Volume 1 : Issue 1

June 2022

Paryaveshanam

INDIRA GANDHI COLLEGE OF ARTS AND SCIENCE

A Peer Reviewed and Refereed Multidisciplinary Journal

Published from Indira Gandhi College of Arts and Science, Nellikkuzhi

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The Meta-ethics of Military Homicide in *URI* and *Hamid*

Aleena Alex

Abstract:

The artistic contrivance of a film undeniably endorses a certain ideology, which often affects the notions of political correctness. The objectives of cinematic discourses have the potential to twist and turn the presumed doctrines of society. URI and Hamid function as platforms that induce the effects of certain political prospects. Both movies attempt to decipher the psyche of soldiers and other civilians against the framework of warfare. The project seeks to elucidate the ethical comprehension of nationalism and patriotism from the prospect of military ethics. The article inquiries about the genealogy of military morality and the contemporary influence of patriotism along with the historical guidance, the ethical ambivalence of homicide in militarization within the narratives of URI and Hamid, and the moral dilemma of soldiers in consequence of the post-democratic scenario and confers the relevance of postmodern plurality in the realm of military ethics.

Morality exists through a series of exclusions, the exclusion of the bad from the good, the abnormal from the normal, the uncivilized from the civilized, and the delinquent from the disciplined. Such a network of exclusions plays a key role in maintaining what the exclusionists call the balance of society. This balance, often called social order, although thought to be a collective responsibility is to be actually ensured by the state as far as modern societies are concerned. With the emergence of the state, the authority did not vanish altogether. On the contrary, it became more authoritative and powerful in

always being a hidden force; hence, the visibility of power has changed the most. The authority draws a veil over such tendencies with the responsibility of maintaining societal order.

The deliberate or indeliberate exercise of exclusions made by society is a product of the existing social hierarchy based on the genealogy of a particular power principle. Morality is a tool that facilitates the execution of such power principles. The inclusion of exclusive propaganda in the domain of democracy creates a social imbalance. The loopholes in the constitutional enforcement of law make this social as well as moral imbalance quite visible. Our constitution exalts rightful living and rightful killing at the same time. On one hand, the fundamental rights of human beings ensure the right to live, on the other hand, it negates the right to live and justifies the rightful killing on certain grounds.

Art must have unfettered freedom of choice in its subject matter. However, the politics of 'political-correctness' intervene in the realm of artistic independence. Even then, the cinematic genre of art often succeeds in creating an ebb and flow among the dominant patterns of socio-political discourse. The ideological stand of films operates in such a way that it can directly connect to the psychological as well as intellectual inferences of life activities. Moreover, it can support, subvert, or supplant the established notions of sociopolitical ethics. Movies such as *Uri* and *Hamid* willfully insist on a distinct quest for comprehending the ethics of necro-politics. Even though these movies exhibit the same military background, they disseminate different dogmas in their political agenda.

URI, The Surgical Strike, is a film starring Vicky Kaushal, Paresh Rawal, Yami Gautam, and Kirti Kulhari. It is based on the September 2016 counter-attack carried out by the Indian Army in response to the terror attacks at Uri, the army base camp in Kashmir.

The movie starts with a song of ambitions and desires sung by an ordinary soldier addressing his daughter as '*oh mori raani*' (my dear sweetheart) (*URI* 00:03:30). The song is interrupted suddenly by the attack of another group. Thus, the very beginning of the movie creates tension or a threat to the ordinary notions of desire as well as ambitions.

The lyrics of the song suggest the yearning of soldiers to have a normal life of love and compassion, but the serenity of the song is contradicted by the wild and sudden interruption of the attackers. The death of that soldier on the battlefield suggests how the rights of the soldiers to dream are negated. The eyes of the dying soldier question the uncertainty of life while the unsung lyrics reverberate through his last breath.

The film visualizes how soldiers give up their today for the nation's tomorrow and it reminds one of the nation's resolve to signify or repay the sacrifices they make for the country. As the lines quoted, *–zindagi haan thode thode faasle thhe kuch tere kuch mere kyun darmiyaan*‖ (Oh life, why was there was always a rift between us) (00:26:57- 00:27:05), there is always a rift between life and death for civilians in the society and especially for soldiers. *URI* puts a spotlight on the unacknowledged passion in their hearts and fire in their eyes. The film is a fitting filmy tribute to the Indian Army, which in some sense glorifies the nationalist in every compatriot.

Vicky plays the role of a dedicated soldier, Vihaan, who is known for his meticulous strategizing and planning in missions. After a successful mission, he demands a premature retirement to support his ailing mother, and the authority retorts, *–Desh Bhi toh hamaari maa hai*‖ (after all, this country is also our mother) (00:16:52). Hence, the familial obligations of soldiers negate the façade of nationality by questioning their conscience and commitment to the nation.

The repetition of *–'how's the josh? high sir ! jai hind! jai hind'* throughout the movie before

and after their acts of violence functions as a catalyst that supports the legitimacy of death even though it is in the guise of a political strategy.

There is an intensely emotional scene in the movie when the daughter of a dead soldier utters these words, ‖*Shauryam..Daksham…Yuddhe*…‖ (Courage and competence in war) (00:47:17) and the officers complete it by yelling ‖*Balidaan Parmo Dharma*‖ (00:47:24) (sacrifice is the ultimate dharma). This shows the indoctrination of war and its significance even in the minds of children. According to Hinduism, dharma is the essence of life and purpose. The death of the soldier is equated with the sacredness of sacrifice in order to acquire the highest means of dharma, hence the political indoctrination works from the root level of human conscience. It controls the national, religious, as well as psychological sentiments of its subjects. A senior army officer in the movie concedes, ‖*Ankhein bandh karta hoon to bachon ki nahi Kashmir ka territorial map dikhayi detha hai*‖ (When I close my eyes, I do not see my children's faces, I see Kashmir's territorial map instead) (00:57:34-00:57:40). Even the deepest conscience of an ordinary man has been replaced by the divides of territories so profoundly that he cannot sense his obligation towards family or loved ones. The millions of fathers and mothers who see their sons swept into the maelstrom of war have been schooled to overlook conflict with their consciences.

‖*Pakistan jo basha samachtha hai, ussi basha mein Pakistan ko samjane ka samay ab aagaya hai*‖ (It is the time we send a message to Pakistan in the language they understand) (00:48:50 – 00:48:55), here *Basha* (language) is a metaphor used to signify the aspect of rightful killing. Death is the language they are implying to use as a messenger to convey their stand to Pakistan. ‖*vishwas ud jayenaga logon ko hamare sarkar se*‖ (People will lose the faith in our government) (00:49:05). Here it is explicit that in order to restore the power of the authority, they must exercise the right to kill. Hence, death serves as a powerful tool professing to satiate the power of the authority.

–vo apne logon ko bookha pyasa chod dhenge marne keliye lekin aathankavadh ka funding nahi rukhenge‖ (Pakistan might let their people starve to death, but never stop funding terrorism) (00:49:28- 00:49:33). This explicates the agency of terrorism, which has the potential to exercise power by distorting another's freedom of life.

When the protagonist Vihaan faces a moral dilemma regarding his participation in the war, he recollects the idea of a lecture given by the senior officer during his training period, *–farz or farzi mein ek mathra ka anthar hota hai mein vo mathra nahi banhna chatha hoon, agar mein apne desh apne bhayen keliye ab nahi lada, tho apne hi nazron mein farzi banker reh jaoge*‖ (There exists a thin line between responsible and irresponsible. I do not want to be on the other side of that line. If I do not fight for my men, my country, then I will be irresponsible in my own opinion) (00:56:05 - 00:56:20). Therefore, it is evident that the nation instills such kind of commitment in the minds of the soldiers and they teach them how to surrender mentally and emotionally to their duty. The protagonist of the movie who is also an army head challenges the military troop members with his psychologically wrapped nationalistic conscience. *–kya badle keliye aapke khoon fod raha hai*‖ (Is your blood boiling for revenge?) (01:00:28). Such questions stimulate the emotional reprisal in the psyche of the soldiers because –the effusive motivational speeches delivered by leaders to their armed forces during wartime aim to boost morale and unite the troops to fight to the bitter end for their leader's cause‖ (Calhoun 333). There are so many such instances in the film, which made them inured to violence and detach them from the individual reasoning. The strong mental indoctrination acquired by the soldiers during the training period desensitizes their emotional quotient as well as physical inhibitions, which is ostensible in the line *–mein lad jaana hai lahoo mein ek chingari*‖ (The fire in my blood makes me want to fight) (1:16:48). The 'fire

mentioned here is an emotionally empowered political installation of ethnocentricity done by the ideological indoctrination of power which is conducive to the confirmation of an enslaved as well as loyal 'subject' who helps in formulating the concealed consciousness of nationality that is inherently subjective and absurd.

Courage also functions as a dominant instillation when the battlefield demands fatal bloodsheds that are subtly delineated in the movie by these lines –*challa sirte banke kafan jad tureya tanke*‖ (–A passionate soul wears a shroud on his head and is ready to die‖) (1:16:58). Hence, a soldier is ready to die for his country, he is fearless, and a brave heart is ready to die for his country. He is heroic. Here comes the conjugation of the nation's multiple agenda of creating 'heroic' as well as 'compassionate souls' concurrently. Every probable tactic of socio-political manipulation is evident in such ideologies. Similar beliefs are no more subjective now. We cannot assert that such conceptions are the deliberate ingestion of a few minds. However, these ideals of power and politics have been involuntarily indulging the cognition of the populace.

The patriotically designed morality of martyrdom or homicide is not only a product of political indoctrination; it has also an active analogy with one's religious persuasion. When it comes to the notion of 'Indianness,' the influence of Hinduism is indeed dominant. Hindu ideas on war have often been seen as following a completely contrasting rational inference from other world religions. This alien rationality has been summed up in one word: *karmayoga*. The core classic *Bhagavadgita,* which is part of the *Mahabharata* and the most famous text of the epic literature of Hinduism imparts several pragmatic precepts on war. In the *Bhagavadgita,* Krishna tells the warrior Arjuna to see the fighting itself as the end of the war. He should not think about the fruits of the battle. Fighting is a goal in itself for Arjuna because he is a warrior and by carrying out his duty, he lives in accordance with dharma. Every soldier who advances against the enemy in battle takes part

in the sacrifice of battle (*yuddhayajiia*). *Mahabarata yudha* was one of the bloodiest wars recorded in the history of Hinduism. However, according to Bhisma, it had a profound purpose and the battle itself was a sacrifice. ―The flesh and the blood of the dead become oblations and mutilated bodies, bones hair, severed heads, weapons, elephants and even the sounds of cutting and piercing have precise functions in the sacrifice of battle‖ (qtd in Brekkle 115). Such references have made scholars conclude that the *Mahabharata* war really is a sacrifice. Just as the bloodiest visuals in the *Mahabharata* war have been delineated as something admirable, the movie *URI* also exalts the ugliness of violence which is evident from this dialogue by the protagonist that states, ―*vakth aagaya hain Khoon ka badla khoon se lene keliye , unhe Kashmir chahiye hamein unka sirr*‖ (―time has come to make them bleed for their deeds. They want Kashmir and we want their heads‖) (1:27:48- 1:27:55). Here the ugliness of violence has been shrouded with the prestige of patriotism.

In short, the concept of war, that we find in the great epics of classical Hinduism, does not distinguish between the private and public war. Unlike the systematic warfare, the world of the Hindu epics is a world of individual heroes. Great warriors go to heaven when they die, whereas the warrior who dies in bed or runs away from danger goes to hell. The ethos of this world is summed up in the verse: "There is nothing higher in the three worlds than heroism *(Saurya)*‖ (Shanti Parva 100-18). It is quite apparent that the

Indian psyche has been infected with this so-called glory of heroism, which is palpable in the film *URI* also. Any chance to prove their heroism was considered a worthy deed ―*Unka sirr gardhan se alag karne ka moka de raha hoon*‖ (―A chance to behead them‖) (1:00:12). They perceive homicide as a ―*moka*‖ (chance) to prove their loyalty and nationality. Because this act of extreme loyalty by dismissing the intrusion of any personal moralities would make them 'heroic.'

The spirited nationalism that has been instilled in the first half of the film vaguely counter-poses the glorified jingoistic morality in the second half of the film. Certain dialogues in the film distinctly depict the inhumane approach of justifying homicide on account of political intolerance and egoistic revenge. *–mere ghar mein guss kar mere bayon ko mara tha na , aaj mein tere ghar mein guss kar tere bayoon ko maar raha hoon, indian army kehte hai hamein*‖ (―You barged into my home and killed my brothers, today I barged into your home, and I am killing your brothers. We are the Indian army‖) (1:57:38-1:57:48). This statement convenes the central theme of the URI mission in India as well as the motive of the movie. It is based on the Prime Minister's stern message*–ghar mein ghuss kar marenge*, (we will enter their home and hit them) (00:51:06) to Pakistan as a reaction against their terrorist attacks. Furthermore, the strong articulation of '*we are the Indian army*' in the film indirectly signifies the notion that homicide may be legitimized or desensitized on the account of extreme patriotism. It also shows the indifference of human ethics against violence which drifts between the passivity of approval and practicality of disapproval.

The film talks about a new 'Hindustan' that has the capability to ―infiltrate them (Pakistan) and hit them where it hurts‖ this idea of revenge is indeed an outcome of strategic violence. Such incidents justify the propagation of violence. These instincts are perceptible in the lines, *–Jalti lapton ko humne hathon mein hai thaam liya, hai woh kar jaana ke saara zamanaa phir dega misaala yaroon sabko apne naam diyaan"* (lighting up the fire in our heart with our passion. We have held the burning flames in our hands. We have to do something memorable, so the world remembers as for our deeds) (1:17:45- 01:18:03). They are not afraid of holding the 'flames' in their hand. They call their deed admirable and want to set a good example for the world. Here the meaning of goodness and morality has blurred. The honor of patriotism fades when acts of violence such as homicide have been misinterpreted as a good deed that can set a fine example for society.

In this sense, the film *URI* also petrifies the stereotypes of power structure without probing the narratology of dominant discourses in society.

The narration of the movie parades a slow progression, where it starts with the compassion of humanity and ends with the passion for 'patriotism.' This passion often propagates a legitimate exercise of violence in order to stabilize power within the notions of boundaries.

The political correctness of art has been problematic over the decades. Even the notion of being politically correct is itself dubious. Hence, it is perceivable that each artistic endeavor proposes a certain politics of ethical correctness. In an unbiased critique, it is indeed coherent to consider *URI* as a politically subservient piece of art. However, *Hamid* poses a different frame of mind when it comes to the ethical uncertainties of nationalism. Hence, the film can neither be perceived as a query on patriotism nor as a response to nationalism, but simply as a projection of the prevalent socio-political simulation.

Hamid is an achingly beautiful portrayal of loss, love, and longing in one of the world's most troubled and militarized zones, Kashmir. What is interesting and praiseworthy is that the writers do not pander to jingoism, as is the case in most Hindi films about Kashmir, but stick to the point. Rehmat (Sumit Kaul) is missing, who is father to seven-year-old Hamid (Talha Arshad Reshi) and husband to Ishrat. While Ishrat tries to find her husband, like how thousands of Kashmiri women do; by going to the police and later to the morgue, little Hamid has his own, brilliant way. He calls God directly and inquires about his father's whereabouts. He figures out a way to dial Allah, and the call is routed to a CRPF Jawan, who gets involved in the boy's life, albeit from a distance. The movie shows what art is here for; to pose resolute questions and to show a true reflection of society.

The movie juxtaposes the narratives of humanity and politics. Whether it is a child missing his father or a Jawan weighed down by unexpressed guilt and the frustration of not being able to visit home and family, both are victims of political mechanisms. *Hamid* portrays an auto-destructive mechanism of democracy, especially on the outskirts of Kashmir. It effectively chronicles the tension between civilians and the government. In the film, military forces are portrayed in a manner to establish their representation in the manoeuvring of authority. Therefore, the movie shares a mental as well as physical tug of war between the ordinary people and military forces. The film conceives the self-destructive relationship between the forces and the stone-pelters and how both are injured in the process of opposing each other. Both the soldiers and the commoners get affected in such a dispute, which positions power over life. Henceforth, a strong instrument is needed to turn up the inequalities of political hierarchies and art is indeed a bold platform, which cultivates a sense of realization with the proper implementation of linguistic modalities.

A language is an important tool that helps to portray the function of art in society. Films use language as a medium of political correctness. In *Hamid*, we can see the influence of language. The pure composition of Urdu poetry in the movie also exemplifies the cultural purity of the inhabitants and it delineates their linguistic identity. They use this linguistic identity to represent their political as well as ethical concerns. ‖Here, one fights with a gun in his land, to gain access to the heavens above, while the heaven on earth lies in shambles‖ (Hamid 1:03:23-1:03:33). In the film, Hamid recites these lines from his father‘s poem to the Jawan. The moment of silence that follows on hearing these lines is an explication justifying the soldier’s ethical concerns regarding his deeds of violence. Hamid‘s father in the film taught him ‖*zubaan saaf hoti hai toh seerath bhi saaf hoti hain*‖ (your language reflects your character) (00:11:09). In addition, his father stubbornly

wants Hamid to master language, because he knows that language is the only powerful metaphor that has the sovereign power to question the politics of language itself:

> Language is the sovereign who, in a permanent state of exception, declares that there is nothing outside language and that language is always beyond itself. The particular structure of law has its foundation in this presuppositional structure of human language. It expresses the bond of inclusive exclusion to which a thing is subject because of the fact of being in language, of being named. To speak [dire] is, in this sense, always to–speak the law. (Agamben 20)

If the nationalistic doctrines urge someone into a war that inevitably will bring death and injury to human beings, then it is a sheer policy of aggression. Such an aggressive initiative may dismantle the balance of human nature. The Jawan in the movie is a perfect example to conceive the dilapidating psychological trauma of a military man who is fed up with the inscrutable violation of humanity in the guise of national security. It is evident when he says, ―*Thak chuke hai hum*‖ (―I am sick of it‖) (00:37:52) hence, the arrogance of the soldier was waning with his guilty conscience. Social Democrats like Carlo Schmid, who opines that the citizen must be able to state for moral reasons-**―I** wish to serve my fatherland in its crisis in a manner other than by killing someone‖ (qtd in Bucerius). As per the conventions of constitutionalism, it is very much translucent that no person shall be compelled against their conscience to render military service involving the use of arms. In that case, compulsion is not the instinct that propagates the vindication of homicide but something else. The movie *Hamid* is indeed layered in the sense that it does question and answer every ideological instigation regarding a political homicide in a very subtle manner, which may not be comprehended superficially. There is a scene in the movie where Hamid asks the Jawan *–aap bhi karti hai kya shayari?* (Do you write poetry as well‖) (1:03:51) he retorts:

> I don't know how to, but I will recite one…The Himalayan mountain peaks speak for our glorious land, they motivate us to take a stand to be a nation, proud and free as its immortal son, stay steadfast to the path you have chosen… march on march on… Thunderbolts may strike you, son of our motherland, do not wave, be brave...like a raging fire, conquer what is in your way; there will be triumph over all brave, march on…(1:04:03- 1:04:50)

From these lines, it is evident that he has been indoctrinated with the presumption of pride over his conscience regarding the sacredness of his mother nation. Therefore, the tactics of militarization are to cultivate the spirit of nationality in such a way that it supersedes the ethical distress of homicide itself. However, the film has shown that every individual has a triggering situation that finally leads him to the path of self-identification: *–mein Allah nahi hain ek jawan hai*‖ (I am not Allah, I am a soldier) (1:29:30). When the soldier admits to Hamid that he is not Allah but a mere officer in the army, he implicitly admits the fact that he does not have the freedom to take lives. In the first half of the film, he says that he is Allah. Moreover, he may consciously or unconsciously ingest the belief that he has the right to take lives. However, in the end, he realizes that he does not have the power to take someone else's life. *–jaan lene ka haq sirf allah ko hain"* (Only Allah has the right to take lives) (1:11:51) as Hamid's father taught him. The movie culminates with the inequitable objective that no one has the right to take anyone's life on any grounds. The moral dissection of *Hamid's* theme would undermine the unprincipled ethical concealment of a homicide, at the same time it inquests about the ambiguity of patriotic morality in the realm of militarization.

Both movies show the advocacy of nationalism in the guise of patriotism. The military missions of a nation operate with the highest patriotic conscience. The ethical concerns have been

sidelined while viewing the glorious progress of political success in the nation. *URI* deliberately shows the conception of fanatic nationalism that glorifies the infinities of patriotic fallacies. The political façade over the spirit of nationalism has been

involuntarily unveiled through the film. Even though the movie is a representation of the intolerance of Pakistan's terrorism in India, it unconsciously circulates the propaganda of violence. Hence, *Uri* portrays the necropolitical side of any established power, which considers it appropriate to control lives inside as well as outside boundaries. Violent initiations such as a surgical strike propagate the idea that it is ethical to be killed and kill for the country. These conceptions of an ethical fallacy have been visible in the movie even though it portrays the humanistic approach toward the life of soldiers. The realistic portrayal of the plot has been undermined by the ethical voidity of glorifying violence.

In contrast, *Hamid* questions the patriotic disorientations in society. The projection of Kashmir has been deliberately designed in order to deepen the effects of an unanswered democratic rule. *Hamid* neither glorifies the patriotic violence nor undermines the nationalistic concerns of territory. It subtly coordinates the ill effects of patriotic nationalism, which further creates an ambiance of a narcissistic as well as jingoistic attitude and entails an impartial democratic recognition of rights and respect. The movie also identifies the guilty conscience of an ordinary soldier who battles between familial and national obligations. *Hamid* presents a different view of a soldier's inner psyche. Films like *URI* show the glory of sacrifice and exaltation of killing the enemies, but *Hamid* portrays the guilt of violence and the loss of sacrifice.

In this matter of concern, both movies delineate paradoxical perspectives on the ethics of war and militarization. When *URI* shows the extreme loyalty of soldiers towards the patriotic

doctrines, *Hamid* shows the extreme sense of guilt because of their (soldier's) disloyalty towards one's conscience. Hence, it is evident that both movies show the dual ethics of nationalism. On that account, it infers the ideological dilemma of military morality. As far as ethics is concerned, the sociopolitical dimensions of any established discourses predominantly play a crucial role in the comprehension of such moral implantations of the society. All this refers to the idea that the twenty-first century indeed demands a defensive step for national security, which is apparent in the movie *URI*. However, the increasing moral apprehensions of living in a global world invigorate the need for psychological well-being, which is a byproduct of national well-being. The film *Hamid* investigates such psychological implications for people regarding morality.

Hence, it is evident that both movies exemplify a paradoxical narrative of ethics with a foundation in national ethics that itself is dubious in nature. In relation to the doctrines of various philosophical schools such as Meta-ethics, Emotivism, Relativism, Naturalism, and Objectivism, it is evident that the morality of military homicide does not incur any pre-established value system or ethical genealogy. Conforming to the Meta-ethical cognitivism, ethics can exist with or without having truth values. Emotivism argues that ethical claims are simply an emotional disposition towards particular statements. Realism or objectivism claims that there are real objective facts of the matter about ethical issues that were independent of our beliefs about them. Relativists or subjectivists claim that moral statements are not separate from beliefs. Naturalists think moral facts are reducible to some scientific facts about the world. Consequently, it is perceptible that any philosophical research on morality confers the degrees of relativism. The meta-ethical concerns of homicide do not petrify the true or false notions of moral understanding, rather it creates an air of ambiguity that can be subjectively interpreted based on an objective moral cognition.

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Thematizing Post-truth in Cinema: A Cultural Reading of Android Kunjappan ver. 5.25

Soumya Murukesh

Abstract:

Post-truth is generally defined as a social and political situation that creates an alternative or parallel world beyond the reality or truth. It is narrated as a characteristic of post-modern society. Even though it is considered a social and political phenomenon through artistic representations, post-truth also becomes an artifact of culture. The paper analyses the Malayalam film Android Kunjappan Ver. 5.25 in the light of the theory of post-truth and explores its cultural intracity in the life of Kerala.

Post-truth is a tenant of Postmodern culture and society. Post-truth gained its popularity in 2016 when the Oxford Dictionary selected the word as *International Word of the year*. The reason behind this selection is the irrelevance of truth in the election of the United States. Then the Post-truth social culture is formed as a characteristic of Postmodern society. In a post-truth condition, truth becomes irrelevant. It is a state in which the truth gets rid of its significance, a condition in which facts do not matter anymore, while the only thing that counts is the capability of channeling and exploiting the emotions prevailing in the disgruntled masses (Diago Han, 12). Here truth belongs to everyone, no one tries to attain truth in a proper way and chooses deceitful shortcuts. The freedom of finding personal truth gets abused and replaced by the alternative truth found as a result of social or personal reasons. This results in a person feeling lost or insecure. The concepts

like truth and freedom lose their magical appeal among people and start to feel dangerous. Post-truth gives way to Hyperreality or Para reality. It creates a new reality. Hyperreality is a special kind of social reality that is created or defined by reference to models. It is an inability of consciousness to distinguish reality from a simulation of reality, especially in a technologically advanced society. It also shows the technological advances of the future. In Hyperreality the process of simulation occurred and created different Simulacra. The simulacra or hyper-real copies precede our lives and encounter "the death of real" where one lives in a hyperreal realm by connecting more and more deeply with things like virtual realities.

The Process of simulation is as follows:

1. Order of sacrament: t is the reflection of a basic reality. (Exact representation)
2. Order of Maleficent: It masks and perverts a basic reality (Exaggerate the reality)
3. Order of Sorcery: It masks the absence of a basic reality (No original but a sense of reality)
4. Order of Simulation: It bears no relation to any reality (The successful condition of Hyperreality...no sense of basic real...lives in world of para reality)

Android Kunjappan Version 5.2 is a Malayalam movie released in 2019. The script of the film is written and directed by Ratheesh Balakrishnan Poduval. Major characters are Suraj Venjaramoodu, Soubin Shahir, Sooraj Thelakkad, Kendy Zirdo, and Saiju Kurup. The film narrates the bonding of Baskara Poduval (Suraj Venjaramoodu) and his son Subramanyan (Soubin Shahir) Baskara Poduval is a stubborn old man, who is totally against the technological world. He is basically a farmer and is utmost reluctant to send his son Subramanyan for a job in the town. He never uses any kind of equipment in the kitchen and always leads a simple and strict lifestyle. But without considering his father's approval, Subramanyan left for Russia for a job in a Japan Robotic

Company. From the company, Subramanyan bought a Robotic Home nurse to look after his father. First of all, Baskara Poduval was against the idea but gradually he considered the Robot as his son. The film presents dynamic concepts of post-truth and explores the encounter between the human world and the digital world.

The cinema begins with a scene of performing a death ritual. The scene itself is the best example of the uncertainty of truth. The son practices the death ritual without any belief. The day of the death of the father is questionable here. Even, the death of the father is not confirmed. Without considering the real knowledge, a discourse of pseudo and ambiguous knowledge is established. The opposing elements like belief and knowledge become meaningless and go hand in hand.

Then the cinema presents the son and his duties to his father in a realistic manner. Subramanyan's urge to grab a good future resulted in the arrival of his substitutes who are supposed to look after and take care of the father. The home nurses who came to look after Baskaran Pillai are presented as a perverted image of his son. They are comics. Never assimilate with the needs of the father.

Thirdly one could see a robot Android ver 5.2 as a caretaker of the father. The father got an accident and his son called him from Russia to enquire about his health. In between their conversation, the signal became lost. The incident foreshadows the detachment of father and son in the future. Then there is a scene in which the father touches the heart of the robot while he was going to fall once. There begins the absence of basic reality. Most of the scene which narrates the complex relationship between the father, son, and the robot represents absurd reality which is one of the chief characteristics of post truth and postmodernity. Gradually the father rather thinks or

believes that the robot is his friend or his son. He made the robot wear dress. He wrote his horoscope. He shared his secrets which he could not want to share with anyone. The robot becomes more than his son. When the man took over the control of the Robot by himself, he began to live in hyperreality. He is completely separated from basic reality.

The robot becomes a human being in his psyche. He is unable to differentiate between the real and hyperreal. While the municipality men were taken away from the robot he reacted nervously. He is not ready to give up the robot even though his son told him that the robot would be a threat to his life. He decided to elope with the robot. The last scene of the film says that he will not be able to escape from the hyper-real world where he and his robot enjoyed their life.

In the context of psychology, the impact and influence of post-truth are defined as:

> post-truth promotes a very hopeful future. These post-truth characteristics make it look good, especially for certain people. Specifically, people who feel confused, disoriented, and insecure. These characteristics make people susceptible to needing a higher level of closure. Aside from this, these people normally feel threatened, humiliated, or insignificant. Because of this, they have an intense desire to search for importance. (What is Post-Truth? - Exploring your mind)

When Subrahmanyan went to Russia, Baskara Poduval felt that he was abandoned by his son. The incidents after their parting and his behaviour toward the servants and others prove that he is confused, disoriented, and insecure in his life. He is not interested in anything and becomes rougher and more reserved. The robot helps him to have contact with his ex-lover. To keep such a relationship after a long time explores his intense desire to be important in his life. Uncertainty is

a chief characteristic of post-truth conditions. The film ends abruptly without giving a clear idea about the mental state of Poduval.

The Malayalam film industry always represents and adopts new trends, especially in its theme and presentation. The film becomes a good example of the present digital world and human addiction to it. The relationship between Poduval and the robot is highly subjective and the personification of the robot becomes a hyper-reality in contemporary society. The character experiences emotions and passions toward a machine. The machine becomes man, son in the digitalized world.

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The Rationale behind the Migratory Affairs in Perumbavoor, Nellimattom, and Nellikuzhi: A Case Study of the Pandemic Scenario

Shameena K Muhammed

Abstract:

Migrant laborers have become a vital part of Kerala's economy. Kerala is witnessing a large influx of migrant laborers from different parts of the country in recent years. People started to move all around the country in search of gainful employment, better living conditions, and a possible standard of living. The large-scale migrant labourers are entering Kerala from Assam, Orissa, West Bengal, and Jharkhand. In this context, an attempt is made to analyse the underlying factors responsible for the heavy influx of migrants to Kerala and the study also concentrates on the covid 19 impact on migrant labourers based on the data from a sample of 100 migrant labourers from Ernakulum district. High wages in Kerala and low wages in their state, lack of opportunities, family responsibilities, and uneconomical agriculture in their home state have been identified as the main factors responsible for migration to Kerala.

Keywords: Migrant laborers, influx, migration, employment, covid 19.

Introduction

Migration has a long history in human existence. From the very beginning man began to go to different places in search of a better destination. During the 1980s and 1990s, migrant laborers came to Kerala from places like Tamil Nadu, Karnataka, and Andra Pradesh in search of gainful employment and better living conditions, and they were accommodated in the construction and other unskilled employments mainly ironing clothes. In contrast, they are coming from the far-flung states of Orissa, Assam, West Bengal, and Jharkhand. The migration data of census 2011 also indicated that a large number of migrants are arriving in different urban areas, particularly metro cities from different states. There are about 2.5 to 3 million

migrant workers working in various sectors in Kerala. Today, apart from the urban areas of Kerala, they have spread to the villages also. In Kerala, they are blessed with a wide range of occupations including the construction sector, cashew processing, plywood industries, wooden furniture, marine fishing, mining and quarrying, footwear sector, hotel and restaurants, and malls. The main reasons for people to migrate to Kerala are low wages, low employment opportunities, family responsibilities, floods, crop failure, and drought in their native place. Unceasing employment opportunities, a good social environment, less discrimination, and educational and health facilities in Kerala motivate them to stick here.

Migrant labourers have played a significant role in the state workforce for the past three decades. The national lockdown announced on March 25, 2020, to prevent the spread of the Covid-19 infection has been devastating for the country's migrant workers. With the exception of those working in the essential services, everyone lost their jobs. Hundreds of thousands of migrant workers and their families, including children, were pushed to the streets. The Covid-19 pandemic has led to extensive challenges to public health and food systems. The pandemic slowdown has deeply impacted businesses and jobs around the country. Especially companies - micro, small, and medium enterprises (MSMEs) – are under intense strain. "Unlike other states, migrant workers in Kerala enjoy better rights and have greater access to health, education, and housing. While migrant laborers are being forced to leave cities in north India in droves in the wake of the Covid 19 outbreak, the Kerala government has been taking proactive steps to ensure the welfare of guest workers in the state right from undertaking health screening, delivering food or food items and setting up help desks to allay their concerns" (Times of India Apr 4, 2020)

This study was carried out in some areas of Ernakulam dist. namely, Perumbavoor, Nellimattom, and Nellikuzhi. Perumbavoor lies in the north-eastern tip of the Greater Cochin area and is also the headquarters of Kunnathunad Taluk. It has many immigrants from other

parts of India, including West Bengal, Orissa, and Uttar Pradesh. Most work in plywood or other industries. Tamils, Assamese, and Nepalese have special colonies of their own. Nellimattom is a small Village in Kothamangalam Block in Ernakulam District of Kerala State, India.Nellikuzhi" The furniture village of Kerala a Gramapanchayath in Kothamangalam Taluk, Ernakulam Dist, Kerala,

Methodology

The present study is based on a field survey carried out in the district of Ernakulum in Kerala. The survey sample included 100 migrant workers from West Bengal, Assam, Orissa, Sikkim, Mizoram, Bihar, and Kolkata who had been working in Kerala. The purpose of this paper is to find out the reasons favoring the heavy influx of migrant laborers into the state and analyze the Covid 19 impact on migrant laborers. The study is limited to three places in the Ernakulam district of Kerala. For the primary data collection, a field survey was conducted among the migrant laborers in Perumbavoor, Nellimattom, and NellikuzhI where the greatest number of migrant labourers exists. A very limited sample size of 100 casual workers seeking work in the labour market on a day-to-day basis has been interviewed by using a pre-structured questionnaire. Migrant laborers are interviewed directly and analyzed on the basis of primary data. We have taken the help of the local contractors to find out their working places and the places where they have been living. The data collection was done by visiting either work sites or residences as per convenience. The collected data are tabulated, analyzed, and interpreted.

Analysis and Findings

The table below shows a consolidated analysis.

Table 1. Age Composition

Characteristics	Frequency	Percentage
20-25	39	39
25-30	21	21
30-35	15	15
35-40	13	13
40-45	12	12
Total	100	100

(Source: Primary Data)

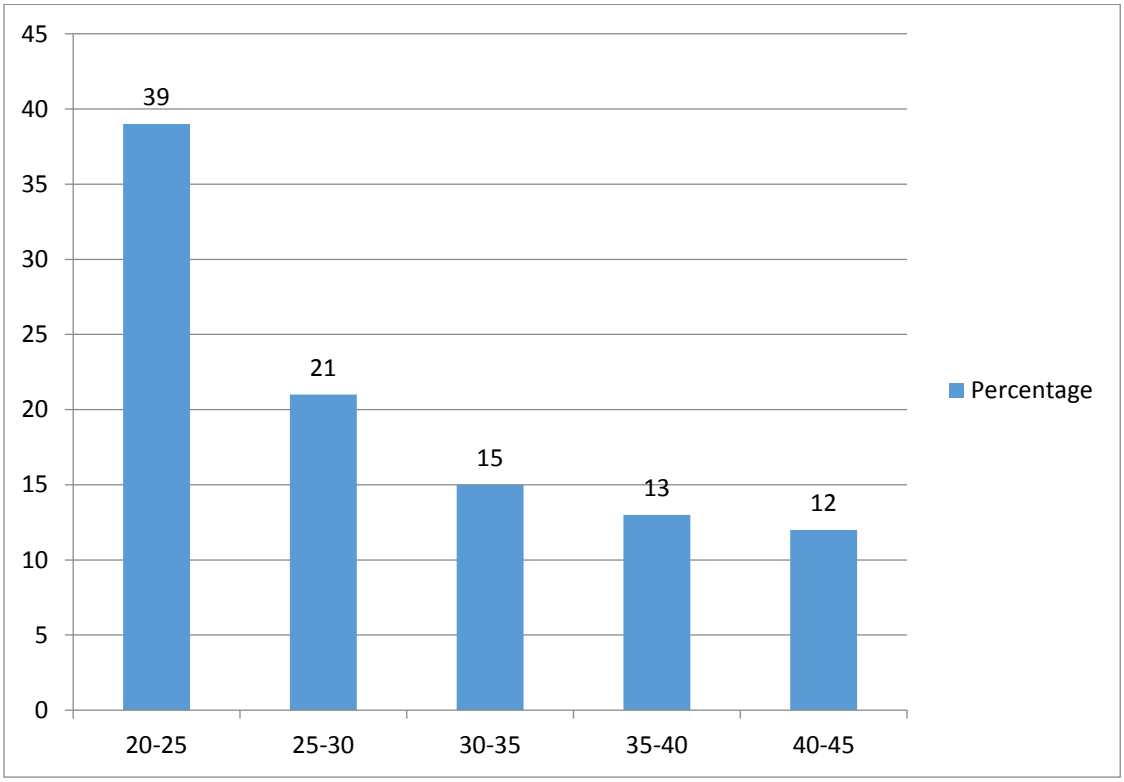


Table2. Education Level

Characteristics	Frequency	Percentage
LP Education	42	42
UP Education	30	30
Secondary Education	18	18
Higher Secondary Education	10	10
Total	100	100

(Source: Primary Data)

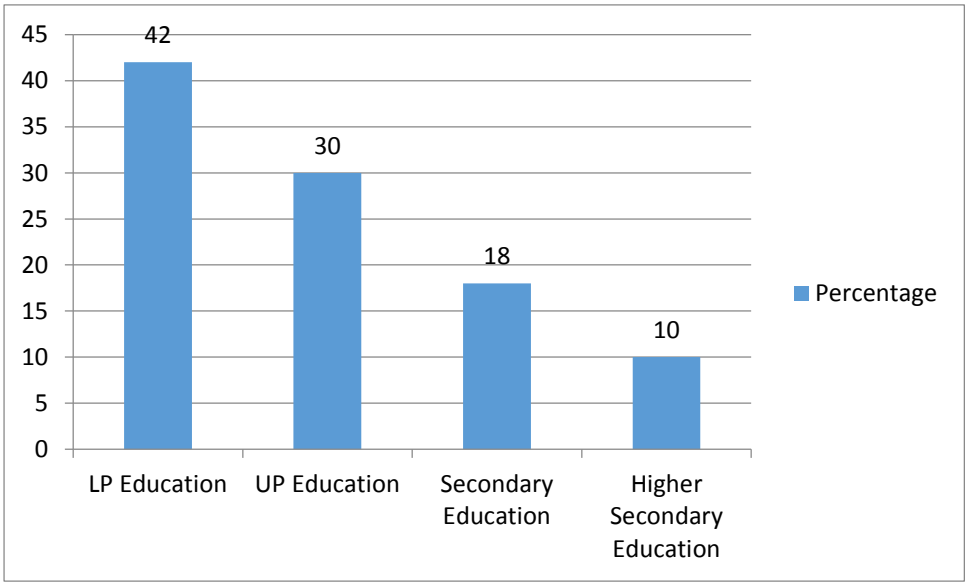


Table 3 State of Origin

Characteristics	Frequency	Percentage
West Bengal(Kolkata)	2	2
Sikkim	5	5
Assam	50	50
Bengal	21	21
Mizoram	5	5
Orissa	15	15
Bihar	2	2
Total	100	100

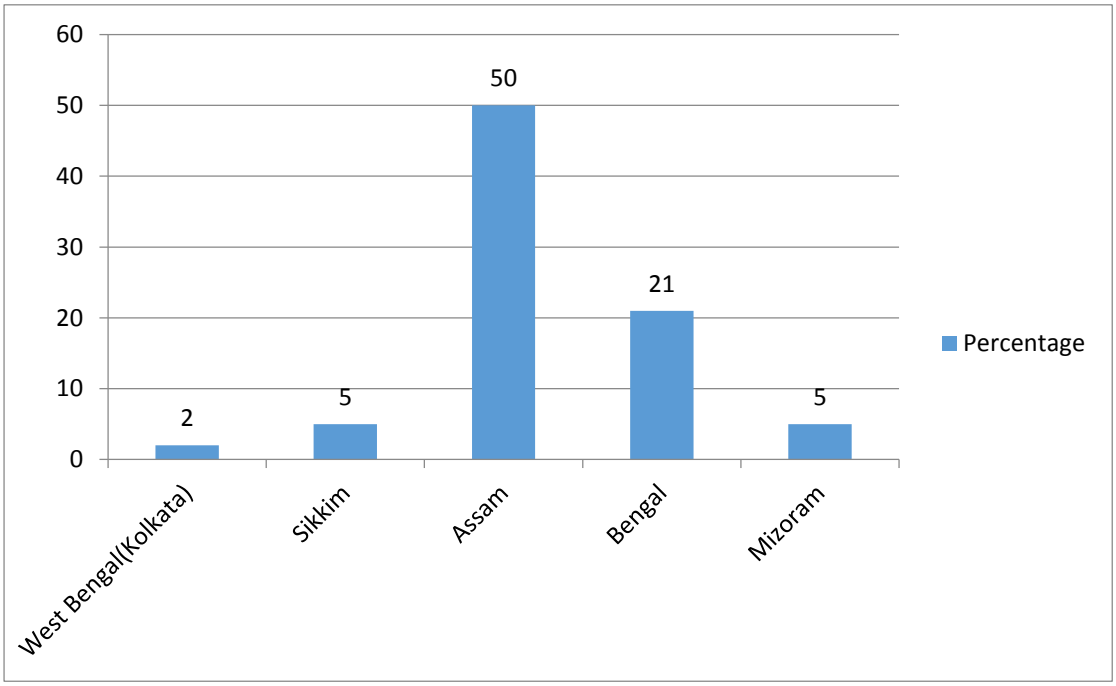


Table 4

Type of work

Characteristics	Frequency	Percentage
Plywood company workers	30	30
Carpenters	20	20
Casual workers	10	10
Construction workers	40	40
Total	100	100

(Source: Primary Data)

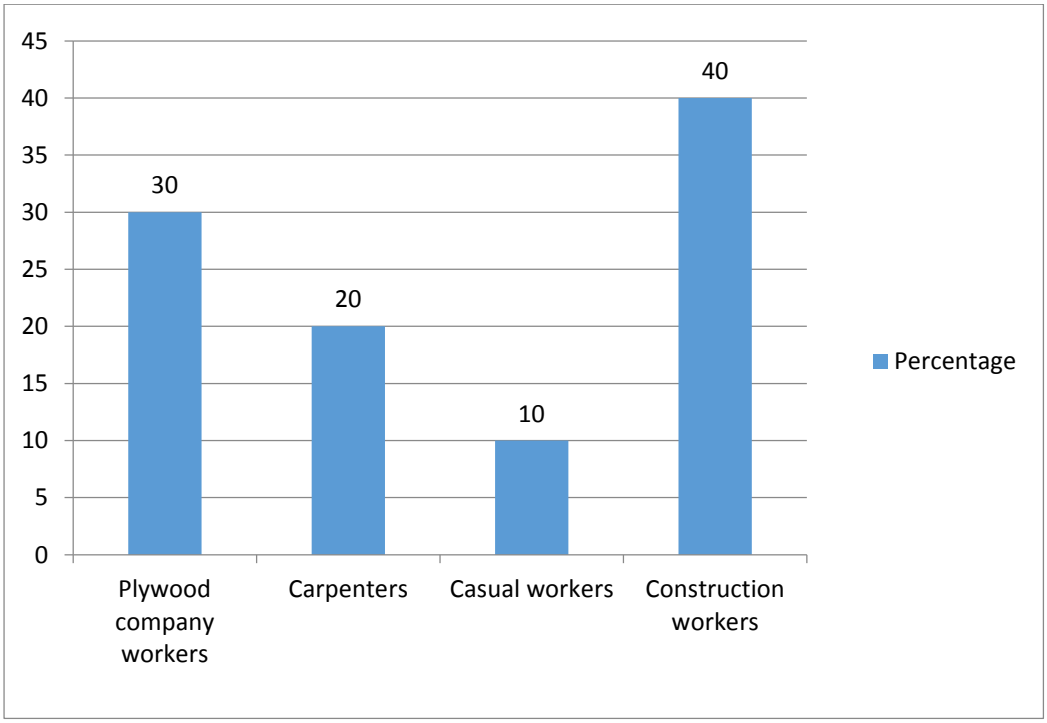


Table 5: Place of work

Characteristics	Frequency	Percentage
Perumbavoor	30	30
Nellikuzhy	30	30
Odakkali	25	25
Nellimattom	15	15
Total	100	100

(Source: Primary Data)

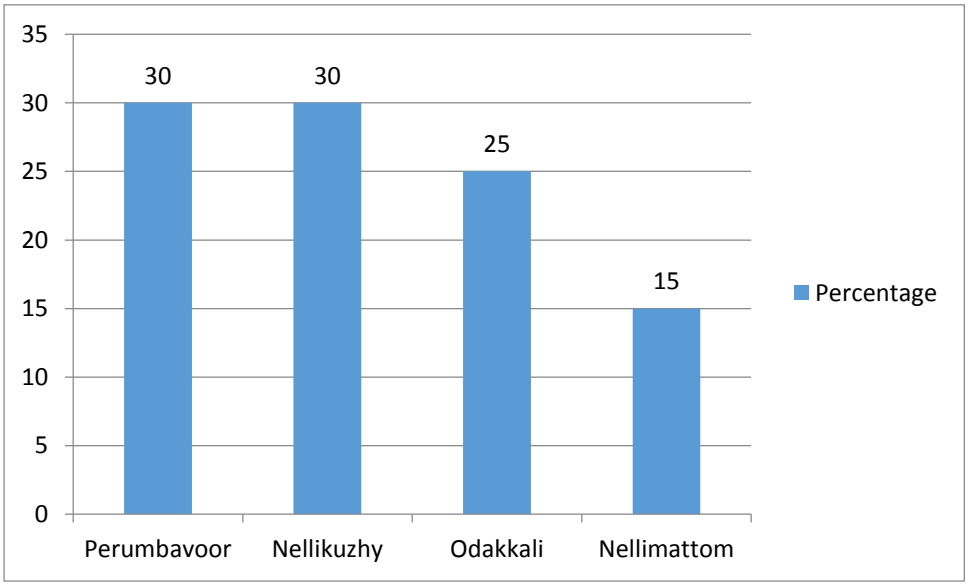


Table 6 Daily wages in their state

Characteristics	Frequency	Percentage
100-200	31	31
200-300	40	40
300-400	17	17
400-500	12	12

Total	100	100

(Source: Primary Data)

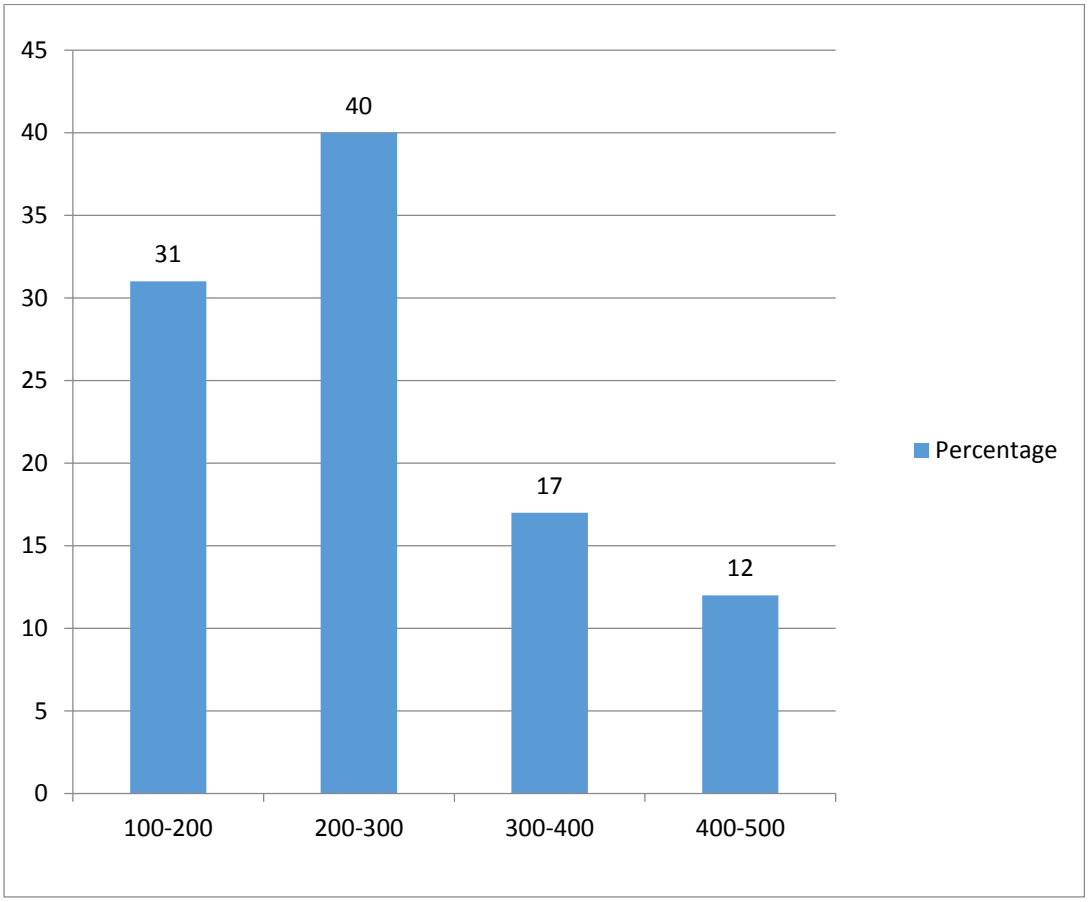


Table 7 Daily Wages in Kerala

Characteristics	Frequency	Percentage

400-500	11	11
500-600	12	12
600-700	26	26
700-800	51	51
Total	100	100

(Source: Primary Data)

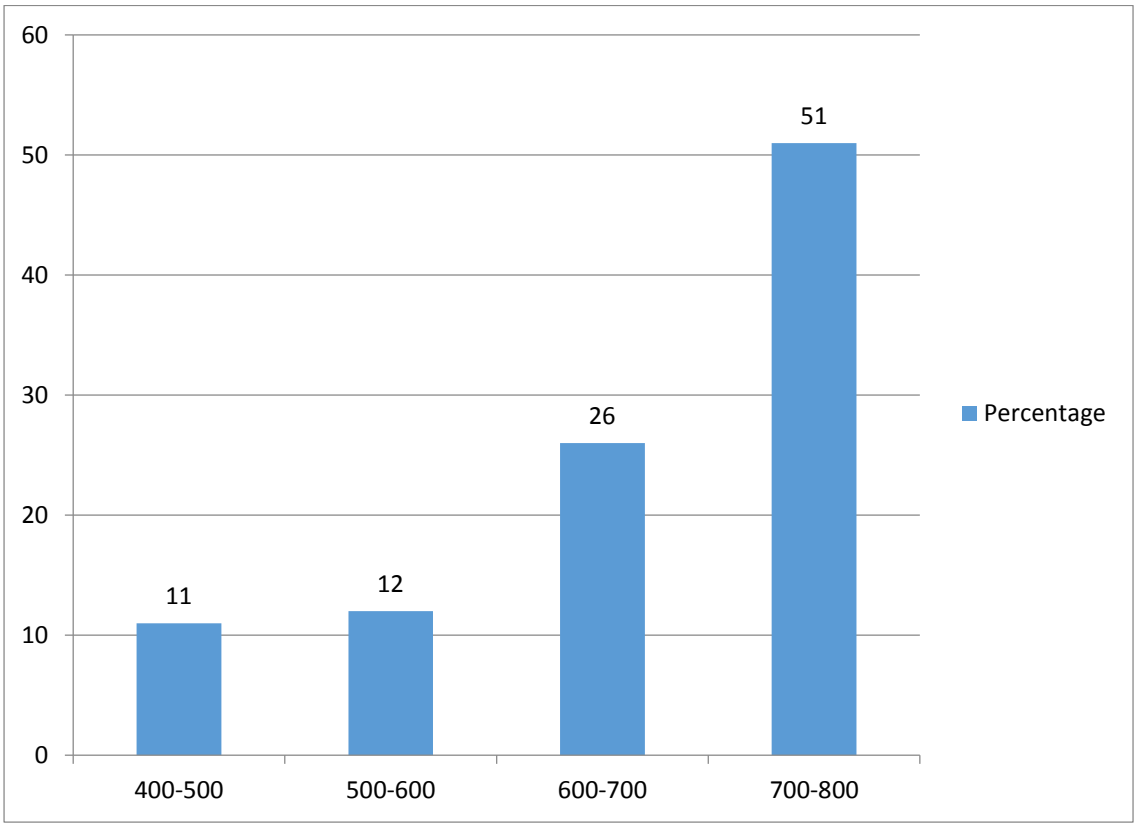


Table 8 Reasons for Migration

Characteristics	Frequency	Percentage

Family problems	14	14
Unemployment	25	25
Low wages in the home state	40	40
Uneconomic agriculture	21	21
Total	100	100

(Source: Primary Data)

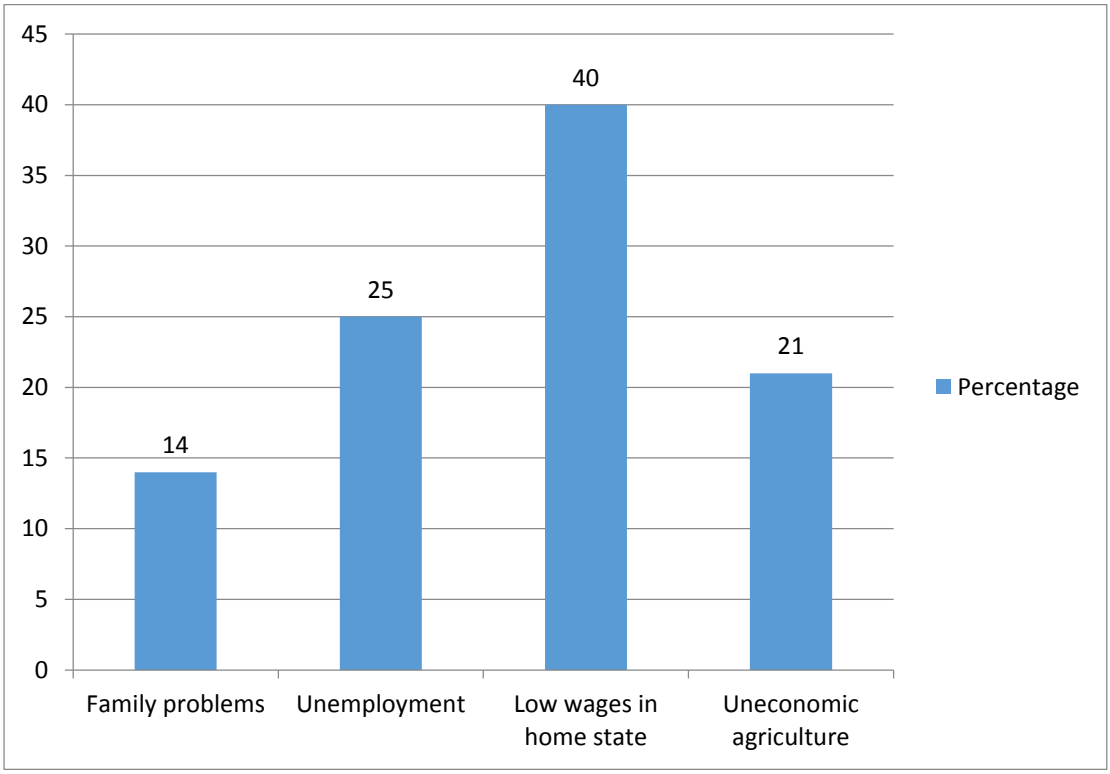


Table 9 Awareness of Covid-19

Characteristics	Frequency	Percentage
No Information	45	45
How to prevent covid	20	20
Where to get tested	0	0
What to do, if positive	0	0
Symptoms of covid 19	35	35
Total	100	100

(Source: Primary Data)

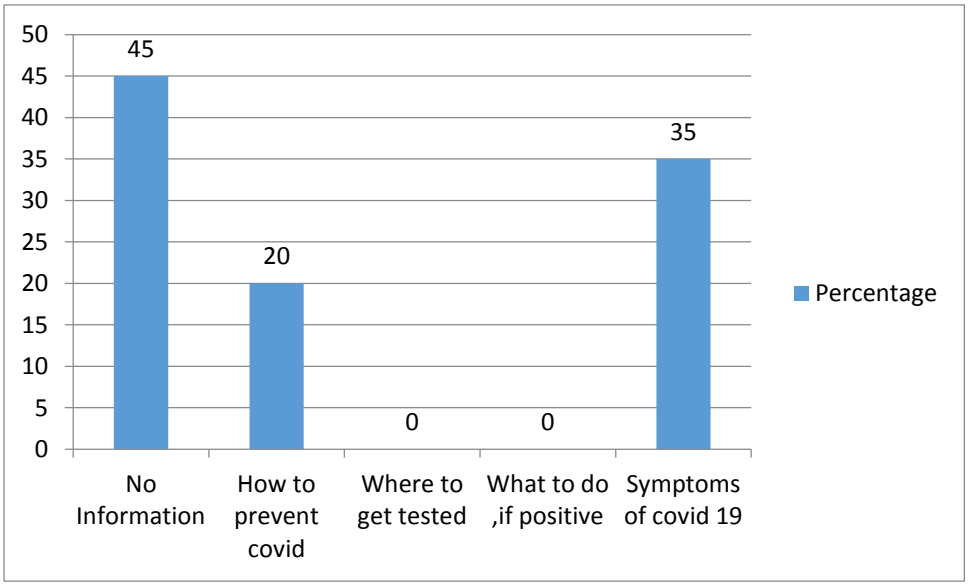


Table 10 Supported Organisation

Characteristics	Frequency	Percentage
Government(home state)	2	2
Government(state where you work)	30	30

Union government Employer LSG	1 45 22	1 45 22
Total	100	100

(Source: Primary Data)

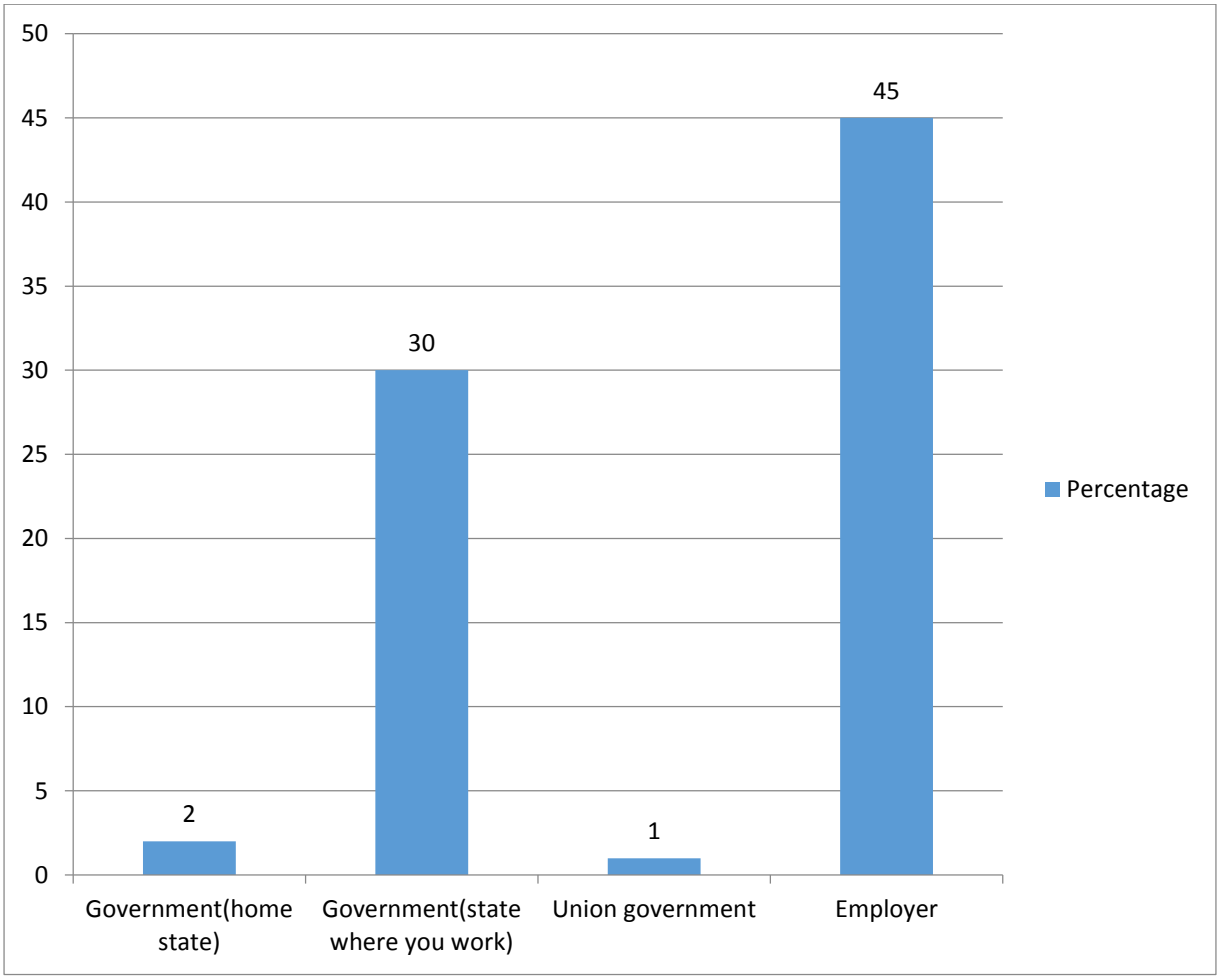


Table 11 Most Pressing Needs

Characteristics	Frequency	Percentage
New job	7	7
Money for food	10	10
Money for accommodation	8	8
Money for treatment	15	15
Assistance to travel back home	20	20
Assistance to travel back to work	40	40
Total	100	100

(Source: Primary Data)

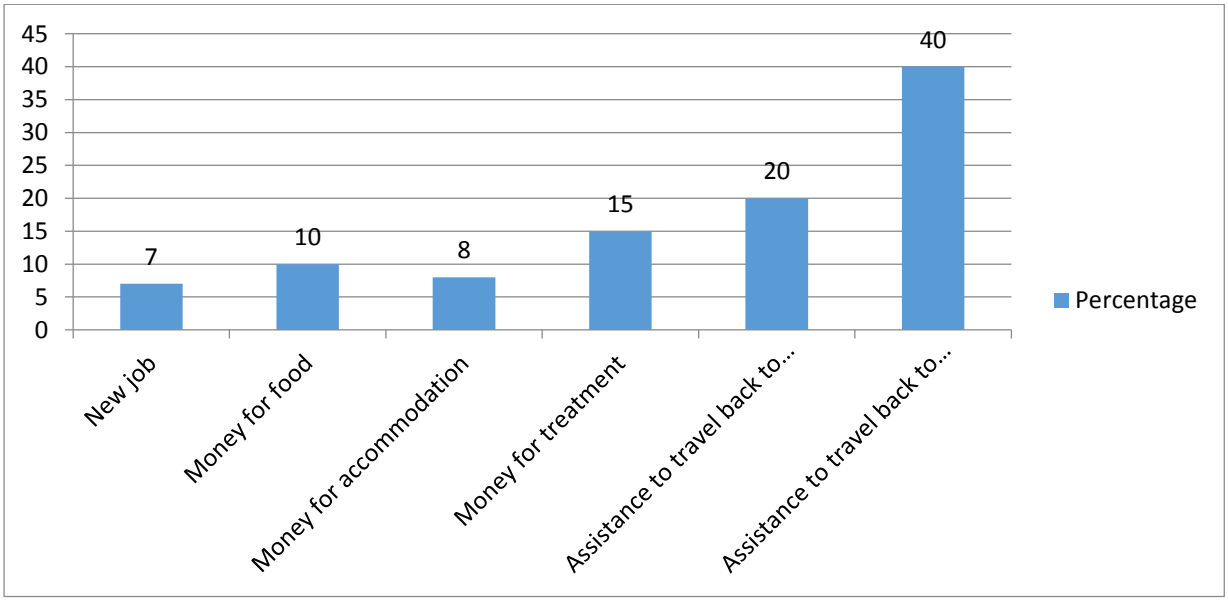


Table 12 Challenges Experienced

Characteristics	Frequency	Percentage
Reduced income	24	24
Lost all income	50	50
No money for food and treatment	16	16
Others	10	10
Total	100	100

(Source: Primary Data)

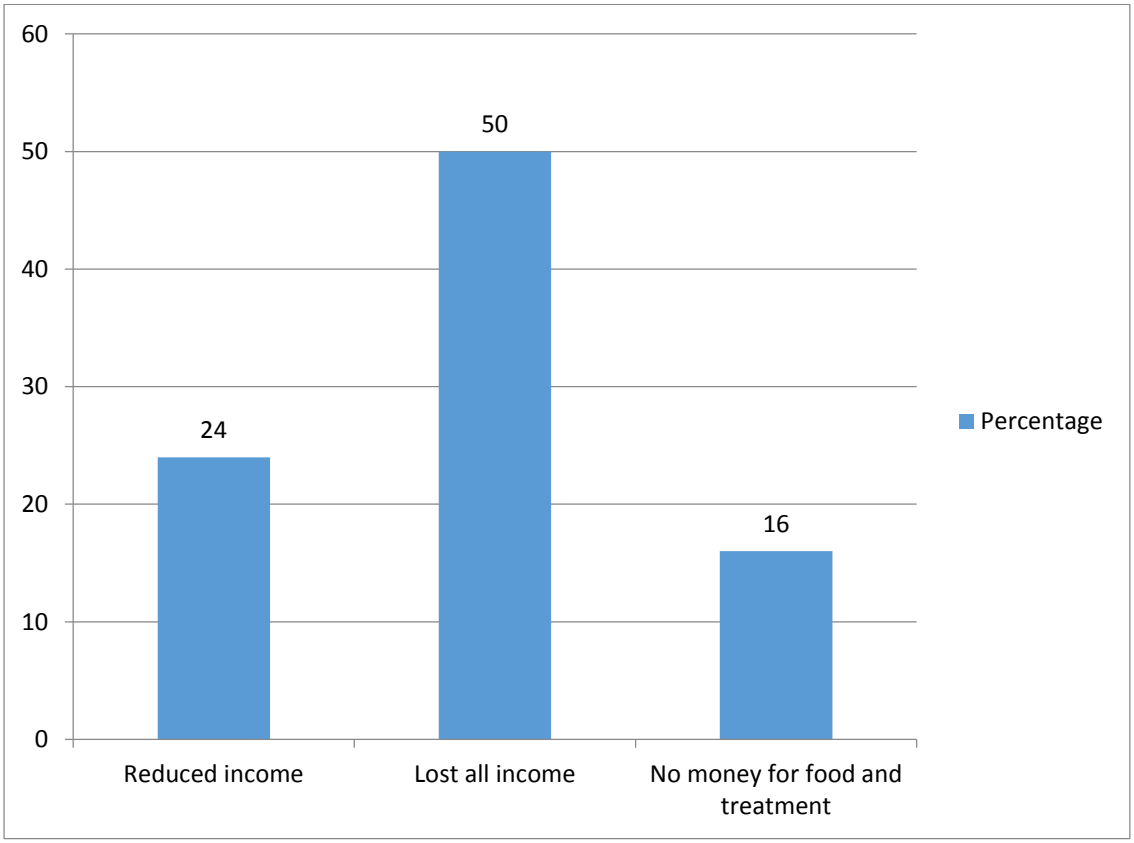
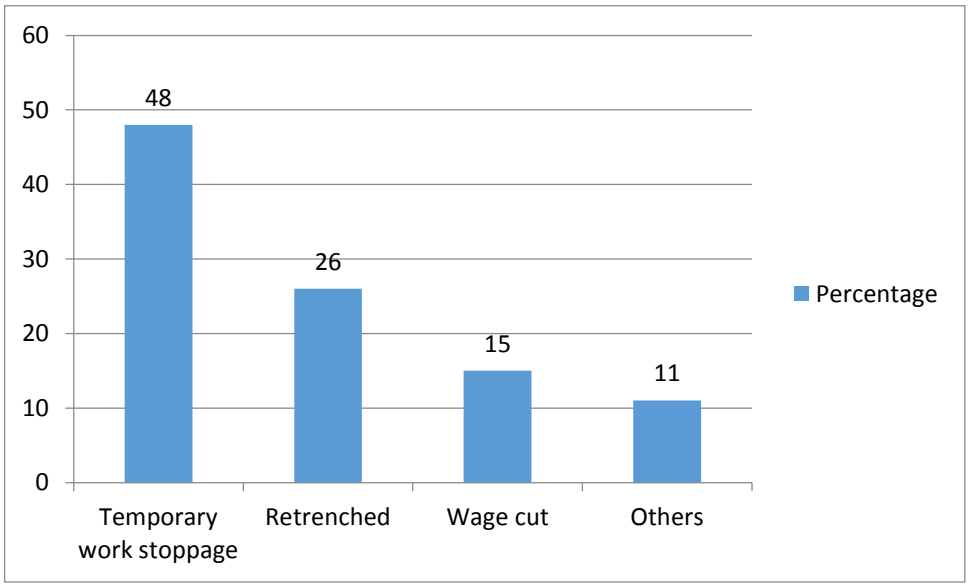


Table 13 Effects of Covid19

Characteristics	Frequency	Percentage

Temporary work stoppage	48	48
Retrenched	26	26
Wage cut	15	15
Others	11	11
Total	100	100

(Source: Primary Data)



This study takes a multidimensional overview of migrant laborers in Kerala by encompassing the factors like reasons for migration, wages, and benefits obtained in Kerala, effects of Covid 19, challenges experienced and supported organizations. The first objective of the study is to analyse the factors responsible for the heavy inflow of migrants to Kerala. We can find out from the above analysis that, of the 100 responses received, 39% of the workers are from the age group 20-25 and the majority (42%) of the migrants have only LP school education. About 50% of the samples migrated to Kerala from Assam, 21% from Bengal, 15% from Orissa, and the remaining from Kolkata, Sikkim, Mizoram, and Bihar. The majority of

the respondents (40%) were construction workers, 30% of the workers were employed in plywood companies, 20% of the respondents were carpenters and casual workers constitute 10%. We can view from the above table that 51% of the migrant labourers received 700 to 800 as daily wages from Kerala instead of receiving a daily wage of 200 to 300 in their native state. The above data reveal that 40 % of the migrants leave their native place due to low wages in their own state, 25% due to unemployment, 21% due to uneconomic agriculture, and 14% due to family problems in their home state.

The migrant laborers from outside South India usually called 'Bhais' received reasonable wages and enjoyed the work and the peaceful life in Kerala. Kerala government has introduced several welfare schemes for out-of-state workers. Kerala is the first Indian state to enact social security schemes for migrant workers (Srivastava 2020). Under the auspices of the state education department, schools introduce special programmes for accommodating the children of migrant labourers under Sarva Siksha Abhiyan. The government of Kerala has also opened secure hostels called "Apna Ghar" for migrant workers in Kerala. 'Avas Insurance Scheme' was launched in 2016 for migrant labourers.

The second objective of the study is to find out the consequences of covid 19 among migrant labourers in Kerala. The migrant labourers were impacted from the very first day of lockdown as they were not allowed to assemble at the junctions seeking work. As a consequence of the pandemic a large number of migrant workers, especially in the construction and hospitality sectors left the state.

However, it is found that those working in private firms (45%) stayed back as their employers provided them with food kits and other supplies until work resumed. 30% of the workers opined that the government of the state where they work had helped them the most. From this study, we can see that 45% of the workers at the destination were totally ignorant

about the Coronavirus or COVID 19. However, 35% of the workers have information about the symptoms of covid 19 and 20% of the respondents know how to prevent it and no one knows where to go to test and what to do if the test is positive, yet all the workers at the destination had heard about the Coronavirus or COVID. The most pressing need of the migrant labourers at that time was to get assistance to travel back to work. When India declared a lockdown to capture the covid 19 pandemic, many out–of–state workers working in the construction and hospitality sectors were displaced through Shramik trains and buses. Kerala made efforts to protect some of the migrant labourers by providing food and shelter. The community kitchens set up by the LSGs provide food to migrant workers for free at the beginning stages and at a cost of 20 per person at the later stages. A few workers stayed back here as their employers provided them with food kits and other supplies until work resumed.

The state government has made two weeks of rigorous quarantine mandatory for those returning to Kerala with the help of contractors and employers. Workers can return to work only with the permission of the local health authority.

Conclusion

Interstate workers have become an indispensable part of Kerala's economy, today. The attitude of the state government towards these labourers has changed over the years. At first, the government addressed them as migrant labourers and later as interstate migrant labourers. Now it has christened them "guest workers" (Times of India Apr 4, 2020)

This study tried to analyse the underlying factors responsible for the heavy inflow of migrants to Kerala and covid 19 impacts on them. The major attraction of migrants to Kerala is reported as the higher wages, availability of work and better working conditions. There are many job opportunities in the industrial and manufacturing sectors in Kerala. However, during 2020, the impact of Covid-19 on the migrants examined here and their remittances have been

disastrous. The lockdown has resulted in a huge loss of employment in almost all sectors where migrant labourers are employed. The impact of the loss of employment was severe in the case of self-employed and casual workers in the state. Hundreds of thousands of migrant workers had to deal with the loss of income, food shortages, and uncertainty about their future. Due to the lockdown, with no means of transport, the Central and State governments took various steps to help them and facilitated transportation. In short, the covid 19 pandemic, subsequent lockdown, and associated measures have a catastrophic impact on both the village economies and migrant labourers of Kerala.

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A Methodical Study on Rationale to Green Initiatives of IT Companies at Techno Park, Kerala

Raisa George & A. Mohamed Siddique

Abstract:

As the greenest IT Park in India, Technopark still strives to live up to its tag. The folks at Prakruthi, a green campus club celebrating its first anniversary, announce that some 30,000 seedlings of vegetables such as Brinjal, Okra, Runner Beans, Wide Beans, Red Amaranthus, Tomato, Chilli, and the like have been distributed to 670 techies themselves. In addition to this, with a first-of-its-kind integrated and decentralised waste treatment facility, Technopark is going green. Technopark companies are perceived as being environmentally conscious and aim to build a vision of treatment. Technopark's businesses have demonstrated that renewable energy sources minimise energy demand and lower electricity bills. The most important rationale for the Green Initiatives of IT companies at Technopark, Kerala is owing to the Competitive Aspects, Profitability Aspects, Client Requirement Aspect, Legal and Regulatory Aspects, CSR Aspects. There is a difference in the Intrinsic and Extrinsic Aspects of Green Initiatives of IT companies at Technopark, Kerala.

Key words- Technopark, Competitive Aspects, Profitability Aspects,Client Requirement Aspect, Legal and Regulatory Aspects, CSR Aspects

Introduction

As the greenest IT Park in India, Technopark still strives to live up to its tag. A look at some human, collective and Technopark-wide green initiatives, which have a positive effect on the

climate, in the run up to World Climate Day on June 5. At Technopark, a green revolution is well and truly under way. For a while now, many businesses have green clubs and organic fruit and vegetable farming in gardens and on terraces has been in vogue among techies. The IT hub, with 40,000 IT professionals, functions 24 hours and produces three tonnes of solid waste every day. The folks at Prakruthi, a green campus club celebrating its first anniversary, announce that some 30,000 seedlings of vegetables such as Brinjal, Okra, Runner Beans, Wide Beans, Red Amaranthus, Tomato, Chilli, and the like have been distributed to 670 techies themselves. In addition to this, with a first-of-its-kind integrated and decentralised waste treatment facility, Technopark is going green. In the first step of the waste management project, waste is disposed of on the same day in an eco-friendly, economically viable manner. Instead of only making more disposal areas, there is a mentality about reusing and recycling waste. At Technopark, a maximum world-class work and life ecosystem is being structured that will lift it to international standards.

Need and Significance of the Study

Time is a scarce commodity in today's society and many environmental issues are man-made; humans have had a greater unconstructive impact than nature has ever had on climate change and the environment. Many of us reflect on being sustainable in various aspects of our lives in search of solutions, be it at home, in our shopping patterns and in our workplaces. The understanding of the world has spread to the corporate atmosphere and affects how people behave themselves at work and also impacts their job quest. Through their corporate sustainability plans, this vivacious momentum propels not only people, but also corporations to emulate their environmental responsibility and prioritise climate change mitigation. This is because green initiatives not only save on costs, reuse capital and satisfy compliance criteria, but also help to build consumer brand

awareness. Technopark companies are perceived as being environmentally conscious and aim to build a vision of treatment. Technopark's businesses have demonstrated that renewable energy sources minimise energy demand and lower electricity bills. Many businesses at Technopark have also provided incentives to those who build green houses and buildings. Thus, new job opportunities are also created by green initiatives. Essentially, prices can be cut by a green programme. Going green at Technopark will increase the overall productivity of a company. Reducing unnecessary waste will reduce the operational costs of the company's Technopark operation. Turning off lights in empty offices, for instance, will save electricity, save on maintenance costs and improve the bottom line of the business. The logic of the Green Initiatives of IT Companies at Technopark, Kerala has been investigated in this back drop.

Statement of the problem

In today's world, education forms the foundation of everything, including the environment. Environmental education and its protection impart information about the present situation and the possibilities for nature in the future. It teaches people to discuss all environmental concerns and to participate in wise ways of preserving them. At Technopark, a number of IT companies have taken the initiative to provide both practical and theoretical awareness of the effect of human activities on nature. Technopark's IT businesses take workers out of the four walls of a cubicle and make them do things such as planting, watering plants, community park meditation, crop seedlings, waste disposal facilities, and waste recycling. The only way to make the best minds work productively is by edification. We need knowledge, which can only come from the working community associated with our ecosystems, to take some step towards preserving our climate. What are the challenges that are facing the world today? What are the pieces that form

the universe? What are the distinct plant and animal species? How will we ensure their longevity in the long run? What is sustainability and how to do it?

Only if we think about the world and apply that information functionally will all these questions be answered. Certain variables may have influenced them to inspire workers towards green impact. In the current research report, the factors that influenced Technopark's IT companies towards green initiatives are examined. Hence the present study entitled as "***A methodical study on rationale to Green Initiatives of IT companies at Technopark, Kerala".***

Objectives of the Study

1. To examine the rationale for Green *Initiatives of IT companies at Technopark, Kerala*.

2. To compare the Intrinsic and Extrinsic Aspects of Green *Initiatives of IT companies at Technopark, Kerala.*

Hypotheses of the Study

1. There is no significant difference in the rationale for Green *Initiatives of IT companies at Technopark, Kerala.*
2. *The Intrinsic and Extrinsic Aspects of* Green *Initiatives of IT companies at Technopark, Kerala is the same*

Methodology

Primary data is used for the study. The primary data is collected using a standardised questionnaire from 50 administrative staff employed in different IT-related businesses at Technopark. The investigator adopted the Judgemental Approach of Sampling. In order to collect data, the investigator visited 5 multinational companies, and 10 respondents were selected from each organisation. To make the analysis, the researcher relied One factor Anova, *Post hoc* analysis- p-values for pair wise t-tests, Correlation and Independent sample t-

Result and Discussion

Table 1.1

One factor Anova - *Rationale for Green Initiatives*

One factor Anova					
Mean	*n*	*Std. Dev*	*Rationale for Green Initiatives*		
3.8	50	0.99	Profitability Aspects		
4.4	50	1.06	Competitive Aspects		
3.2	50	1.36	Legal and Regulatory Aspects		
3.7	50	1.22	CSR Aspects		
3.6	50	0.99	Client Requirement Aspect		
3.7	250	1.19	Total		
Anova table					
Source	*SS*	*df*	*MS*	***F***	***p-value***
Treatment	37.78	4	9.444	**7.34**	**0.000***
Error	315.06	245	1.286	**Result**	
Total	352.84	249		**Significant**	
Post hoc analysis- p-values for pair wise t-tests					
Rationale for Green Initiatives	Legal and Regulatory issues	Client Requirement Aspect	CSR Aspects	Profitability Aspects	Competitive Aspects
	3.2	3.6	3.7	3.8	4.4

Legal and Regulatory issues	3.2					
Client Requirement Aspect	3.6	0.079				
CSR Aspects	3.7	.0180*	0.5376			
Profitability Aspects	3.8	.0052*	0.291	0.6597		
Competitive Aspects	4.4	0.000*	.0005*	.0039*	.0142*	

Source-Primary data

The rationale for the green initiatives by the IT companies at Technopark, Kerala has been examined with the support of the One way Anova. The mean score assigned by the administrative staffs on the rationale Profitability Aspects is 3.80±0.99. The score awarded for the Competitive Aspects and Legal and Regulatory Aspects is 4.40±1.06 and 3.20±1.36 respectively. At the same time, the score awarded for the CSR Aspects and Client Requirement Aspect is 3.7±1.22 and 3.60±0.99 respectively.

The statistical analysis was tested with the support of the Anova Test. The CVTS of F value is 7.34 and the p value is 0.000(P value<5%), showed the null hypothesis is rejected. This

implies, there is a significant difference in the rationale for Green Initiatives of IT companies at Technopark, Kerala.

As the test is significant, the Post hoc analysis- p-values for pair wise t-tests was calculated to know the reasons for the difference. It noted from the table that statistically, there is a difference between the Competitive Aspects with Legal and Regulatory Aspects (p value 0.000<5%), Client Requirement Aspect (p value 0.005<5%), CSR Aspects (p value 0.0039<5%) and Profitability Aspects (p value 0.0142<5%), favour to Competitive Aspects. This means that the most important rationale for the Green Initiatives of IT companies at Technopark, Kerala is owing to the Competitive Aspects. Statistically, there is a difference between the Profitability Aspects with Legal and Regulatory Aspects (p value 0.0052<5%) and Client Requirement Aspect with Legal and Regulatory Aspects (p value 0.0180<5%) favour to Profitability Aspects and Client Requirement Aspect. This means that the next important rationale for the Green Initiatives of IT companies at Technopark, Kerala is owing to the Profitability Aspects and Client Requirement Aspect. All other differences are not significant.

Table 1.2- Correlation Matrix - *Rationale for Green Initiatives*

Correlation Matrix	*Intrinsic Aspect*	*Extrinsic Aspect*	
Intrinsic Aspect	1.000		**Result**
Extrinsic Aspect	.805*	1.000	
50	Sample size		
± .279	Critical value .05 (two-tail)		**Significant**

Source – Primary Data

Table 1.2 shows the correlation matrix. Here the dependent variables are Intrinsic Aspect and the Extrinsic Aspect. Intrinsic Aspect includes Competitive Aspects and Profitability Aspects. Similarly, the Extrinsic Aspect includes Legal and Regulatory Aspects, Client Requirement Aspect and the CSR Aspects. The correlation value is 0.805, showed a high positive relationship. This implies, when there is one degree standard deviation change for the Intrinsic Aspect, the corresponding standard deviation change for the Extrinsic Aspect will be 80.5% and is found significant. Thus the null hypothesis rejected. There is a relationship between the Intrinsic and Extrinsic Aspects of Green Initiatives of IT companies at Technopark, Kerala.

Table 1.3

Independent Groups t-test - *Rationale for Green Initiatives*

Hypothesis Test: Independent Groups (t-test, pooled variance)		
Intrinsic Aspect	Extrinsic Aspect	
4.080	3.473	mean
0.835	0.873	std. dev.
50	50	n
98	Df	
0.6067	**difference (Intrinsic Aspect - Extrinsic Aspect)**	
3.55	**T**	
.0006*	**p-value (two-tailed)**	
Result	**Significant**	

Source: - Primary data

The mean score assigned by the administrative staffs on the rationale Intrinsic Aspect is 4.080±0.835. The score awarded for the Extrinsic Aspect is 3.473± 0.873

The statistical analysis was tested with the support of the Independent Groups t-test. The CVTS of t-test value is 3.55 and the p value is 0.0006(P value<5%), showed the null hypothesis is rejected. This implies, there is a significant difference in the Intrinsic and Extrinsic Aspects of Green Initiatives of IT companies at Technopark, Kerala. This implies, the gap (0.6067) between Intrinsic and Extrinsic Aspects of Green Initiatives of IT companies at Technopark, Kerala is relevant. IT companies at Technopark, Kerala, give due importance for the Competitive Aspects and Profitability Aspects for making the Green Initiatives.

Conclusions

From the following, it is clear that the most important rationale for the Green Initiatives of IT companies at Technopark, Kerala is owing to the Competitive Aspects, Profitability Aspects and Client Requirement Aspect. There is one degree standard deviation change for the Intrinsic Aspect; the corresponding standard deviation change for the Extrinsic Aspect will be 80.5%. This means both intrinsic and extrinsic aspects are closely related to each other. The influence of the Legal and Regulatory Aspects and CSR Aspects are same as far as the administrative staff is concerned. There is a difference in the Intrinsic and Extrinsic Aspects of Green Initiatives of IT companies at Technopark, Kerala. This implies, the gap (0.6067) between Intrinsic and Extrinsic Aspects of Green Initiatives of IT companies at Technopark, Kerala is relevant. IT companies at Technopark, Kerala, give due importance for the Competitive Aspects and Profitability Aspects for making the Green Initiatives. .

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Awareness of People Pertaining to Digital Payment Tools in Kottayam

Stephen Mathew

Abstract:

Demonetization in India in its wake brought about increased use of various digital payment tools facilitating easy financial transactions. It is assumed that 60 percent of all financial transactions in India are taking place through digital platforms now. This digital payment revolution is largely due to the Indian Government's 'Digital India policy' that aims at digitally empowered Indian economy which operates through a paperless and cashless' payment system . Consequently, several digital payment platforms are operating in India now. Their successful performance makes it imperative to find out how far the concept of digital payment tools permeated in to the Indian society at the micro level. Hence, an attempt has been made in this paper to analysis the awareness of people pertaining to digital payment tools in Kottayam Dist. Kerala state.

Key Words: Digital Payment, Cashless Economy, AEPS, UPI, Mobile Wallets, Bank Prepaid Cards, Digital Payment Apps, Internet Banking and mobile Banking

Introduction

Nowadays we see phenomenal growth in the use of internet banking and mobile phone banking in financial transactions in India. This is a payment made through digital modes using digital tools. In digital payments, payer and payee use digital modes to send and receive money. Digital payment system is an electronic medium that allows consumers to make electronic commerce transactions for their purchases and also financial transactions.

Digital payment system has gained remarkable momentum particularly after

demonetization in India. The government of India is taking various steps for efficient utilization of digital payment platforms to wipe out corruption and black money from the Indian economic system. Presently, around 60 per cent of the transactions in India are thought to be carried out through digital platforms.

Indian government as well as private sector companies such as paytm, free charge, Vodafone (mpesa) , Airtel (Airtel money) and mobiwik have been using several digital payment tools. Besides Aadhar Payment App and the National Payments Corporation of India (NPCI) sponsored Bharath Interface for Money App (BHIM app) are also available facilitating Digital Payments .

As stated already, Demonetization in India in its wake brought about increased use of various digital payment tools facilitating easy financial transactions. The increase in digital payment is largely due to the Indian Government's 'Digital India policy' that aims at a digitally empowered Indian economy which operates through a paperless and cashless' payment system . Consequently, several digital payment platforms are operating in India now. Their successful performance makes it imperative to find out how far the concept of Digital payment tools permeated in to the Indian society at the micro level. Hence, an attempt has been made in this paper to analysis the awareness of people pertaining to digital payment tools in Kottayam Dist., Kerala state.

Explanation of Key Words

1. Digital Payment: Payments made through the digital or electronic mode.,egs:-Debit Cards, Credit Cards ,Internet Banking, Mobile Wallets , Unified Payments Interface (UPI), Unstructured Supplementary Service Data (USSD) and Mobile Banking .

2. Cashless Economy: A system that effects payments without paper cash transactions.
3. Mobile Wallets: A mobile wallet is a type of virtual wallet service that can be used by downloading an app. The digital or mobile wallet stores bank account or debit/credit card information or bank account information in an encoded format to allow secure payments. One can also add money to a mobile wallet and use the same to make payments and purchase goods and services. Some of the mobile wallet apps in the market are Pay tm, Mobikwik, Free charge, etc.
4. Bank Prepaid Cards: A prepaid card is a type of payment instrument on to which you load money to make purchases. The type of card may not be linked to the bank account of the customer. However, a debit card issued by the bank is linked with the bank account of the customer
5. Internet Banking: Internet banking refers to the process of carrying out banking transactions online. These may include many services such as transferring funds, opening a new fixed or recurring deposit, closing an account, etc. Internet banking is also referred to as e-banking or virtual banking. Internet banking is usually used to make online fund transfers via NEFT, RTGS or IMPS. Banks offer customers all types of banking services through their website and a customer can log into his/her account by using a username and password. Unlike visiting a physical bank, there are no time restrictions for internet banking services.
6. Mobile Banking: Mobile banking is referred to the process of carrying out

financial transactions/bankingtransactions through a Smartphone. The scope of mobile banking is only expanding withthe introduction of many mobile wallets, digital payment apps and other services like the UPI. Many banks have their own apps and customers can download the same to carry out banking transactions at the click of a button.

7. Digital Payment Apps: egs:- Aadhar Enabled Payment System (AEPS),UPI,USSD, Bharath Interface for Money(BHIM), Google Pay and Paytm.

Statement of the Problem

Mobile users nowadays use their smart phones to make money transactions or payments using applications and tools installed in the phones. This has led to tremendous increase in ‘ Cashless ‘ or Digital Payments . The Government aims at transforming Indian Economy in to a ‘Digitally Empowered’ one. The existence of a number of Digital Payment tools promoting Digital Cash transactions backed by the Government’s policy support makes it imperative to ascertain how far the Digital Payment concept permeated into the micro level of the society. Hence, the study focuses on “**Awareness of People Pertaining to Digital Payment Tools in Kottayam** district” Kerala State.

Objectives of the Study

- To analyze the awareness level of customers about digital payment systems.
- To evaluate the priority of the customers about various digital payment systems.

Scope of the Study

The study is conducted among a cross section of the people of Kottayam district. Efforts have been made to ensure that the sample selected represent different categories of people in all respects. So sample consists in respondents from different walks of life and area. The out come of the study through replication else where may be used to promote or modify the 'Digital Drive' carried out by the Indian Government.

Research Methodology

Collection of Data

- **Primary data**

  Primary data is collected from students, farmers, businessman etc… belonging to Kottayam Dist. Kerala State by administering a questionnaire specifically designed for the study.

- **Secondary Data**

  Secondary data were collected from various published and unpublished sources,magazines, journals and internet .

Sample design

The required data for the study has been collected from a sample of 100 customers belonging to Kottayam Dist. A structured questionnaire specifically designed forthe study was used for collection of data.

Tools used for the study

The data collected were analyzed by using appropriate statistical and mathematical techniques. Test of ANOVA, Percentage, pie diagram, bar charts, graph etc were usedto present the data in simple manner.

The study uses the hypothesis:

There is no significant difference in awareness of customers relating to different Digital Payment tools.

a. There is no significant difference between occupation and awareness of respondents in Digital Payment tools.

b. There is no signify difference between age and alertness of customers pertaing to Digital Payment tools

Analysis and Presentation of Data

Awareness Level of Digital Payment Tools

The awareness level of Digital Payment tools is found to be different among customers. The following table shows distribution of respondents on the awareness about digital payment tools :-

Table 1

AWARENESS LEVEL OF DIGITAL PAYMENT SYSTEM

Awareness	No. of Respondents	Percentage
Highly aware	13	13
Aware	47	47

Unaware	40	40
Total	**100**	**100**

Source: Primary Data

Out ofthe 100 respondents 13% were highly aware, 47%were aware and 40% were unaware of digital payment tools. It can be concluded that majority of the respondents are aware of digital payment tools.

Awareness about Various Digital Payment Tools

The following table shows the awareness of respondents about various digital payment tools like Banking cards, Unstructured supplementary service data(USSD), Aadhaar Enabled Payment system(AEPS),Unified payment interface(UPI),mobile wallets, bank pre- paid cards, Point of sale (PoS), Internet banking, Mobile banking, Digital payment apps, and Bharath interface for money app (BHIM).

Table 2

Percentage of Awareness about Various Digital Payment Tools

Digital payment Tools	**Excellent**	**Very good**	**Good**	**Poor**	**Total**
Banking cards	43	40	10	7	60
Unstructured supplementary services	-	-	56	44	60
Aadhar enabled payment system	-	-	-	100	60
Unified payment interface	37	22	32	9	60
Mobile wallets	25	32	36	7	60
Bank prepaid cards	17	15	26	42	60

Point of Sale	-	-	-	100	60
Internet banking	34	48	15	3	60
Mobile banking	43	36	21	-	60
Digital payment apps	56	40	4	-	60
Bharath interface for money app	-	-	-	100	60

Source: Primary Data

- As only 60% of the respondents (Table 1) have been aware of Digital Payment tools , their extent of awareness is given in percentage pertaining to different Digital Payment tools .

The following are the conclusions drawn from above analysis

- 43% of the respondent's are well aware of Banking Cards followed by 40% who are reasonably aware of the Cards and 10% is aware of them. However, 7% of the respondents have poor awareness of the Bank Cards.
- 56% of the respondents are aware of unstructured supplementary service data, whereas 44% have poor awareness.
- The respondent's awareness on aadhaar enabled payment system is very poor: (100% of the respondents have poor awareness).
- 37% of the respondents are well aware of Unified Payment Interface, 22% of the respondent's awareness is very good, 32% of respondent's awareness is good and 9% of respondents has poor awareness.
- 25% of respondents has excellent awareness of Mobile wallets, 32% of respondents has very good awareness, 36 % good awareness and 7% has poor awareness .

- 17% of the respondents have excellent awareness on Bank prepaid cards 15% of them has very good awareness,26% has good awareness and 42% has poor awareness.
- 100% of respondents have poor awareness of point of sale
- In the case of Internet banking, 34% is well aware, 48% has very good awareness, 15% good awareness and 3% has poor awareness.
- For mobile banking 43% of respondents has excellent awareness 36% very good awareness and 21% has good awareness.
- On Digital payment apps 56% of the respondents has excellent awareness, 40% has very good awareness and 4% has good awareness.
- The respondent's awareness of Bharath interface for money app is very poor(100%)

Conclusion

The study indicates that a considerable segment of the population (40% of the sample) is not aware of the existence of various Digital Payment tools . This makes it imperative to carry out Digital Payment awareness campaigns in the society at the grass roots level. Besides, even among the people who are aware of Digital Payment tools the BHIM app, Aadhar Enabled Payment System and Point of Sale have not reached their ' awareness'. Moreover, a very negligible segment is aware of Unstructured Supplementary Services and Bank Prepaid Cards . Hence, if these tools are to be successful, must be introduce to the population through vide publicity and promotion campaign.

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Heat of Solution from Solubility Measurements

Anu Jayaprakash & Nadukkudy V. Eldho

Abstract:

When a solute is dissolved in a solvent to form a solution, heat is either absorbed or evolved. The heat change per mole of solute is called heat of solution. The heat of solution of naphthalene-toluene binary mixture is determined by its both molal and/or molar saturation solubility at different temperatures. Even though solubility studies are reported, the molal heat of solution from solubility measurements is not known and we are reporting it for naphthalene-toluene binary mixture solution. Here, the method is described and in comparison to molar heat of solution.

Keywords: Heat of solution, solution enthalpy, saturation solubility

Introduction

During a chemical reaction, energy can be transferred as heat and thermochemistry involves measurement of such energy being transferred. The heat changes accompanying a transformation depend on path chosen, but if the process is carried out at constant pressure or constant volume, the heat changes involved have definite values. It is for this reason that the processes are conducted at constant pressure or at constant volume conditions. The Van't Hoff equation[1,2] relates the equilibrium constant variation with temperature as a function of the enthalpy of the system, assuming the enthalpy change is independent of temperature.

$$\frac{d\ln k_p}{dT} = \frac{\Delta H^o}{RT^2}$$

$$\int_1^2 d\, lnk_p = \frac{\Delta H^0}{R} \int_{T_1}^{T_2} \frac{1}{T^2}\, dT$$

$$ln\frac{k_{p2}}{k_{p1}} = -\frac{\Delta H^o}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$$

where, K_p is the equilibrium constant in terms of pressure and ΔH^o is the enthalpy change of the reaction when the reactants and products are in their standard states. Thus, if we know equilibrium constant at two different temperatures, enthalpy of solution can be determined. In general, the enthalpy change does not vary appreciably with pressure and ΔH^o can be replaced by ΔH, the enthalpy change of reaction at moderate pressures. So, we can write van't Hoff equation as,

$$\frac{dln\, k_p}{dT} = \frac{\Delta H}{RT^2}$$

The influence of temperature on solubility can be expressed by van't Hoff equation,

$$\frac{dln\, m_s}{dT} = \frac{\Delta H}{RT^2}$$

where m_s is solubility of the salt in moles per 1000 gm of solvent and ΔH is the molal heat of solution. On integration gives,

$$\ln m_s = \frac{-\Delta H}{R}\frac{1}{T} + Constant$$

A plot of ln m_s versus $\frac{1}{T}$ gave a straight line with slope = $\frac{-\Delta H}{R}$.

In the experiment, heat of solution of naphthalene in toluene is determined by measuring saturation solubility at different temperatures. Here solubility can also be expressed[3] by mole fraction of naphthalene in toluene at different temperatures. The solubility behavior of compounds

depends on relative strength of their intermolecular interactions. Even though naphthalene and toluene are non-polar aromatic compounds, the forces of interactions between them are weak vander Waals forces. When these two solvents are mixed, the intermolecular forces between naphthalene-naphthalene, toluene-toluene and toluene-naphthalene are not identical strength. Hence enthalpy of mixing is not zero.

The solubility of a solid in an ideal solution depends on temperature, melting point of solid and molar heat of fusion. In an ideal solution, heat of solution is equal to heat of fusion, which is assumed to be constant and independent of temperature. Ideal solubility is not affected by nature of solvent. For an ideal solution of a solid in a liquid, the mole fraction solubility is given by,

$$ln\, X = \frac{-\Delta H_f}{R}\left(\frac{T_0 - T}{T\, T_0}\right)$$

Where X is ideal solubility of solute expressed in mole fraction, T_0 is the melting point of solid solute and T is the absolute temperature of solution. In an ideal solution, liquid solute is miscible in all proportions with the solvent and so the equation is not valid when $T > T_0$. The above equation can also be written as,

$$ln\, X = \frac{-\Delta H_f}{R}\frac{1}{T} + Constant$$

$$\text{Or,} \qquad ln\, m_s = \frac{-\Delta H_f}{R}\frac{1}{T} + Constant$$

A plot of ln m_s or ln X versus $\frac{1}{T}$ will be a straight line with slope equal to $\frac{-\Delta H_f}{R}$. Since the chemical potential in real cases depends on activity rather than on molality, the results are expected to differ from ideal case.

Materials and Methods

All chemicals used were analytical grade. The solute naphthalene was added to a boiling tube which contains a stirrer (Steel) and a thermometer which can measure temperature to an accuracy of 0.1 ^{0}C and are inserted through a cork into the boiling tube. The solvent toluene is added to the boiling tube through a burette. It is important that both solid and solution phases should be in dynamic equilibrium at all temperatures. So experiment is beginning with tempering the saturated solution.

To the boiling tube, weighed 7gm (0.0546 mol) of naphthalene and added 2 ml of toluene. The thermometer is introduced so that the bulb is immersed in the liquid. The solution is stirred and noted the solubility of naphthalene. Since it is not completely soluble, the mixture is gently warmed in hot water and transferred into an air jacket. The solution is stirred until naphthalene crystals completely dissolved and the temperature is noted at which the last crystals go into solution. Then, the solution is allowed to cool until crystals reappear and again the temperature is noted. The average of the two temperatures is calculated and thus, recorded the saturation solubility temperature. The mixture is re-heated just enough to cause the crystals to re-dissolve again to narrow the discrepancy between the temperature readings. In cases were crystals not appeared at room temperature, cold water bath is used to cool the solution until crystals appear, followed by allowing the solution to warm up until the crystals re-dissolve. Here also, it is repeated again to narrow the discrepancy between the temperatures at which the crystals disappear and reappear.

The experiments are repeated with other volumes of toluene and in each case average saturation solubility temperature is noted. Mole fraction (X) and molal solubility (m_s) of naphthalene is calculated in each case. A graph is plotted between ln X or ln m_s against $\frac{1}{T}$ (K^-

[1]) and from the slope of the graph, the heat of fusion of naphthalene is calculated. The data is fitted by the linear regression analysis using least squares method in Microsoft Excel and the coefficient of the least square method is computed.

Results and Discussion

A solution is a homogeneous mixture of two or more components. The component which is usually present in largest proportion is called the solvent and the second component, which is dissolved in the solvent is called solute. The solutions can be different kinds:: gases in gases (example: air), liquid in liquids (example: gasoline), gases in liquids (example: soda drinks), solids in solids (example: alloys), and solids in liquids (example: salt water)[1]. This experiment will involve a solution formed with a solid solute and a liquid solvent.

Solubility of a solid in a liquid depends on temperature. At a given temperature, if maximum amount of solute is dissolved in a given amount of solvent, then it is called saturated solution. This maximum amount of dissolved solute can be expressed quantitatively in units of molality and molarity[3]. The factors that can affect solubility of a solute in a solvent are, (1) the nature of solute and solvent and (2) temperature. Polar and ionic solutes are soluble in polar solvents and non polar solutes are soluble in non-polar solvents. The temperature of the solvent generally has a marked effect on the amount of solute that can dissolve.

The solubility behaviour of the compounds and the heat of solution depend greatly on the relative strength of their intermolecular interactions. Both naphthalene and toluene are non polar compounds and the attraction that exists in naphthalene and toluene are van der waals forces. When they are mixed, enthalpy of mixing is not zero because the strength of forces between solute-solute, solute-solvent and solvent-solvent are not identical. In such a case, the solution cannot be considered as ideal.

In the experiment, different volume of toluene is added to 0.0546 mol of naphthalene and saturation solubility temperature (T) is determined (Table 1). It is also obtained for additional volumes of toluene. The mass of toluene is calculated from its volume and density. Molal solubility (m_s) is calculated at different temperatures and a graph is plotted with $\ln(m_s)$ versus $\frac{1}{T}$ in K^{-1} (Figure 1). The molal heat of fusion of naphthalene obtained is 49.89 kJ/kg of solvent.

Table 1. Molal saturation solubility of naphthalene in toluene at different temperatures

Moles of Naphthalene	Volume of toluene (ml)	Saturation solubility temperature (K)	$\frac{1}{T}$ (K^{-1})	Mass of toluene (kg)	Molal solubility (m_s) (mole/kg solvent)	$\ln(m_s)$
0.0546	2	339.75	0.00294	0.00174	31.38	3.446
0.0546	2.5	336.75	0.00297	0.0022	24.82	3.212
0.0546	3	333.75	0.0030	0.00261	20.92	3.041
0.0546	3.5	330.75	0.00303	0.00305	17.90	2.885
0.0546	4	328.4	0.00305	0.00348	15.69	2.753
0.0546	4.5	325.75	0.00307	0.00392	13.93	2.634
0.0546	5	323.25	0.00309	0.00435	12.55	2.530

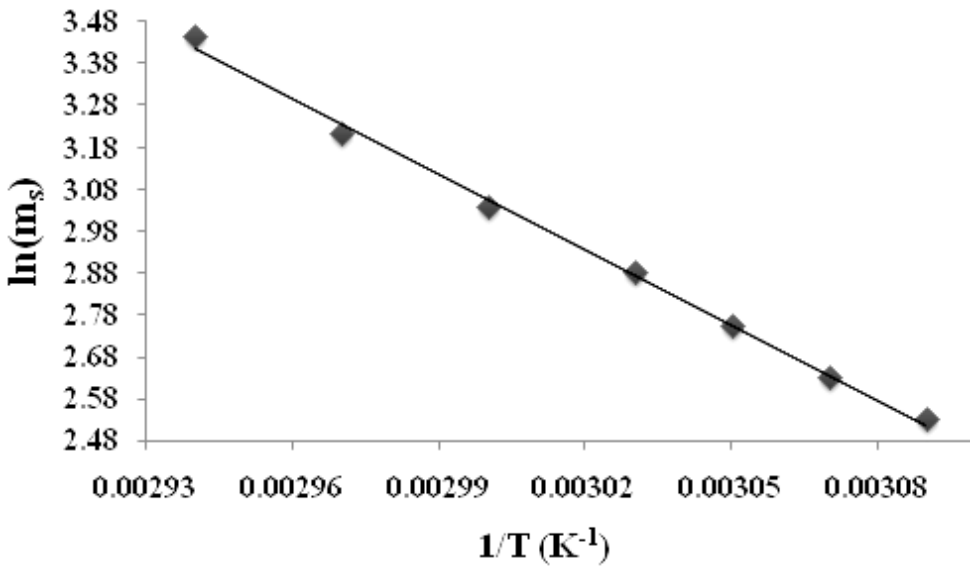

Figure 1. Plot of $\ln(m_s)$ against $\frac{1}{T}$ (K^{-1}) of naphthalene in toluene.

Mole fraction solubility of naphthalene is also calculated at different temperatures (Table 2) and a graph is plotted with ln(X) versus $\frac{1}{T}$ in K^{-1} (Figure 2). The molar heat of fusion of naphthalene obtained is 17.8 kJ/mol, which is very close to the reported value of 18.8 kJ/mol[4,5].

Table 2. Mole fraction solubility of naphthalene in toluene at different temperatures

Moles of Naphthalene	Moles of toluene	Saturation solubility temperature (K)	$\frac{1}{T}$ (K^{-1})	Mole fraction of naphthalene (X)	ln(X)
0.0546	0.0189	339.75	0.00294	0.74	-0.3011
0.0546	0.0236	336.75	0.00297	0.70	-0.3567
0.0546	0.0283	333.75	0.0030	0.66	-0.4155
0.0546	0.0330	330.75	0.00303	0.62	-0.4780

0.0546	0.0378	328.4	0.00305	0.59	-0.5276
0.0546	0.0425	325.75	0.00307	0.56	-0.5798
0.0546	0.0472	323.25	0.00309	0.54	-0.6162

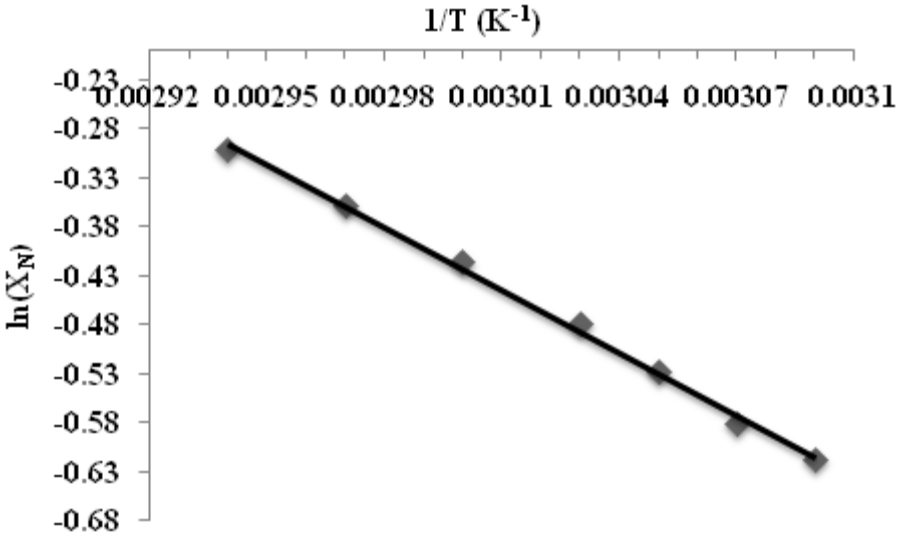

Figure 2. Plot of $\ln(X_N)$ against $\frac{1}{T}$ (K^{-1}) of naphthalene in toluene.

From the experiment both molal and molar heat of fusion can be calculated. The heat of fusion is not zero, which implies that the solubility of naphthalene in toluene is not exactly ideal. Solubility data is widely used in chemistry and related fields of science and engineering for many different purposes. For some intended purposes, highly precise data are required; but for others, order-of-magnitude estimate is satisfactory[3].

Conclusion

The solubility behavior of naphthalene in toluene is not ideal. The study of solubility behavior of different kinds of compounds in different solvent system is important that it gave

information about enthalpy content. Such studies can provide that the system will be a better source for making an *in situ* heating pad.

Acknowledgement

The authors acknowledge the Indira Gandhi College of Arts and Science, Nellikuzhi for the support of the work.

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Determination of Sugar Content in Soft Drinks Using Polarimetric Method

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Abstract:

The sugar content in various soft drinks has been carried out using a polarimetric technique. For this, colourless carbonated soft drinks like Sprint, Sprite and 7UP were chosen. Within the error limit, the values obtained were matched with the values printed on the bottles. It is to be noted that, we have avoided coloured soft drinks from the study because of their dark colour.

Key Words: Soft drinks, Sugar content, Optical Rotation, Polarimeter

1. Introduction

Soft drinks are non-alcoholic beverages with colouring agents, flavouring agents and natural or artificial compounds as sweetening agents as their chief components, besides water. Some of them are carbonated drinks. The overuse of soft drinks makes human body overloaded with sugar; thereby damaging the internal organs it increases the chances of lifestyle diseases like diabetes, high blood pressure and heart related problems. The excessive intake of soft drinks causes softening of bones in children. Child obesity is also another ill effect of soft drink consumption. Dehydration and Calcium depletion are some of the problems related to excess soft drink consumption.[1-4] Ramasami *et. al.* has done comparative studies to estimate sugar in soft drinks by using different techniques, namely Density, Refractometry, Infrared Spectroscopy and Statistical Methods.[5] Aloh G. S. *et. al* has studied the sugar content in soft drinks using EDTA Method.[6] Al-Mhanna *et. al.* has done the analysis of the sugar content in food products by using Gas Chromatography, Mass Spectrometry and Enzymatic Methods.[7] A. Debebe *et. al.* has used modern techniques like HPLC to estimate the sugar contents in alcoholic beverages.[8] In this paper, we have attempted to study sugar contents in soft drinks

using polarimetry method. Literature survey has shown that only few studies have done in estimating the sugar in soft drinks by using polarimetric methods. We have followed the procedures reported in the book *Advanced Practical Physical Chemistry*, J.B.Yadav[9] and also took the support of web site https://apniphysics.com/viva/specific-rotation-sugar-solution for our studies.

2. Materials and Method

Soft drinks are purchased from the market. For polarimetric studies, Half Shade Manual Polarimeter has used. Sodium Vapour Lamp has used for illumination.

3. Results and Discussion

3.1. Determination Percentage Composition of Sugar using Polarimeter

1. Weight out 50g of sugar and dissolve it in distilled water up to the mark in 250ml, in a volumetric flask. If the rotation is not clear, it is diluted to 75, 50, 37.5 and 25 cm^3 of the solution to 250ml separately in a volumetric flask, so as to get 15, 10, 7.5 and 5% solutions.
2. The glass tube is cleaned from both sides and is filled with distilled water.
3. The tube is mounted on the frame and the sodium lamp is switched on. The analyzer is looked through an eyepiece connected with the rotating scale.
4. Two equal portions of dark and bright could be seen, that could be interchanged by rotating the analyzer.
5. The analyzer first rotated it in the clockwise direction and then in the anticlockwise until the circular field of view becomes bright.
6. The readings are noted

7. Similarly second and third readings are taken for both the directions, which is in the absence of sugar solution.
8. The average of the readings in both directions is taken.
9. Now the polarimeter is filled with sugar solution.
10. It is mounting on the frame carefully.
11. The same procedures are repeated as done in the case with distilled water.
12. The analyzer first takes the reading in the clockwise and then in the anticlockwise direction. The other readings are also taken similarly.
13. The difference in the value between the sugar and water solution will give the angle of rotation.
14. The experiment is repeated with different sugar solutions with varying concentrations.
15. The room temperature and length of the tube used in this experiment are noted.
16. The angle of rotations for soft drinks is also measured similarly.

The polarimeter readings for the determination of zero point are shown in Table 1 and those for calculating the angle of rotation (α) is shown in Table 2. The Calculated angle of rotation (α) and Specific rotation(S) are shown in Table 3.

Table 1. DETERMINATION OF ZERO POINT

	No.	Conce-ntration	Clockwise (a)			Anticlockwise (b)		
			MSR	VSR	Total	MSR	VSR	TOTAL
Distilled Water	1		90	5	90.05	275	9	275.09
	2		91	7	91.07	273	4	273.04

	3		92	6	92.06	274	6	274.06
	4		90	5	90.05	273	9	273.09
				Mean(a)	90.8075(a)		Mean(b)	273.82(b)

Table 2. DETERMINATION OF ANGLE OF ROTATION

Vernier I (a) = 90.8075

Vernier II (b) =273.82

	Number	Concen-tration (%)	Vernier I (a')			Vernier II (b')		
			MSR	VSR	Total	MSR	VSR	Total
Sucrose	1	25	99	8	97.555	277	8	278.055
	2		96	3				

	1 2	37.5	99 97	5 10	98.075	284 282	7 7	283.07
Sucrose solution	1 2	50	102 102	9 4	102.066	289 285	6 9	287.076
	1 2	75	104 106	4 2	105.03	290 287	7 6	288.565
	1 2	100	116 118	3 2	117.025	299 291	5 9	295.05

The optical activity of a substance is expressed in terms of specific rotation. S, and calculated by the formula,

$S = \theta / LC$

Where 'θ' is the angle of rotation expressed in degree, The length of tube is expressed as L in decimeter (1 decimeter = 10 cm) and the concentration is expressed in C in g/mlin the solution. The unit of specific rotation is degree/(decimetre) x (g/ml).

If the length of the solution (tube) is in L cm, C = mass of the substance (M) / volume (V).

Then,

Specific rotation = (θ X V) / (L X M)

Table 3. SPECIFIC ROTATION OF VARIOUS SUCROSE SOLUTIONS

Percentage	Angle of rotation (α)	Specific Rotation
5%	5.491	54.91
7.5%	8.258	55.05
10%	12.246	61.23
15%	14.483	48.27
20%	23.72	59.30

The average value of Specific Rotation for sucrose solution as 55.75 and this value is taken to calculate the concentration of sugar in soft drinks and is tabulated in Table 4.

TABLE 4. PERCENTAGE OF SUGAR CONTENT IN VARIOUS SOFT DRINKS

Sl no	Soft drinks	Clockwise vernier I	Anticlockwise vernier II	α value	(%) of sugar
1	Sprint	101.06	284.54	10.486	9.40%
2	7UP	99.54	288.55	11.731	10.52%
3	Sprite	106.045	287.535	14.476	12.90%

4. Conclusion

The sugar content in the branded soft drinks was studied using polarimetric method. The values obtained were within the range of what is printed on their bottles (8 to 13%), showing the feasibility of usage of polarimetry in determining the sugar content of colourless soft drinks, fruit juices and beverages.

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The Lonely Runner Conjecture

Anjaly Jose

Abstract

Suppose there are *n* runners in a circle, initially at the same position. Assume the circle has unit length, and all the runners start with constant, but distinct speeds. A runner is said to be *lonely* at a time if the person is away from all others at least by a distance of 1/*n* unit. The lonely runner conjecture states that every runner will be lonely at some point in time. In this note, we will discuss this unsolved problem and present the known results so far.

Introduction

Imagine a circular track, with unit circumference for simplicity. Let there be two runners at the starting point. This is not a usual running game in which the first one who reaches the finishing point is the winner. Instead, we are considering the case where the runners have a constant speed throughout; also, the speed of each runner is different from the other. Moreover, the runners continue to run even after finishing a lap – they keep on running through the circular track without stopping. This means that the runner with the greater speed among them is ahead while the other runner is behind. At some point in time, the runner who is ahead will cross the other runner since they are not stopping. Hence, there will be a time t_0 at which the faster runner is ahead of the slower runner by a distance of ½ unit measured along the circumference of the track. This means, they are away from each other by ½ unit, or one is *lonely* in the sense that the other person is away by a distance of ½ unit.

Now we can generalize this situation to the case of *n* runners. For this, we need to modify the definition of *loneliness* accordingly. If there are *n* runners, we say a runner is lonely if the person is away from all others at least by a distance of 1/*n* unit. We are now ready to state the conjecture:

Conjecture (Lonely runner): *If there are* n *runners on a circular track of unit length, running with constant but distinct speeds, then every runner will be lonely at some point in time.*

In this article, we look at the history of the problem and its connection to various fields of mathematics. We also present the known results so far with sketches of proofs in a few cases.

A Reformulation of the Conjecture

The above formulation of the conjecture was made by Bienia et. al. [3]. Though, it was originally stated by J. M. Wills in 1967[9] as a Diophantine approximation problem. We have a reformulation of the conjecture (in its original form) as follows:

Conjecture: *Let* $a_1,a_2,\ldots,a_{n-1}$ *be positive real's. Then we can find another real number* $t>0$ *such that*

$$\{a_i t\}\in\left(\frac{1}{n}\ ,\ \frac{(n-1)}{n}\right) \textit{ for } i=1\ldots,n-1,$$

where $\{x\}$ *is the fractional part of x, i.e.,* $x=x-\lfloor x\rfloor$.

We would like to point out that although the problem is easy to understand without any serious knowledge of mathematics, the solution is not easy. We will start with the simple cases and point out the proof attempts in the remaining cases which require careful analysis.

The Cases of 1 & 2 Runners

The conjecture is obviously true for n=1 because the sole runner is always lonely at every time. Now, in the case of two runners, both are at different speeds. At some point of time, they will be diametrically opposite to each other. So, the difference between their distance will be ½, they are lonely.

The Case of 3 Runners

We then evaluate the situation with three runners. A stationary runner experiences loneliness at some point, and that is what we need to demonstrate. The other two runners are A and B, and A is the fastest of the two. B is located 1/3 of the way from the stationary position in the first stage. Only when A is no slower than B than C can this concept be applied. Now, if A is moving at a speed more than twice that of B, we can observe that B is currently between the 1/3 and 2/3 points of A's speed. A travel more than 2/3 of the distance in this interval; therefore, at some point, he will also be further than 1/3 from the beginning [10].

Remaining Cases up to 7 Runners

For 4 runners, several proofs are available in the context of the Diophantine approximation problem, see [2,5]. The first proof for the case of 5 runners was given by Cusick and Pomerance, in connection with view-obstruction problems. This was computer-assisted proof. Another independent proof was given in [3] later. The cases of 6 and 7 runners were done in [4] and [1] respectively.

The conjecture remains open for the remaining cases.

Related Results

There are several reformulations to the conjecture (one such was given after the introduction). The problem remains the same if we reduce the speed of one runner from all others - taking the speed of that runner to be zero and look at the time at which this runner becomes lonely. So, if there are *n* runners, we search for a time at which all of them are away from the *starting point* by a distance of $(\frac{1}{n+1})$units. We can get that this distance is less than $(\frac{1}{n+1})$ units and we have the trivial lower bound of $\frac{1}{2n}$; for a proof of this lower bound, see [8], proposition 1.2. This lower bound is improved to $\frac{1}{2n} + \frac{c \log n}{n^2(\log\log n)^2}$ where c>0 is some absolute constant [8].

Also, we can assume the speed of all runners to be integers. This reduction, of the speeds from real to integers is done, for example in [4], section 4. In [7], it is proved that the lonely runner conjecture is true for two or more runners if we can assume that the speed of $(i+1)^{th}$ runner is more than double the speed of the i^{th} runner for each i, arranged in increasing order. We conclude by reproducing the proof of this result from [7].

Theorem1.

Let $S = \{s_1, s_2, \ldots, s_n\}$ *where* $n \geq 2$, *and* $(\frac{s_{i+1}}{s_i})\left(\frac{n-1}{n+1}\right) \geq 2$ *for each* $i = 1, 2, \ldots, n-1$. *Then there exists a real number x such that*

$$\|s_i x\| \geq \frac{1}{n+1} \qquad \text{for each } i = 1, 2, \ldots, n.$$

Proof:

Consider an interval $J = [a,b] = \left(\frac{1}{s_{1(n+1)}}, \frac{n}{s_{1(n+1)}}\right)$ Clearly, for $x \in J$, we have $\|s_1 x\| \geq \frac{1}{n+1}$ and the difference of the interval a-b = $\frac{n-1}{s_{1(n+1)}}$.

Let us denote the interval J by J_1.

Now construct the intervals $J_2, I_3, \ldots J_n$ with the following properties:

(a) $J_1 \supset J_2 \supset J_3 \supset \ldots \supset J_n$

(b) For $J_i = [a_i, b_i]$, $a_i - b_i = \frac{n-1}{s_{i(n+1)}}$

(c) For each $x \in J_i$, $\|s_i x\| \geq \frac{1}{n+1}$

Clearly, J_1 satisfies (b) and (c). Using induction, define the i^{th} interval $J_i = [a_i, b_i]$. We have

$$S_i b_{i-1} - s_i a_{i-1} = \left(\frac{s_i}{s_{i-1}}\right)\left(\frac{n-1}{n+1}\right) \geq 2.$$

Therefore, there exists an integer $\ell(i)$ such that

$$S_i a_{i-1} \leq \ell(i) < \ell(i) + 1 \leq s_i b_{i-1} \Rightarrow a_{i-1} \leq \frac{\ell(i)}{si} < \frac{\ell(i)+1}{si} \leq b_{i-1}$$

Define, $J_i = [a_i, b_i] = \left(\frac{\ell(i)+\frac{1}{n+1}}{s_i}, \frac{\ell(i)+\frac{n}{n+1}}{s_i}\right)$

The interval J_i satisfies all (a), (b) and (c). Since the intersection of the intervals $J_1, J_2, I_3, \ldots J_n$ is nonempty. Hence the proof. We conclude that the n runners having their speeds $s_1, s_2, \ldots s_n$ with $\left(\frac{s_{i+1}}{i}\right)\left(\frac{n-1}{n+1}\right) \geq 2$ satisfy the conjecture.

Acknowledgement

First, I would like to express my gratitude to almighty God to enabling me to complete this journal. I Would like to express my deep gratitude to Sreejith M.M, research scholar, Kerala school of Mathematics, for his valuable and constructive suggestions during the planning and development of this article. Finally, I wish would thank to my husband Jenin K Paul for his support and suggestions throughout my work.

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A Review Article on Biopolymers

Diya Jaison & Sulfath Nassim

Abstract:

The environmental effect of plastic wastes is raising a global accentuate issue and disposal methods are limited. The growing consciousness about the problem has attracted research interest in biodegradable natural polymers. The applicability of biopolymers is widespread in the fields of medicine, food, and petroleum industries. Biopolymers can be produced from renewable sources hence they are biodegradable and thus are excellent substitutes for many synthetic compounds. Plants, animals, and microorganisms can produce and excrete a good number of polysaccharides in normal production conditions. The polysaccharides produced by microorganisms are adopted both as commercial products and have the potential for commercialization. The recent advancement in microbiology and biotechnology helped scientists to view organisms and the materials they secrete. The limiting factor in the development of these polysaccharides is the lack of efficient technology for their extraction and purification. However new applications in agronomy, foods, cosmetics and therapeutic could in a near future will prominent the effort of research for their development. Biopolymers are produced mainly through a biological process like fermentation and a chemical process like polymerization. The main focus is on microbial production of biopolymers as they are more efficient. So, this review concentrates on various useful biopolymer, their production as well as their applications in various fields.

Keywords: Biopolymers, renewable resources, biodegradable, microorganisms, applications, polysaccharides

Introduction

Biopolymers are polymeric biomolecules. They are made out of living organisms. As the rise of modern civilization along with all its technologies had a huge impact on the earth it was not a concern till recently when there were raising questions about the overuse of fossil fuels and petrochemical plastics. We are facing a very large and important issue as we have loaded our mother nature with many undesirable waste products and we literally are choking the life out of it. So there comes a need to release our earth from this hamartia and give its full life back. That was the time when biopolymers were invented as a substitute or to be more precise biopolymers were there even before we came out with the discovery of plastic but we were dumb enough to try out synthetic ones. So, the main advantage of biopolymer is that it is degradable that is unlike synthetic sources it will never be a burden to the earth. They account for a greater part of the human body as well as the ecosphere. So, through this presentation, we outline the summary of information that we have gathered through our investigation of biopolymers.

What is a Biopolymer? [1]

Biopolymer is a biodegradable chemical compound that is developed from living beings.

- A biopolymer consists of repeating monomer units that can either be homopolymers or heteropolymers.
- A homopolymer consists of one type of monomer in a repeating fashion while a heteropolymer consists of more than one type of monomer in complex and often branched structures.
- Some biopolymer examples are proteins, carbohydrates, DNA, RNA, lipids, nucleic acids, peptides and polysaccharides.

Biopolymer Classification.

Based on the first type of classification biopolymers are broadly divided into four:-

1. **Sugar-based biopolymers**:- starch or sucrose is used as the input for sugar based biopolymers. The main examples are polyactides or lactic acid polymers which are produced from potatoes, maize, wheat, and sugar beet. These polyactides are resistant to water.[7]
2. **Starch-based biopolymers**:- starch act as a natural polymer and is stored in plant tissues as a form of carbohydrate. They are mainly obtained from wheat, tapioca, maize and potatoes. Starch is a polymer of glucose monomers and is only found in plants and not in animal tissues.[10}
3. **Biopolymers based on synthetic materials**:- synthetic compounds like petroleum can also be used for making biodegradable polymers. Though these compounds are made from synthetic components they are completely compostable and biodegradable. Examples are aliphatic aromatic copolyesters.[15]
4. **Cellulose based biopolymers**:- this polymer is composed of glucose and is used for packing cigarettes, CDS and confectionery. It is obtained from cotton, wood, wheat and corn.

Biopolymer Types.

There are primarily two types of biopolymers:-

1. Bio-based biopolymers:- they are produced from plants, animals and microorganisms.
2. Fossil fuel-based biopolymers:-they are produced from renewable resources but require polymerization.

Sources of Biopolymer.

Biopolymers can be produced from biological and chemical sources and they are modified and designed for various applications. [6]The biological sources are mainly plants, animals and microorganisms while the chemical synthesis is done by polymerising biological monomer units such as sugars, amino acids, nucleotides and oils.[5]The production of novel biopolymers from plants provides a bio-renewable method for its synthesis.[14]Industrially biopolymers are produced in bulk and shaped for specific end-use.[12]Microorganisms play a very important role in producing a variety of biopolymers like polyesters and polyamides.[9]

Artificial Production of Biopolymers.

Microorganisms produce a wide variety of biopolymers like polysaccharides, polyesters and polyamides. Mainly they are produced by fermentation and for large-scale production of biopolymers, fermentation is done in large bioreactors. These biopolymers are then extracted from the bioreactors and chemically processed to form the end product.[11] The physical properties of biopolymers can be altered by the genetic manipulation of the microorganisms thereby making them efficient in various fields like industries and pharmaceuticals. For the production of biopolymers from microorganisms, certain environmental conditions and nutrient composition should be maintained. Biopolymers are also produced by the chemical polymerization of monomer units.[13] Bioplastics can be produced from renewable biomass sources such as vegetable oil, corn starch, pea starch etc. Algae can be used for the production of bioplastics because of their high yield and ability to grow in a wide range of environments. The use of algae has other merits like the utilization of carbon thus neutralizing greenhouse gas emissions. Bioplastics from algae are

more efficient than those produced from biomass.[16] An example of biopolymer production from *Pseudomonas aeuruginosa* is stated below:-

- Isolation , purification and cultural conditions[2]:

A sample of the sediment was collected from the Karachi coast. The bacterial strain was isolated, purified and coded as CMG607w, and the strain CMG1421was isolated from the dry soil. It was also purified and both were preserved in 20%glycerol at -70degree Celsius. Both the strains were identified by using an API kit and were found to be *Pseudomonas aeruginosa*. The strain CMG607w was maintained at 30 degrees Celsius in artificial sea water, in 1L of distilled water. It is supplemented with tryptone and a 10 g carbon source (glucose/sucrose). To carry out polyhydroxyalkanoate[PHA] synthesis same cultural conditions were used. The incubation time was increased from 24-120hr at 30 degrees Celsius and 200rpm. For the synthesis of hydro absorbent polysaccharide, CMG1421was grown in the minimal medium supplemented with a 20g /L carbon source. After growing in the minimal medium,1 ml (48h old) seed culture was inoculated into a 2L minimal medium and it was incubated at 30 degrees Celsius for 15 days.

- Extraction and purification [3].

For the extraction of the PHA, a lyophilised cell material was used with chloroform at 65Degree Celsius for 4hr in the screw cap bottles. The extraction is repeated three times with the same material. By passing through the cellulose filter the cell debris was removed and by using a rotary evaporator the chloroform solution was concentrated. The polymer was precipitated by pouring chloroform solution into ethanol. By filtration, the precipitated polymer was separated and it was dried by exposure to hot air. The precipitation was repeated for further purification. The viscous culture broth of CMG 1421 was diluted with the half volume of sterilized distilled water and it was placed in a shaking incubator at 30 degrees Celsius for 1 hour. The bacterial cells were

regimented by centrifugation at 10,000rpm or 30 minutes at 4 degrees Celsius. To precipitate the extracellular Protein fractions, trichloro acetic acid [TCA] 5 to 10% was added to the cell-free supernatant. To collect the protein fractions, it was centrifuged at 9000 rpm for 30 minutes at 4 degrees Celsius. The clear supernatant was added to equal volumes of absolute ethanol. The precipitates were collected around the glass rod. To obtain uniform white precipitates, the dissolution and precipitation process was carried out for 4 to 5 hours. The sample was dried in the wheaten dry seal vaccum desiccators. The crude hydroabsorbant was dialyzed against the distilled water lyophilized.

Applications of Biopolymers.

Biopolymers are caused due to their biocompatible and biodegradable nature.

It is used to improve the performance of the other biologically active molecules in a product.

It has various applications including;

1. **Synthesis of nanomaterials**[17]

- Nanotechnology means research which deals with the synthesis, characterization, and applications of nonmaterial.
- Nowadays researchers are more focusing on developing the synthesis of nanoparticles.
- The main focus is synthesis protocol shifted from physical and chemical processes towards green chemistry and bioprocesses.
- Metal nanoparticles process various novel properties due to their quantum size effect.
- Synthesis protocol causes a major threat to the environment.
- Synthetic organic solvents and reducing agents used in synthesis protocol include organic solvents and toxic reducing agents like hydrazine, N-dimethylformamide and sodium

borohydride which are highly toxic to the environment and these chemicals pose potential environmental and biological risks.

- For synthesizing different nanoparticles biopolymers like chitosan, heparin, soluble starch, cellulose, gelatine, PVA and PVP are used to replace various toxic reagents.
- Biomedical applications Biopolymer materials have great interest nowadays because of their biomedical applications such as in tissue engineering, pharmaceutical carriers, and medical devices.
- Gelatine is a common biopolymer and is widely used for applying to wounds and as an adhesive.
- Biomaterials are made from proteins, polysaccharides and synthetic biopolymers.
- The properties of biomaterial are improved by cross-linking, most of these causes cytotoxicity and cause undesirable changes to the function of biopolymers.

2. **Food industry**[18]

- Bio-based films and containers replace oil-based packaging materials.
- Biopolymers are used for food coatings, food packaging, and encapsulation matrices to functional foods.
- Certain biodegradable polyesters and thermoplastics like starch, PLA, PHA, and so on are the most commercially viable materials in food packaging.
- Starch and PLA biopolymer are the most attractive type of biodegradable material.
- PLA is particular interest in food packaging due to its excellent transparency and relatively good water resistance.

- Other materials extracted from biomass recourses, such as proteins, polysaccharides and lipids also have excellent potential.
- Chitosan has shown great potential as an antimicrobial packaging agent to preserve food against several microorganisms.
- Lysozyme is a naturally occurring enzyme and is the most frequently used antimicrobial enzyme in packaging materials.
- Amylose when mixed with plasticizers has excellent potential for forming thin films for various food and packaging applications.
- Starch has a high sensitivity to relative humidity due to its hydrophilic nature and can reduce by introducing plasticizers and starch.

3. **Packaging applications**.[4]

- Biodegradable polyesters are the most commercially viable materials in food packaging.
- These materials are used in monolayers and multilayer applications in the food packaging field.
- Sustainable biopolymers are used in monolayer packaging including starch, PHA, and PLA. Starch and PLA biopolymers are the most attractive types of biodegradable materials.
- If they improve their barrier and thermal properties so that they perform like polyethylene terephthalate (PET).
- To improve the barrier properties of biopolymer is to add various nanofillers like nanoclays and metal oxide nanoparticles.

- Polyglycolic acid is one of the most promising new commercially available barrier polymers due to its excellent barrier properties. It can now be produced via a natural metabolic route, the glyoxylate cycle.

4. **Water purification.**[16]

- Through the effective purifying mechanisms nanotechnology has promising developments in providing safe drinking water.
- Safe drinking water is significant.
- It has been proved that several nonmaterial has antibacterial and antifungal properties.
- Release antibacterial materials like silver nanoparticles into water is an effective way of providing microbial-safe drinking water for all.
- When developing stable materials which can release nanoparticles continuously.
- New polymer i.e.; chitosan shows superior performance where many conventional polymers fail. Chitosan is used as a water treatment process in the environment over periods of weeks or months or years. Chitosan removes metals from water by forming chelates.

Conclusion

Biopolymers are excellent in absorption capacities. They are used in different fields such as chemical biological fields etc. Through this article, we present the properties, applications, and sources of biopolymers. Biopolymers are important alternatives to unsustainable products. They have a high rate of biodegradation in the environment. Nowadays many studies are going on to think about natural and biodegradable polymers replacing synthetic polymers in various applications and different fields. They are mainly produced during the life cycle of plants, animals

and fungi, etc. So they can be widely used and nowadays they are used due to their advantages. Boogieman may be bacteria or fungi that can adhere to a surface tightly to form communities and can resist antibiotics. Biopolymers are the key to the survival of a pollution-free generation and for the survival of our mother nature. Newer research methodologies and production strategies for the production and applications of biopolymers are still under investigation. Usage of recombinant technology for the microbial production of biopolymers will be very useful since other applications like medicinal values can be added along with the novel uses of biopolymers. Moreover, this information will serve a great scope of further research in these fields for better application and will be useful to companies interested in the production and application of biopolymers.

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Preliminary Studies on Laccase Producing Fungi Isolated from Sawmill Waste Dumping Area

Subi B. S, Reya Issac, Lakshmi Prabha M

Abstract:

Laccase(E.C.1.10.3.2; parabenzenediol: oxygen:oxidoreductase) belongs to a group of Cu containing polyphenol oxidases, known as multicopper oxidases. In this present study 20 fungal strains were isolated from soil collected from different areas .Out of these only 3 fungal strain showed reddish brown zone around the colony when grown in PDA plates incorporated with 0.02% guiacol. They were tentatively coded as LF-1, LF-2 and LF-3.The most potent fungal strain for laccase production was screened on 0.02% guaicol containing PDA medium. The microscopic morphology of the 3 fungus were studied and also screened the type of medium favorable for better production of laccase enzyme. The culture medium used for the study was Semisynthetic media and Agrowaste Based media. Yeast extract Peptone broth and Glucose peptone broth were used as semisynthetic media. .Of these laccase enzyme productions was found high in yeast extract peptone broth medium. In agro waste based medium of the 3 types of agro wastes used in saw dust incorporated medium production of laccase was found at the 8^{th} day of incubation. The pH of the medium was adjusted to 5.0 before sterilization. Dye decolourisation studies were also conducted to check how far the selected fungus was able to degrade dyes. Of the 4 dyes selected for the study 72% of degradation was found in Methylene blue containing medium .From these preliminary data came to a conclusion that LF-2 might be a good candidate for the production of laccase enzyme.

Keywords: Laccase, guaiacol, congored. methylene blue

Introduction

Laccases are blue multicopper enzymes (EC 1.10.3.2) which oxidize a broad range of both phenolic and non-phenolic substrates, via a four-electron reduction of molecular oxygen to water (1, 2). Laccases are widely distributed in nature and have been isolated from bacteria, fungi and plants and also from lichens and sponges. Literature reviews showed that laccases are widely distributed among the prokaryotes and eukaryotes. For example, laccase from *Azospirillium lipoferem*, *Marinomonas mediterranea*, *Streptomyces griseus*, *E.coli*, *Bacillus subtilis* and many more bacteria have been purified and characterized. Laccase activity has been demonstrated in many fungal species belonging to ascomycetes and basidiomycetes and the enzymes has already been purified from many species. There are many records of laccase production by ascomycetes. Phytopathogenic ascomycetes like *Melanocarpus sp, Cerena unicolor, Mangaportha grisea, Trametes versicolor, Trichoderma reesei* and *Xylaria polymorpha* are examples for laccase production and the enzyme was purified. Besides in plant pathogenic species, laccase production was also reported for some soil ascomycetes, species from the genera *Aspergillus, Curvularia and Pencillium* as well as from some fresh water ascomycetes.

Among physiological groups of fungi laccases are typical of the wood rotting basidiomycetes which cause white rot and a related group of litter decomposing saprophytic fungi, which is the species causing lignin degradation. Almost all species of white rot fungi, were reported to produce laccase in varying degrees and the enzyme has been purified from many species (3).The majority of laccases characterized so far have been derived from white rot fungi which are efficient lignin degraders (4). Many fungi contain, several laccase encoding genes, but their biolological roles are mostly not well understood (5). *Agaricus bisporus* , *Botrytis cineria, Coprinus cinereus, Phlebia radiate, Plaeurotus ostreatus* and *Trametes versicolor* were some examples of basidiomycetes that produce laccase. Interest in laccase has increased recently because of their potential use in detoxification of pollutants and in

bioremediation of phenolic compounds (6, 7 and 8). Laccase exhibit broad range of substrate specificity and have the ability to degrade a range of xenobiotic including industrial colored waste water (9). It is also used in the medical diagnostics and for cleaning herbicides, pesticides and some explosives in soil (10). Keeping in view of the above justification, the aim of the present work was to isolate and screen laccase producing fungi from saw mill waste dumping soil.

Materials and Methods

Materials

All the chemicals used in this study were procured from HI Media, Mumbai, India.

Isolation of fungi

From the collected samples 1gm was weighed and added to 9ml of sterile distilled water and mixed well. The suspension was serially diluted from 10^{-1} to 10^{-7} dilution factors. Later 1ml of each dilution was spread plated on the surface of potato dextrose agar medium plates which contains 0.01%chloramphenicol and incubated at 37^{o}C for 5-7 days. Distinct fungal colonies were isolated and repeatedly sub cultured until pure cultures were obtained. The cultures were maintained on PDA slants at 40^{0}C.

Qualitative screening

Laccase enzyme production was carried out by inoculation of mycelium from each strain into PDA plates containing 0.02% Guaiacol. It was incubated at 37^{0}C for 5- 7 days. The formation of reddish brown zone indicates the positive laccase secretion.

Screening of culture media

Two semi synthetic culture media and 4 types of agro waste based culture media were used for the study.1.Yeast extract peptone dextrose copper sulphate (YPD-Cu)medium contains glucose

20g/l, peptone 5g/l, yeast extract 2g/l, copper sulphate 100mg/l. 2. Glucose peptone broth (GPB) media contain glucose 100g/L, peptone 3g/l, KH_2PO_4 0.4g/l, $FeSO_4$ 0.0005g/l, $MnSO_4$ 0.05g/L, $MgSO_4$ 0.5g/l and copper sulphate 0.01g/l 3.Agrowaste based medium contain 10g of each material(pineapple leaves, wheat bran, saw dust) is individually moistened (70%) with the liquid media containing $(NH4)_2SO_4$ 1g/l and $MgSO_4.7H_2O$ 0.5g/l without glucose (11).

Inoculum preparation

The inoculums was prepared by cutting the 5 days old fungus grown on PDA plates into small discs (10mm) in size and inoculated into 250ml Erlenmeyer flask containing proposed media.

Enzyme activity

The laccase activity was assayed at room temperature by using 10mM sodium acetate buffer (pH 5.0).The reaction mixture contained 3ml acetate buffer,1ml guaiacol and 1ml enzyme source. The change in the absorbance of reaction mixture containing guaiacol was monitored at 470nm for 10 min of incubation using UV – spectrophotometer. Enzyme activity is measured in U/ml which is defined as the amount of enzyme catalyzing the production of one molecule of coloured product per minute per ml (12).

Morphological and microscopical identification

Morphological characterization of fungus was commonly performed to distinguish the microbes based on colony and cellular morphologies. Morphological analysis was performed for colonies of strains on solid media. Size, shape, and staining by lactophenol cotton blue was analyzed using light microscope.

Dye decolourisation

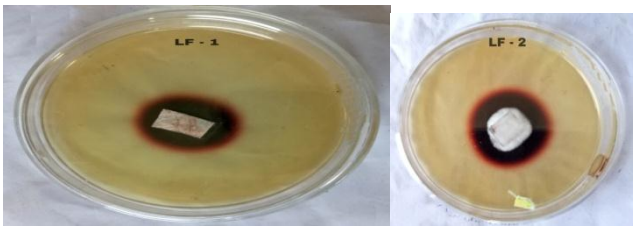
Three synthetic dyes such as Congo red (CR), methylene blue (MB) and crystal violet (CV) were used for investigating the efficiency of deolourisation by the potent fungus .Stock solution of these dyes were prepared in distilled water and diluted to the required concentration and then

used for the decolourisation assay. The reaction mixture contain PDB incorporated with 50mg/l of CR, MB and CV in a total volume of 50 ml. pH was adjusted to 5.5.The inoculum was added and incubated at room temperature. The decolourisations of the tested dyes were calculated at different time interval .The decolourisation rate was calculated using the following equation (13).

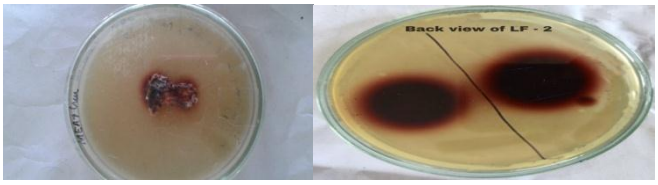
$$\text{Decolourisation Percentage (\%)} = \frac{\text{Final absorbance-initial absorbance}}{\text{Initial absorbance}} \times 100$$

Result and Discussion

A total of 50 fungal colonies were isolated from the saw mill waste dumping soil. Isolated fungi were maintained in PDA medium. They were screened for potential laccase production ability using Guaiacol as indicator. Screening of a large number of fungi is therefore necessary to select strains capable to produce high titers of laccase with normal characters. Such a screening should preferably rely on the use of inexpensive, rapid and sensitive testing methods.(14).The organism surrounded by red brown halo were marked as laccase producing fungi. They were coded as LF-1, LF-2 and LF-3.The diameter of the zones measured was 35mm, 41mm and 12mm respectively.



LF-1 LF-2



LF-3 BACKSIDE VIEW OF LF-2

Figure.1. Reddish brown zone formation around the selected fungal strains LF-1, LF-2 and LF-3.

Of the 2 types of semi synthetic medium used, laccase production was found high in YPD medium. About 2.99 U/ml of enzyme was produced by LF-2 at the 12th day of incubation.LF-1 and LF-2 didn't show a notable drastic change in enzyme production compared to LF-1 (Fig.2 and fig3.).Likewise in the case of GPB enzyme activity was present but the rate of enzyme activity was very low compared to YPD-Cu medium. But in both the medium better activity was noticed by LF2.The presence of copper is an inducing agent for laccase production in the YPD-Cu medium. Copper has been reported as a strong inducer in several species; among them are *Trametes versicolor, Pencillium chrysogenum, Pleurotus* etc. It is known that Cu induced both laccase transcription and activity (15) and increase in activity is proportional to the amount of copper added.

In the case of agro waste based media maximum laccase production was found in medium having saw dust as substrate compared to wheat bran and pineapple leaves. The agro waste act as a nutrient support for the growth of microbes. They are rich in sugars which make the process more economical (16) and help to solve environmental problems which are caused by them due to the disposal in the open environment. The fungus coded as LF-2 showed increase in production of laccase enzyme in saw dust incorporated medium. The maximum activity of about 4.0U/ml (Fig.4) was observed on the 8th day of incubation. In wheat bran

1.08U/ml (Fig.5) of enzyme activity was observed on the 14th day of incubation. In pine apple leaves added medium on 8th day about 3.1U/ml (Fig.6) was observed. So from the above results it is clear that in sawdust incorporated agro waste based medium, better production started at the earlier stages of incubation and the organism was coded as LF-2. So it is selected as a good candidate for further studies.

In the present study LF-2 was identified as *Coriolopsis sp*. The identification of moulds is based on the shape, method of production, and arrangement of spores (conidial ontogeny). White rot fungi belong to the phylum Basidiomycetes and the subphylum Hymenomycetes. Detailed molecular characterization has to do in the next stage of this work.

The dye decolourisation efficiency was checked by inoculating the fungus LF-2 into various dyes like Methylene blue, Congo red and Crystal violet (MB, CR and CV) incorporated medium. On 14th day of incubation observed 72% of degradation in MB incorporated medium (fig.7). No change was observed in the rest other two dyes added medium. Laccase producing microorganisms especially white rot fungi were extensively applied for dyes decolorization experiments. Decolorization ability of five indigenous white rot fungi on vat dyes during 10 days was studied by Asgher et al. (17) and it was determined that *Coriolus versicolor* IBL-04 showed excellent decolorization potential on all tested dyes. Decolorization potential of laccases even on a same dye shows variation and depends on the biological sources of producing microorganism.

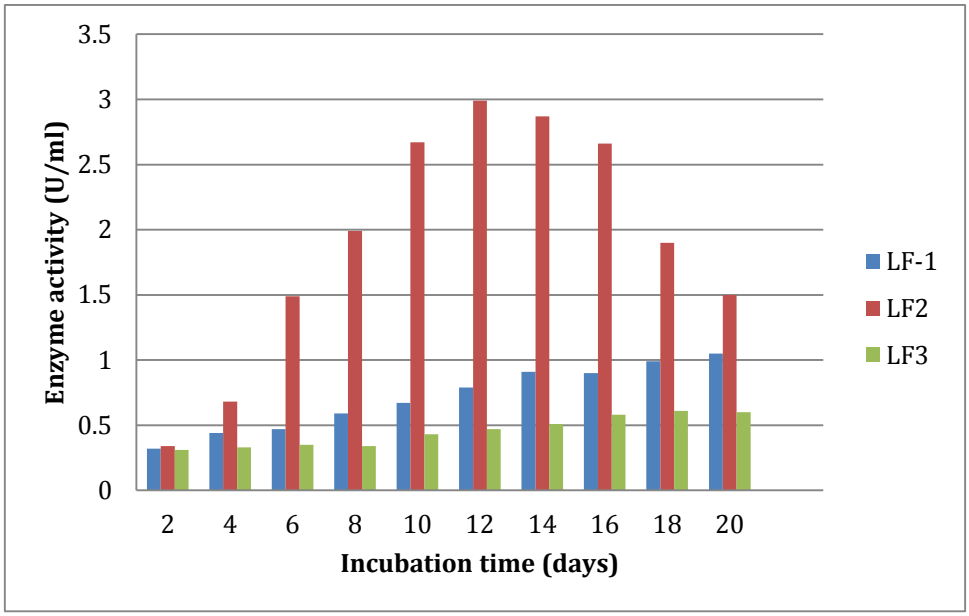


Figure 2. Enzyme activity profile of LF-1, LF-2 and LF-3 on YPD-Cu Broth

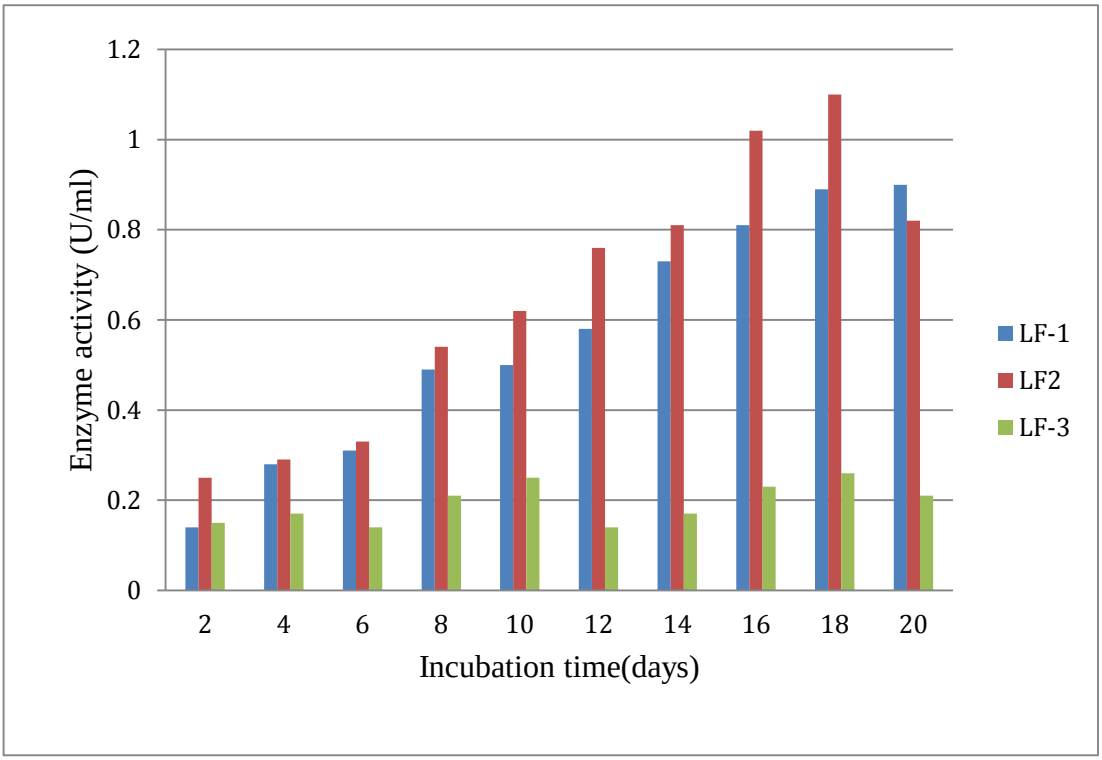


Figure 3. Enzyme activity profile of LF-1,LF-2 and LF-3 on Glucose Peptone Broth

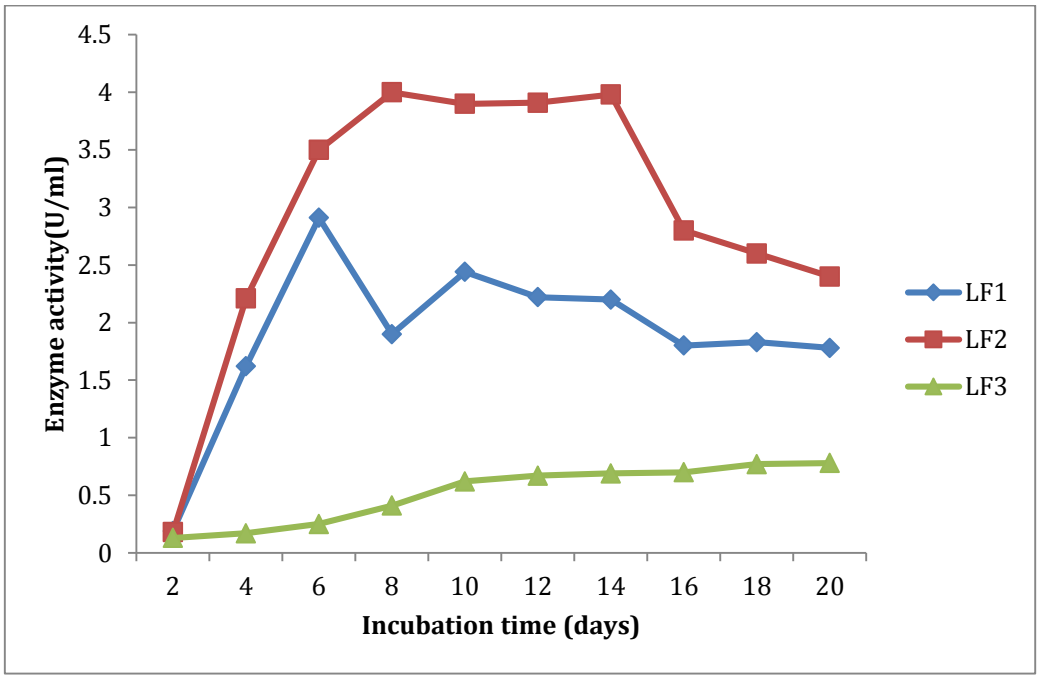


Figure 4. Laccase production by the 3 isolated fungi in Sawdust incorporated medium.

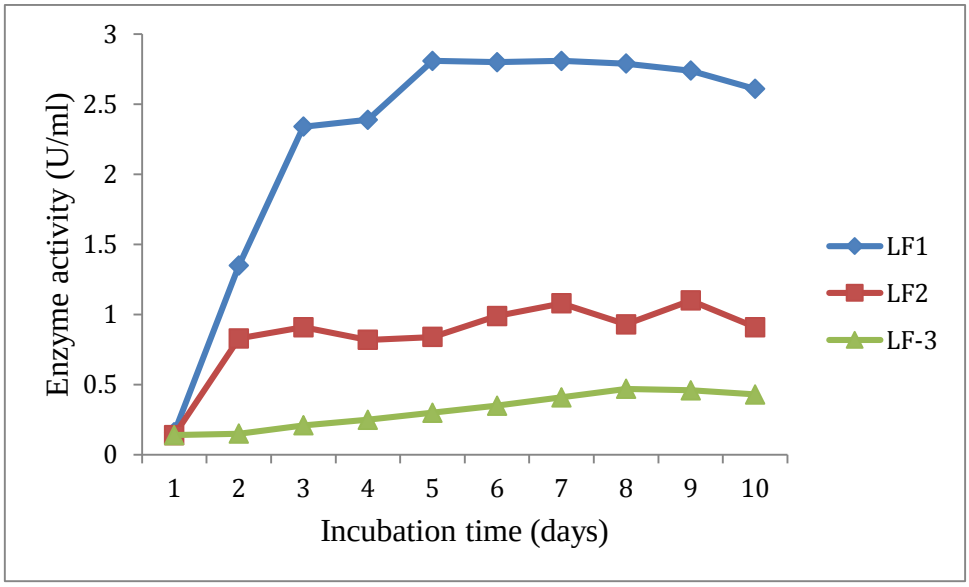


Figure 5.Laccase production by the 3 isolated fungi in wheat bran incorporated medium.

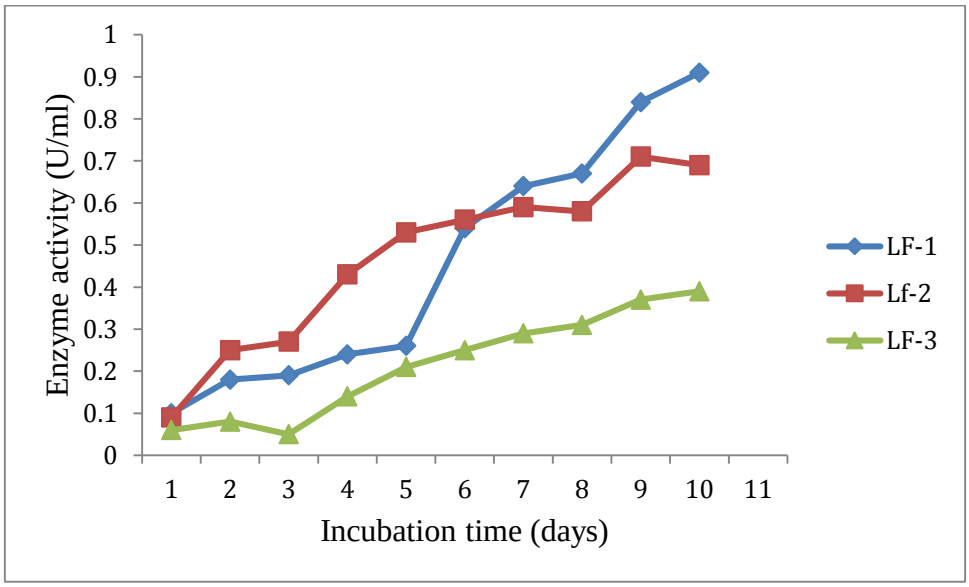
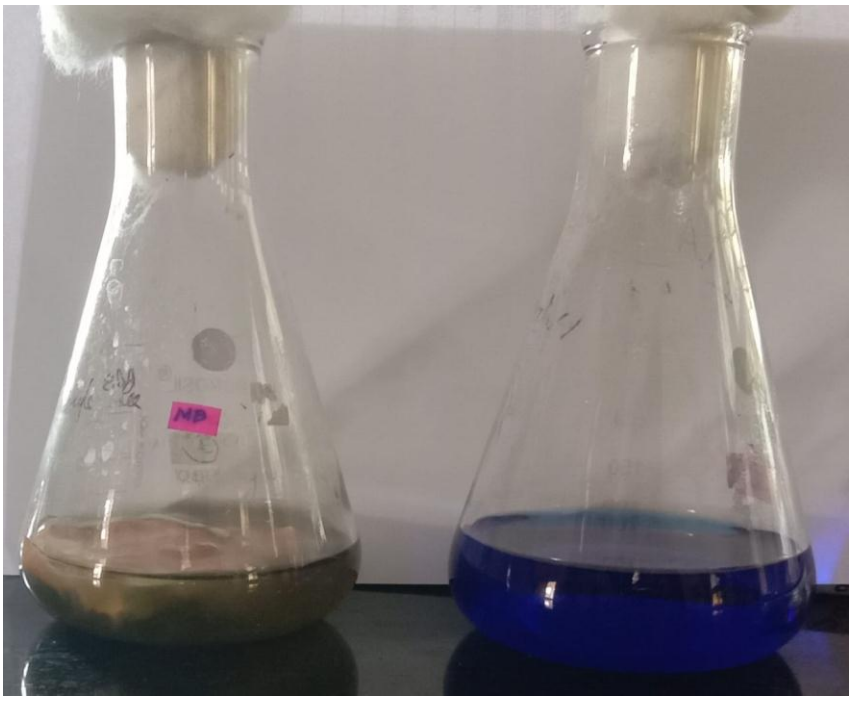


Figure 6.Laccase production by the 3 isolated fungi in pineapple leaves incorporated medium.



colour change observed on 14th day of incubation

CONTROL

Figure 7. Biodecolourisation of methylene blue by LF-2.

Conclusion

From the above studies it is very clear that among the 3 fungal isolates *Coriolopsis sp.* (LF-2 coded fungus) have higher enzyme activity. Guaiacol is found to be a good substrate to facilitate growth and isolation of interested fungi. It can be used for lignocellulosic waste conversion to valuable energy resource. More studies have to be conducted on characterization and purification of this fungal laccase enzyme to explore its application in textile effluent decolourisation.

Acknowledgement

The authors are very much grateful to management of Indira Gandhi College of Arts and Science, Kothamangalam for providing the lab facilities to do this work efficiently.

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