learning in robotics: A survey. The International Journal of Robotics Research", 32(11), pp:1238-1274, 2013.
7. Levine, S., Finn, C., Darrell, T., & Abbeel, P. " End-to-end training of deep visuomotor policies. The Journal of Machine Learning Research", 17(1), pp: 1334-1373, 2016.
8. Lillicrap, T. P., Hunt, J. J., Pritzel, A., Heess, N., Erez, T., Tassa, Y., ... & Wierstra, D. , "Continuous control with deep reinforcement learning. In Proceedings of the International Conference on Learning Representations (ICLR)", 2016.
9. Mnih, V., Kavukcuoglu, K., Silver, D., Rusu, A. A., Veness, J., Bellemare, M. G., & Hassabis, D. "Human-level control through deep reinforcement learning. Nature, 518(7540), pp: 529-533", 2015.
10. Schulman, J., Wolski, F., Dhariwal, P., Radford, A., & Klimov, O. "Proximal policy optimization algorithms. arXiv preprint arXiv:1707.06347", 2017.
11. Silver D., Huang A., Maddison C. ,J., Gue , A., Sifre L., "Van Den Driessche, G., ... & Hassabis, D. (2016). Mastering the game of Go with deep neural networks and tree search. Nature, 529(7587), pp: 484-489". 2016.
12. Sutton R. S., Barto, A. G., "Reinforcement learning: An introduction (2nd ed.). Cambridge, MA: MIT Press", 2018.
13. Wulfmeier M., Posner I., Abbeel, P. "Mutual alignment transfer learning. In Proceedings of the 1st Annual Conference on Robot Learning (CoRL), pp: 281-290", 2017.
14. Zhu Y., Mottaghi R., Kolve E., Lim J. J., Gupta A., Fei-Fei, L., Farhadi, A. ,"Target-driven visual navigation in indoor scenes using deep reinforcement learning. In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), pp: 3357-3364", 2017.

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# Municipal Solid Waste Management System in Bhilainagar Township

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***Abstract*** **- Waste Management is one of the burning issue in current era. Municipalities and urban local bodies have taken many initiatives for sanitation and cleanliness of their area. After launch of swachh Bharat Mission there were a great impact in the field of waste management in India. Bhilainagar Township well-known as 'Steel City' is one of the oldest Township in Chhattisgarh has also taken many initiatives for waste management and developed a SLRM centre. In this paper the steps taken by Bhilainagar Township towards waste management and its importance in present scenario has been taken for study.**

***Index Terms :*** **Geela Kachara- the kitchen waste or Green waste, HDPE- High Density Polyethylene, LDPE- Low density polyethylene, MSW- Municipal Solid Waste, PET- Polyethylene Terephthalate, PHD- Public Health Department. PVC - Polyvinyl Chloride, Safai karmi- the persons engaged for collection of garbage, SBM- Swachh Bharat Mission, SLRM- Solid Liquid Resource Management, SWM- Solid Waste Management, Sukha Kachara.**

## I. INTRODUCTION

In urban area now a days people generally prefers well packed & wrapped materials. In current lifestyle use of cartoons, polythene, plastics, metals, Glass etc. are very common especially in urban area. It is also a myth in urban area that packed items are reliable and possess good quality of materials however, unpacked and loose items are inferior in quality. The Provisions stores items like oil, grain, poha, wheat, atta, pulse, sugar, masala, every things are now a days available in polythene packed in urban area.

At present the market trend is to serve all kinds of customers. These companies manufacturing to solve purpose of Liter to milliliter and Kilogram to gram requirement of different kind of customers as per their need. Now days pouch marketing is also in practice and releases a considerable amount of solid waste in urban areas. This kind of trend generates more packing and generation of more solid waste. In this situation Waste management is a major issue and challenge from an environmental perspective
across the world too [1].

Bhilainagar is a big township and also facing challenges of waste generation in it. So many steps are time to time taken for waste management however, after Swachh Bharat Mission its commitment for clean and green Bhilainagar Township is almost in practice. Many initiatives has been taken in this township for waste management are discussed in this paper.

## II. PURPOSE OF THE STUDY

Bhilainagar Township is one of oldest Township of Chhattisgarh state. The question may arises sometimes that, what the steps are being taken by Bhilainagar Township for its Solid waste management in current situations. Moreover, what are the impact of SBM in Bhilainagar is another important question. Is Bhilainagar is able to manage current challenges of Solid waste? In this research paper answers for these questions are searched by adopting suitable technique of study.

## III. METHODOLOGY

Site survey and Interview techniques has been adopted for the study. About 65 Residents and 20 officials involved in waste management in Bhilainagar Township were contacted for the study. Prepared questioners were asked randomly to the residents of this Township. For financial data concerned engineers of Bhilai Steel Plant were also contacted for the study.

## IV. REVIEW OF EARLIER STUDY

In earlier studies related to Bhilai nagar, the focus was regarding development of Bhilai Steel plant. The technologies upgradation of steel making in Bhilai Steel plant are other topics taken for study. It is felt that regarding Waste management of Bhilainagar Township research work or proper study is still awaited. Considering the gap of research in this field the topic has been chosen for study.

## V. SOLID WASTE MANAGEMENT PRACTICES IN BHILAINAGAR, TOWNSHIP

Bhilai as an industrial estate came into existence with the establishment of Bhilai Steel Plant [2]. Bhilainagar Township is almost 60 years Old Township constructed after Indo Rusia agreement 1955 for development of a Steel Plant in Bhilai [3]. It is a neat and clean township. Around 40,000 houses for employees were built in different phases to shape Bhilainagar Township to accommodate employees of Bhilai Steel Plant. Provision of good quality of drinking water and underground sewerage system is one of the important facility to the residents.

In early days there were no issue of Municipal Solid Waste (MSW) management in Township. The kitchen waste whatever generated in Township generally were utilized to feed nearby cattle & street dogs. At that time there were no issue of poly waste. But after evolution of plastic and broad use of Polythene, Poly propylene, pearl pet in daily life management of the same is difficult to Public Health department of the Township.

At that initial stage citizens used to drop garbage at notified places in each street. A tanks provided by PHD department in that spot of street to accumulate the garbage generates in the street. The PHD department employee collects the garbage at regular interval and dumps it in notified trench. There was no recycling concept of the waste material as such after certain year the dumping area or trench become big hills of garbage.

A few year back Municipal Corporation of Bhilai made certain objection to dump garbage in trench of Bhilainagar Township area. However, after notification of Swachha Bharat Abhiyan Bhilainagar Township Management also explored ways for proper Municipal solid waste management. A process of worm compost started near Jayanti stadium ground but due to certain objections the same could not be continued for long. At that time some experts opined for implementation of Ambikapur Model for recycling of Municipal Solid Waste in Bhilai Township. Afterword a team of Bhilai PHD department visited Ambikapur SLRM centers to study processing of MSW. Shri A R Banjara Team member of the committee expressed that the Ambikapur model is well maintained model and plays a lead role for implementation of SLRM (i.e. Solid liquid Resource Management). The SLRM centers of Ambikapur started in the year 2014 [4].

Accordingly, Bhilainagar Township Management has decided to implement Ambikapur model waste management system in Bhilainagar Township. Street waste collection points were stopped by removal of its tanks from street. Two bucket Green and blue handed over to citizens of Bhilainagar Township for door to Door garbage collection. Citizens were advised to collect Geela Kachra (Kitchen Waste) and Sukha Kachra (Dry waste, plastic, polythene etc.) in separate baskets.

Citizens are happy in new policy that they need not to go other places to drop their garbage as such there is an easier way of door to door garbage collection. It is fact that earlier most of the citizen wait for darkness of night for disposal of garbage, but now a days handing over garbage to the representative in day time is a proud feeling to them.

A SLRM center was developed to manage Municipal solid waste of Bhilainagar Township as detailed in this paper. The whole process of solid waste management adopted by Bhilainagar Township are Door to door garbage collection, Transportation to Bhilainagar Township SLRM Centre, Processing of Garbage (Geela Kachara), Processing of Rubbish (Sukha Kachara) & Disposal of Non-process-able Waste (Land fill) may be seen in the process chart as follows-


## V.I DOOR TO DOOR GARBAGE COLLECTION & TRANSPORTATION TO SLRM CENTER

This is the first and most important stage of Municipal Solid Waste Management System of Bhilainagar Township. An interview with Supervisor Shri Purnanand Dewangan (Mob-9617829026) held on 28.10.2022 at the SLRM Centre. According to him there are 38 team engaged for door to door garbage collection along with Tractor Trolley. Each team having a tractor operator and about 8 Safai karmi (At least 50 % women).

The Tractor operator Shri Sumer Singh presently responsible for collection of Garbage from New Ruabandha Sector and Block no 38 to 93 of Risali Sector area. He informed that they collect Door to Door garbage in Bhilainagar Township area. Two colored (Green & Blue) Plastic buckets were provided to each residents of Township. The Green Baskets are used for storage of Kitchen waste known as Geela Kachra or Garbage and the second one Blue basket is used for storage of Rubbish (i.e. Dry Waste like plastic, polythene, metal , paper etc.).

Shri Sumer Singh further informed that they collects garbage daily from each residential buildings and segregate it in tractor trolley by team members as per requirements. They separates gradients of collected garbage and took it in separate bags. Generally vegetable/kitchen ingredients are separated from dry garbage. Plastic items, pet bottles, Water bottles, white polythene, colored polythene, Cartoons, Glass bottles and metals are separated on tractor trolley by team members. They hand over the separated garbage to the operators of SLRM Centre for further segregation and processing. Regarding his job he expressed that he is very much happy with the job being carried by him to make Clean and green Bhilainagar Township.

### V.II Bhilainagar Township SLRM center

To understand the processing of Solid Waste Management System of Bhilainagar Township and to know functioning of SLRM, Centre Bhilai, I visited the site on 28.10.2022 at 1.00 PM. The SLRM unit is running by SAIL, Bhilai Steel Plant. PHD department is looking after

maintenance of the unit and Shri Radheshyam Gupta is a Contractor for processing of dry garbage (i.e. Plastic, Glass, Cartoons, Polythene, Poly fiber, Perl pet bottle, Metals etc.). It is observed that the SLRM Centre Bhilainagar Township was started on 24.12.2021.

The SLRM unit of Bhilai Steel Plant is located in between Newai village and Station Maroda Basti near Bhilainagar Township at $21.15516^0$ N, $81.36302^0$ E gradient. It is located at 6.2 KM from Bhilainagar Power House Railway Station in south direction and about 10.7 KM in south east direction from District Headquarter Durg. The SLRM Centre is hardly 500 Mtr apart from Durg Utai Main Road. It is spread over 160 X 80 = 12800 Sq Mtr area.

**V.III MAIN STRUCTURES OF SLRM**

As per Google Map measurement, the SLRM Centre is spread over 12,800 Sq Mtr area. At a glance there are three Main sheds. The First one Shed size 500 Sq Mtr approx. is being used for office and segregation purpose. Washing of the garbage is also took place here.

The Second shed is about (40X16)= 720 Sq Mtr area. 44 tanks (each size 2.7 Mtr L X 2.25 Mtr W X 1.45 Mtr Height) are built beneath this shed for making compost from wet waste (Green or Geela Kachara).

The Third Shed is being used as a store as well as processing Centre for Dry Municipal solid waste (Sookha Kachara). It is a big shed about (50 X 21) 1050 Sq Mtr. Some processing Machines are installed here to convert polythene, plastics, pearl pet jar, wrapper etc. in to granules and Cake. Rs 36.5 Lakhs has been invested for construction of the SLRM unit.[10] There is an arrangement of Toilet and drinking water to facilitate workers or employee.

This SLRM Centre is built to process in house solid waste of Bhilainagar Township area. It covers Residential, Religious, Educational and Socio-cultural institutions located from Sector 1 to Sector 10 and Risali Sector, Maroda Sector, Ruabandha & Hospital Sector area. It covers around 27000 Residential units & 2500 non-residential units having total population around 1.5 Lakhs.

**V.IV PROCESSING OF GARBAGE (GEELA KACHARA) AT BHILAINAGAR SLRM CENTER.**

The team members of Door to door garbage collection, handovers the collected Garbage (i.e. Geela Kachra) to SLRM unit for its further processing. It contains biodegradable material therein. At SLRM Centre, the wet/bio-degradable waste is composted in specially designed pits & convert it in to Manure. According to Supervisor of the unit Ms. Sangeeta Sahu, 10 staff members including supervisors deputed for processing wet or Geela Kachra. They collect garbage (kitchen waste) from door to door collection team and drop it in these Pits/tanks.

There are 44 Pit/tanks (almost underground) built about 2.7 Mtr length X 2.25 Mtr Width X 1.45 Mtr height under a big shed about 720 sq mtr area (40 Mtr X16 Mtr ). These tanks are used for composting of wet waste. The door to door collection team handovers the Geela Kachra to this unit on free of cost.

The team members involved in garbage collection, drops Geela Kachra in these tanks and spray bio-culture liquid thereon as per necessity. The kitchen waste decomposes in these tank by bio culture addition. In 40 to 45 days the green waste converts in to compost. They collect slurry liquid of decomposed material in other separate tank. Bio culture 50 ml (concentrated) is added in 5 Ltr water before its spray on garbage in tanks for proper decomposition. At present they are producing compost but not at all selling their products. As informed, it will be utilized by Horticulture Department of Bhilai Steel Plant in future.

While interview with other supervisor Shri Poornanand Dewangan, he told that they are collecting approximate 500 Kgs Geela Kachra and 400 Kgs Sookha Kachra every day. To test the fact I asked him to share data of earlier days. As per his daily entry register the nature of collection of Municipal solid waste from Bhilainagar Township Area to SLRM Centre are as under-

| Sl | Date of Collection | Geela Kachra (Kgs) | Sookha Kachra (Kgs) | Total Kachra (Kgs) |
|---|---|---|---|---|
| 1 | 20/09/2022 | 471 | 404 | 875 |
| 2 | 22/09/2022 | 644 | 328 | 972 |
| 3 | 28/09/2022 | 494 | 426 | 920 |
| 4 | 01/10/2022 | 515 | 343 | 858 |
| 5 | 10/10/2022 | 520 | 446 | 966 |
| | **Total for 5 Days** | **2644** | **1947** | **4591** |
| | **Average per day** | **528.8** | **389.4** | **918.2** |

## V.V PROCESSING OF DRY WASTE (RUBBISH) AT SLRM CENTER

To know Functioning of Dry Solid waste and processing I approached to Shri Radheshyam Gupta, the contractor of SLRM Centre. An interview held with him, where he revealed so many things regarding processing of Dry Waste. According to him the operation system of SLRM is based on Ambikapur Model. Earlier he looked out SLRM activities in Ambikapur for many years. The main process involved in Dry (Sookha Kachara) waste processing units are as under:

a. Segregation of Material - According to Shri Gupta Dry Kachra contains Plastic items, pearl pet bottles, Water bottles, white polythene, colored polythene, cartoons, Glass bottles and metals like Tin, Aluminum, Iron, Steel, Stainless steel etc. Generally the garbage collector segregates the items in various category in side of Tractor Trolley as per their knowledge. However before processing they separates each ingredient of the received material. He shown a plastic bottle to me and told that the bottle is made of pearl pet, the cape is made of plastic HDPE. He shown another bottle where the cap and neck of bottle are made of Aluminum foil.

   Mr. Gupta informed that there are many kind of plastics being used in day to day life and received at the SLRM center. A few of them are detailed as follows:

- HDPE (High Density Polyethylene) Commonly used for bottles of Cleaning solution and soap containers, Food and drink storage, shopping bags, freezer bags, pipes, insulation, bottle caps, vehicle fuel tanks, protective helmets, faux-wood planks, recycled wood-plastic composites.

- LDPE (Low density Polyethylene)- Trays, containers, work surfaces, machine parts, lids, '6-ring' drink holders, drink cartons, protective shells, computer hardware casings, playground fixtures (slides and the like), bin-bags, laundry bags are manufactured by this material.
- Polyethylene Terephthalate (PET) it is one of the plastics commonly used as bottles for Soft drink, water, cooking oil bottles, packaging trays, frozen ready-meal trays, First-aid blankets, polar fleece.
- Polystyrene (PS) Cups, takeout food containers, shipping and product packaging, egg cartons, cutlery and building insulation.
- Polyvinyl Chloride (PVC) Commonly used for making Signage, furniture, clothing, medical containers, tubing, water and sewage pipes, flooring, cladding, vinyl records, cables, cleaning solution containers, water bottles.
- Polypropylene (PP). Clothing, surgery tools and supplies, hobbyist model, bottle caps, food containers, straws, crisp bags, kettles, lunch boxes, packing tape are made by PP.

They separate the above material in the shed with help of labors manually. Shri Gupta described that the plastic, polythene etc. collected are processed in various machines.

b. Cleaning of Material – Generally the material received from door to door garbage collection unit are having foreign materials like dust etc. proper cleaning of the material is required for good quality of granules. As such cleaning of the material (polythene, plastics etc.) held before its processing. In this SLRM cleaning Machine is being used for separating dust or other particles. Cleaning machine is a typical designed rotor type machine where polythene etc. rotated in a rotor and by that the foreign particle separates by gravity.

c. Shredding of Material- The cleaned material received from cleaning machine sent to shredder machine or grinding machine. In this machine the raw material cuts in small pieces.

d. Washing & Drying – The shredded material sent to washing machine. In this machine the raw-material has been washed by water. It is a big tank filled with water. After washing, washed material sent to Dryer. Drier is a centrifugal drier. While rotating the water particle separates due to gravitational force.

e. Mixture Machine- In this machine the dried material is heated and melted.



f. Extruder Machine – In this Machine the melted material were converted in wire or cakes. Generally two types of products are made in this units are granules and Lumps or Gutta. The size of granules is generally up to 5 mm size. However, the Gutta are in cake shapes and are about 200 to 400 Grams

in weight. Granules are produced from the material clean in nature. However, dirty material and multilayers plastics (wrappers etc.) are being processed for Gutta. Production capacity of Granules plant is 2.5 T per day and Plastic consumption capacity of the plant is about 5 T per day.

g. Granule Cutter – This machine is used for shaping final product. The wires produced from Polythene and plastics are cut in small pieces up to size of 3 to 5 mm. Granules are prepared generally from Plastic bags, wires used for preparation of Bardana, low dense plastics, pearl pet bottles, High dense plastics etc. However Gutta are prepared from Multilayer Plastics, Wrappers, colored Polythenes, Polyesters etc. The plastic waste turn it into granules and gutta are presently being sold to interested recyclers.

**V.VI DISPOSAL OF OTHER NON-PROCESSABLE WASTE**

The plastic material which are non-recyclable received in the unit are kept separately in bags or in bundles. They do not throws these non-recyclable materials to anywhere but these materials were handed over to concern recycler for its further utilization. Mr. Gupta said that collection of non-recyclable material is an expensive process but they are committed to do it for healthy atmosphere and environment.

Metal like Tin, Steel, Iron, Aluminium were sold to Kabadiwala as processing of these metal and beyond scope of this unit. The material other than green waste and Dry waste which is not usable in SLRM Centre are generally tree stems, leafless branches, stones are dumped in notified area. At present these kind of materials are being dumped near Jawahar udyan ground, Bhilai. The other non-processable material are utilized for road making and filling low land area.

**VI. CONCLUSION OF THE STUDY**

In last few decades, environmental issue are one of the most important issue in national/international forum. So many initiatives are being taken to improve environment and hygiene. Burning of solid waste, its burial and throwing in trench are big challenges for environment and health. Bhilainagar Township is an Open Defecation Free Township since its very beginning at 1960's. After Swachh Bharat Mission Bhilai steel Plant has taken many initiatives for management of solid waste of its Township. Bhilainagar Township is now managing its solid waste through a SLRM center Located at Newai, Bhilai. The capacity of the Unit is many times than the material received at present. By development of Solid waste Management system and processing of solid waste material efficiently, Bhilai Steel Plant has proven its commitment for clean and green environment to the residents of Township. Bhilai Township is effectively managing its MSW through the newly installed SLRM Centre.

As compared to 50 TPD capacity the Unit, it is presently receiving only 1 ton Solid Waste Material every day. Moreover comparing to 4 to 5 Ton capacity of granules production the plant is receiving only 400 to 500 Kg recyclable dry waste every day. It is noticed that the input in the SLRM unit is quite low as compared to its capacity. Moreover, scope for revenue realization though selling of compost needs to be explored.

A few years back there is a practice to places a tank in each street for collection of Household waste. The tanks not only looks in shabby condition but were also dissipates smell of molasses. This odor creates health issue to nearby residents. After commissioning of the SLRM center for Bhilai Township, the tanks provided in each street are almost removed. This SLRM Centre not only assisting Bhilainagar & Risali Municipal Corporation for their compliance to SWM rules 2016 but also proven Bhilai Steel Plant Managements

commitment to make green and clean Bhilai. Bhilainagar Township is now a days known for its efficient Solid Waste Management System like Ambikapur in Chhattisgarh State.

## VII. REFERENCES :


[1] Mishra K., A Banerjee., Ranga M.M., Jhariya M.K., Yadav D.K., Raj A., 2020. "Solid Waste Management Scenario in Ambikapur, Surguja, Chhattisgarh: A Sustainable Approach." *Climate Change and Agroforestry Systems*, pp. 297–336, 2020.

[2] Mishra Minoo. "Leisure Activities and Social Life in an Industrial Township." *Emerging Trends in Development Research* 4–7:10, 2000

[3] Noonan Norma Corigliano. "*Soviet-Indian Relations, 1953–1963*. Indiana University", 1965.

[4] Dutta Joystu., "Women Warriors of Waste Management." In *Handbook of Solid Waste Management: Sustainability through Circular Economy*, pp. 2281–2303. Singapore: Springer Nature Singapore, 2022.

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