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A FRANSALIAN INSTITUTE OF HIGHER LEARNING

ANKURAM 2022

For UG/PG students

"Global Energy Crisis-Causes Effects & Strategies"

Day 1:24 June 2022
(Offline)

Day 2:25 June 2022
(Online)

ORGANISED BY

"Department of Science (UG)
and
Post graduate Department
of Mathematics"

In Collaboration with

Research Cell

Scan to register

Registration Link

- Delegates are requested to submit Abstract not exceeding 250 words using Times New Roman, Font size 12, Line Spacing 1.5, 1 inch margin on all sides and Key Words. Abstract should have the title of the paper, details of the Author/s (Name, Designation, Affiliation, Mobile No. and Email ID).
- Once the abstract is selected, Delegates are requested to submit the Full Paper as per the format communicated through mail.
- The abstract and full paper should be mailed to bsc.ankuram@sfscollege.in
- Student Presenters should submit Power Point Presentation on or before 21/06/2022.

PUBLICATION DETAILS:

- Papers will be sent for Peer Review. Selected papers will be Published in peer reviewed journal.
- The Best Paper will be awarded. There are also prizes for the Best Presenter (Online & Offline).
- All other papers would be published in the Proceedings Volume (book of abstracts) released by the College.
- Publication Fee will be intimated to the author, if selected for publication.

Registration Fee:

Participation : Free
Presentation : ₹150

IMPORTANT DATES:

Abstract Submission	25 May 2022
Notification of Acceptance of Abstract	30 May 2022
Full Paper Submission	10 June 2022
Notification of Acceptance of Full Paper	15 June 2022
Seminar Date	24 & 25 June 2022

St. Francis de Sales College is managed by the Missionaries of St. Francis de Sales (MSFS) of South West India Province, who firmly believe that 'the education of the heart is the heart of education' hailed by its Founder, Fr. Peter Marie Mermier. St Francis de Sales College came into existence in 2004 with the motto: Excellence, Transformation and Efficiency. It is a minority recognized Institution, permanently affiliated to Bangalore University with Undergraduate (BA, BBA, BCA, BCOM, BSC), Postgraduate (MA, MCOM, MSC, MBA) and Postgraduate Diploma Programs. In the year 2018, the College obtained 2(f) and 12(b) Recognition under the UGC Act of 1965. AICTE approval for MBA was obtained in 2020. The College was granted "B++" Grade by the NAAC in 2021. The College is also an ISO Certified Institution.

ABOUT THE DEPARTMENT OF SCIENCE & POST GRADUATE DEPARTMENT OF MATHEMATICS

The department of Science was started in the year 2009 with the triple main BSc in Math, Electronics and Computer Science. At present the department offers three Bachelors of Science courses; BSc (MEC: Mathematics, Electronics, Computer Science) and BSc (PCM: Physics, Chemistry , Mathematics), BSc (CJP:Computer science, Journalism, Psychology). The Department is regularly involved in activities that promotes and nurtures research aptitude in students as well as to promote science and science awareness. The Post Graduate Department in Mathematics offers MSc in Mathematics.

SUB THEMES

- Technology for energy storage and security
- Mathematics as a tool to overcome the energy crisis
- Sustainable chemicals and biofuels
- Recent development in Solar Power technologies
- Technical solution to the energy crisis

ABOUT ANKURAM- 2022

Science is extremely diverse but converging and overlapping. Considering the importance of science and mathematics in today's world, it becomes essential to undertake scientific global inquires in various aspects. This seminar is a crucial step of the Department of science, St. Francis de Sales College towards bringing various branches of science and mathematics together. The seminar will focus on nurturing the research culture among Post graduate as well as graduate students through paper presentations.

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Researrch cell coordinator

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Note: Due to Covid restrictions the delegates from other colleges can attend and present the seminar online. Offline paper presentations will be restricted to internal delegates.

Report - Student National Seminar

Title	Global Energy Crisis- Causes, Effects & Strategies
Date of Event(s)	24/06/2022
Department / Association	Department of Science
Venue	Seminar hall(4th floor), Google Meet(Online)
Number of Participants	130
Target Audience	UG/PG Students

Resource Person(s) with qualification	Keynote Speaker: **Ms. Smitha Kamath**, Founding Director at Praanapoorna Collective LLP. Research and development of natural products. Bengaluru, Karnataka, India.
Books (if published)	NA

Place of visit/ details of Industrial visit place (if applicable):	NIL
Event Coordinator	Ms. Rashmi N

Science is extremely diverse but converging and overlapping. Considering the importance of science and mathematics in today's world, it becomes essential to undertake scientific global inquiries in various aspects. This seminar is a crucial step of the Department of science, St. Francis de Sales College towards bringing various branches of science and mathematics together. The seminar will focus on nurturing the research culture among Post graduate as well as graduate students through paper presentations. Ankuram 2022 National Student's seminar was conducted on 24th June 2022.

This year, Ankuram 2022 could bring the students before the mindfulness of a resource person like Ms. SMitha Kamath, Founding Director at Praanapoorna Collective LLP. research and development of natural products.Centre for Environmental Law (WWF India) Praanapoorna Collective.Bengaluru, Karnataka, India. Smitha is reviving Natural Products and mainstreaming sustainable chemical-free lifestyle through Praanapoorna Natural products. Also exploring Circular Economy with handcrafted local production and consumption of natural alternates with community production model with Praanapoorna Collective. Post engineering, she has worked in corporate world for 16 yrs in the areas of strategy and operations excellence including BPR, BSC and championing cross-functional strategic initiatives.

•Founded PraanaPoorna Collective – mainstreaming sustainable lifestyle by reviving handcrafted natural products with locally available ingredients. Since 2016

•Devarakaadu - Reviving Ancient wisdom for abundance- Sustainable farming, Sacred Groves for biodiversity and Ground water recharge since 2012
•Greenpeace - Senior management team in 2007 Organisation Development Director
•Mahindra Satyam - 16 years IT Industry -Strategy and operations excellence till 2009 driving Strategic initiative in Sustainability till 2011

Dr Reginold G George guided the students as session co-chair for offline session. Ms. Padmavathi, Dr Pandikani kept guiding the students as session co-chair throughout the Online sessions. Also, in order to improve the efficacy of the online evaluation for best presentation and best paper, review committee assisted the entire sessions.

Inaugural Session

The session started with the welcome and introduction to Ankuram 2022 by Dr Nebula Murukesk, Head, Department of Science. Desalite Deepika introduced the speaker of the day to the audience. Later on Ms Smitha Kamath took over a session through a keynote address. Ms Smitha Kamath explained about plastic reuse, recycling and also ways to reuse plastic.

Technical Session 1:

The keynote address was followed by oral presentations by the student participants. There were 17 presentations under Technical session 1. All the presentations were based on the theme and subthemes given by the department.

Technical Session 2(Online):

Technical session 2 continued after lunch break. The Technical session 2 opened with the welcome and introduction of two session chairs Dr. Pandikani M and Ms. Padmavathi V. Later on the session had oral presentations by students. There were 4 presentations in technical session 2. All the presentations were based on the theme and subthemes given by the department.
Prachi Parihar Paresh, Samuel G of Christ Academy Institute for Advance Studies was announced as the best presenter online by the Department Coordinator Ms. Rashmi N and at the end the participants were requested to submit the feedback form through the link provided through mail so that they can receive the certificate. It was also informed that the presenter certificate would be sent separately through mail within 10 days and the best paper award winner will be intimated through mail after reviewing the papers and also by considering the recommendations of the chair and the co-chair.

Valedictory Session:

The valedictory session started with the concluding remarks by Ms Rashmi N, Coordinator, Department of Science as well as the seminar organising Secretary. Ms Rashmi N consolidated the day's proceedings. There were a total of 23 presentations. At the end the participants were requested to submit the feedback form through the link provided through mail so that they can receive the certificate. It was also informed that the presenter certificate would be sent separately through mail within 10 days and the best paper award winner will be intimated through mail after reviewing the papers and also by considering the recommendations of the chair and the co-chair.

Ashish Robin Bara, Arun M & Kunal Thakur of VI Sem BSc (PCM), St. Francis de Sales College, Bangalore was announced as the best presenter at the end of the session by Ms Smitha Kamath, founding director, praanapoorna collective LLP. Desalite Deepika and Desalite Pooja Bhati did the MC for the entire session. Later on, a vote of thanks was expressed by Desalite Aney L S.

Event Incharge

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Department of Science
St. Francis de Sales College
Bengaluru - 560 100.

RESEARCH

Proposal form for conducting Student's National Seminar- Ankuram 2022

Name of the Department:	Department of Science
Name of the event coordinator:	Rashmi N, Coordinator, Department Of Science
Date of the event	24th & 25th June, 2022
Venue Online Platform	Seminar Hall-Offline Google meet-Online
Title of the proposed research activity:	Ankuram 2022 Title: National Student's Seminar on Global Energy Crisis-Causes, Effects & Strategies
Theme / Sub themes	Sub themes 1. Technology for energy storage and security 2. Mathematics as a tool to overcome the energy crisis 3. Sustainable chemicals and biofuels 4. Recent development in Solar Power technologies 5. Technical solution to the energy crisis
Details of the Resource Person	Dr. Smitha Kamath Founding Director at Praanapoorna Collective LLP, research and development of natural products, Bengaluru, Karnataka.

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STUDENT NATIONAL SEMINAR 2022

Attendance Sheet for Offline Participants

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Studies on current trends in bioethanol as a biofuel

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Abstract

Biofuel is a fuel that is produced over a short time span from biomass and is ethanol, butane, methane, methyl or ethyl esters of fatty acids. This is in contrast to fossil fuels such as oil which are evolved over by very slow natural processes. With the petroleum reserves diminishing and as oil prices continue to rise, there is a dire need to explore alternate fuels. The paper analyses current developments in processing and producing ethanol as a biofuel and its advantages and limitations. Using bioethanol as an additive to petroleum products considerably decreases the emissions of toxic chemicals in exhaust gases, and also it does not release of extra carbon dioxide into the atmosphere. Thus bioethanol as biofuel can contribute to the global climate changes by reducing the carbon emissions and thus the carbon foot print. The sources of bioethanol are mainly various sugars and starch. A very different source of ethanol is lignocellulose from plant biomass, which are the residues of agriculture and wood industry as well as municipal waste. Other way of producing bioethanol is from marine sources like algae, microorganisms found in sea and using sea water instead of fresh water. Thus, marine biomass, microorganism and seawater mixture has a potential for bioethanol production.

Key words: biofuels, bioethanol, carbon emissions, biomass, fossil fuels

1. Introduction

Ethanol (C_2H_6O) is a simple liquid alcohol that is formed from the fermentation of sugars in their natural occurrences or being derived from starch-rich grains or lignocellulosic feedstock. Ethanol is also called ethyl alcohol, grain alcohol, or simply alcohol, and is used as a disinfectant, an organic solvent, a chemical feedstock, and a transportation liquid fuel. Currently, ethanol is produced commercially from a variety of feed stocks via fermentation where the yeast, Saccharomyces cerevisiae is used to ferment the sugars derived from the starch in corn. Of the ethanol produced, 15% used as strong alcoholic beverages, another 15% is used in chemical industry and the rest 70% of ethanol is used as the fuel in combustion engines.

Ethanol as an engine fuel has many advantages over gasoline like has higher octane rating and steam pressure. The presence of oxygen in ethanol molecule results in 33% lower energy content in ethanol relative to identical weight portion of hydrocarbon (gasoline). The environmentally friendly properties of ethanol are of great importance. Unlike the combustion of fossil fuels, burning ethanol derived from biomass does not lead to emission of additional CO_2 into atmosphere[1].

At present almost all ethanol, including fuel ethanol is obtained from traditional source like sucrose and starch. Therefore much attention has been paid to plant biomass as a potential

source for fuel ethanol production. The stocks of biomass are really boundless. They include agricultural waste like straw, corncob, sunflower husk etc., the waste of woodworking and cellulose-paper industry like branches, sawdust, bark of trees, residues of paper industry, and municipal waste[2]

2. Chemistry of bioethanol

Ethanol is a relatively small chemical molecule, composed of two atoms of carbon, six hydrogens, and one oxygen. Its chemical structure is C_2H_6O or C_2H_5OH with the presence of the OH group. The presence of OH groups makes the ethanol a polar molecule. Moreover, the reactivity of the hydroxyl group permits its ready conversion into industrially significant products and intermediates via dehydration, dehydrogenation, and condensation, etherification, and/or oxidation reactions.

The synthesis of ethanol can be performed both by chemical and microbiological processes. In the chemical process ethanol is produced by ethylene hydration, while the microbiological process it is produced by fermentation using yeast mainly Saccharomyces *cerevisiae* yeast[2]. In the chemical process, ethanol is manufactured by reacting to ethane with steam. The formation of the ethanol is exothermic, and the reaction is reversible. The chemical reaction for the production of ethanol is as below.

$$CH_2{=}CH_{2(g)}+H_2O_{(g)}\rightarrow CH_3CH_2OH_{(g)}\ \Delta H=-45KJ{\cdot}kmol^{-1}$$

Currently, the world ethanol production is carried out mainly by the biological means, referred to as alcoholic or ethanolic fermentation. In USA, ethanol is produced from corn while in Brazil uses sugar cane. In the European Union ethanol is produced from sugar beet, maize, wheat, barley, and rye. China is the fourth ethanol producer in the world and their production process is based on corn, wheat, rice, and sorghum. But independent of the biomass, the fermentation process using hexose sugars (C_6) to produce ethanol is developed according to the below equation.

$$C_6H_{12}O_6+O_2\rightarrow biomass(CH_{1.83}O_{0.56}N_{0.17})+CO_2+H_2O$$

The production of ethanol from sugar cane is one of the most important processes in South America. During this process, the sugar cane is subjected to juice extraction, then it is sterilized to inoculate yeast, specifically Saccharomyces cerevisiae. Ethanol production using corn as feedstock requires more steps, mainly because the starch present in corn is not metabolized directly by the yeast. Therefore it is necessary to break down the starch into monomers of glucose, this is commonly carried out using enzymes such as alpha-amylase. After monosaccharides solubilization, the fermentation process and downstream operation are carried out.

3. Production Technologies

Bioethanol production processes vary considerably depending on the raw material involved, but some of the main stages in the process remain the same, even though they take place in different conditions of temperature and pressure, and they sometimes involve different microorganisms. These stages include hydrolysis (achieved chemically and enzymatically), fermentation and distillation. Hydrolysis is a preliminary treatment that enables sugars to be

obtained from the raw materials that are then fermented. In the case of enzymatic hydrolysis, effective pre-treatments are needed, however, to increase the susceptibility of lignocellulose materials to the action of the enzymes.

3.1 Sugar-Based Feedstocks[1]

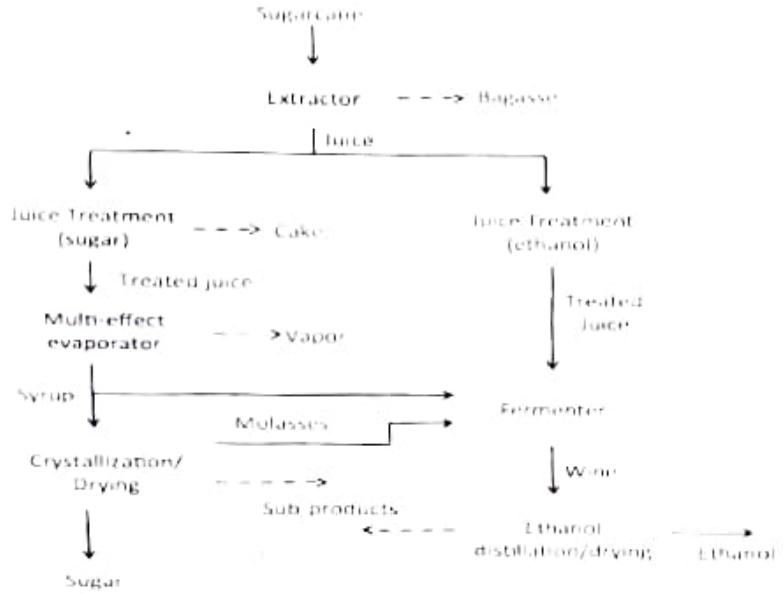

Figure 1
Ethanol extraction from sugar

Sugar cane is washed and undergo a primary "crushing" process before milling. The cane juice obtained undergoes a clarification process in which the pH is balanced. Fermentation is usually done with the aid of a yeast, Saccharomyces cerevisiae, which is separated in a continuous phase by centrifugation and reused in the fermenter. The juice is heated up to 110°C (to reduce the risk of bacterial contamination), then decanted and fermented. The extract leaving the fermenter is then be distilled to extract the hydrated ethanol (an azeotropic solution containing 95.5% v/v of ethanol and 4.5% v/v of water), which is dehydrated using molecular sieves or azeotropic distillation (i.e. with cyclohexanone or benzene) to obtain a higher-grade, anhydrous ethanol. In addition to ethanol, there is also an aqueous solution leaving the distillation process that is called residue.

In the simplest form, production of ethanol from glucose can be expressed by the following equation.

$C_6H_{12}O_6 + 2\ P_i + 2\ ADP \rightarrow C_2H_5OH + 2\ CO_2 + 2\ ATP + 2\ H_2O$

glucose → 2 ethanol + 2 carbon dioxide + energy

According to the above equation, the maximum theoretical yield of ethanol produced from 1 g of glucose is 0.511 g ethanol.

3.2. Starch-Based Feedstocks

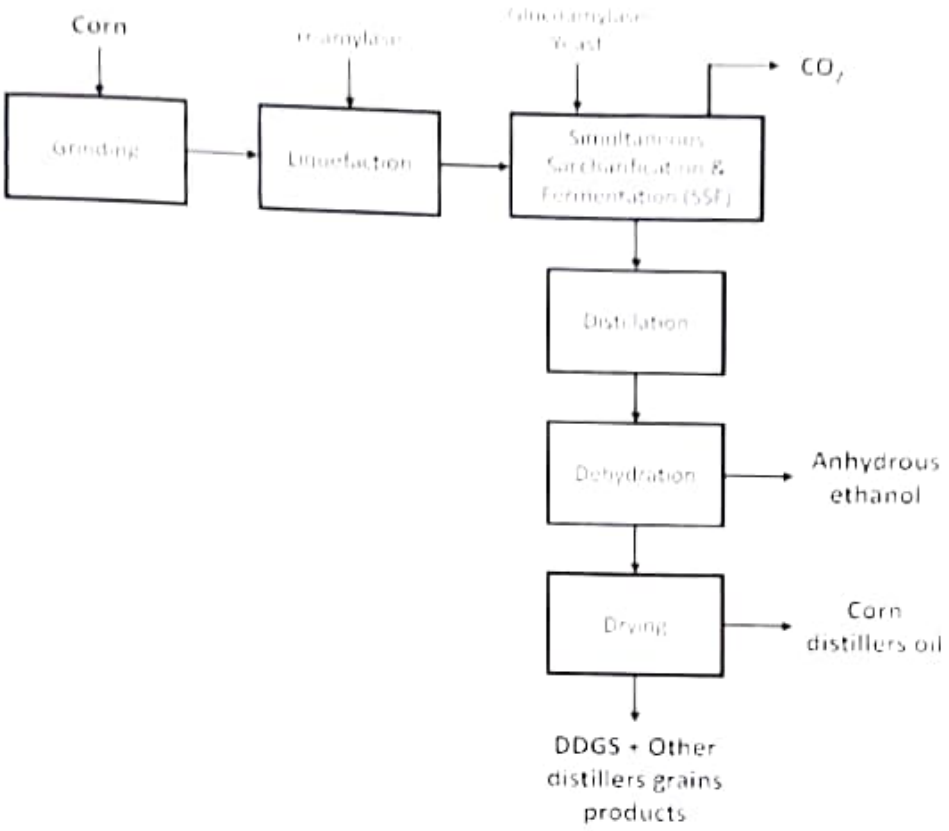

FIGURE 2
DRY GRIND PROCESS FOR ETHANOL PRODUCTION FROM CORN

Corn is used almost exclusively for ethanol production where ethanol is produced from corn by either the wet-milling or dry-grind process. In the dry-grind process, after grinding, water and a thermostable _-amylase is added to the ground corn. In the next step, which is called pre-liquefaction, the slurry then is brought up to 60–70 deg C (warm cook) or 80–90 deg C (hot cook). The slurry, is held at these temperatures for about 30–45 min. The swelling andhydration of the starch granules cause dramatic increase of the slurry viscosity and loss of crystallinity of the granule structures. In the next step, called liquefaction, the mash is maintained at 85–95 deg C for a period of time or forced through a continuous jet cooker at 140–150 deg C. At the end of the liquefaction, starch is hydrolysed to shortchain dextrins . The temperature of the mash is lowered to 32 deg C and the pH adjusted to approximately 4.5. The mash then is placed in a fermentor. Glucoamylase and the yeast culture from the yeast propagation tank are also added. Urea may be added as a nitrogen source. The process of combining enzymatic hydrolysis and fermentation is called simultaneous saccharification and fermentation (SSF). The SSF is a batch process which typically is run for about 50–60hours. The final ethanol concentration is about 15 % (v/v). Commonly used commercial glucoamylase formulations also contain proteases. The ethanol produced is recovered by distillation followed by molecular sieve.

3.3 Lignocellulosic Feedstocks

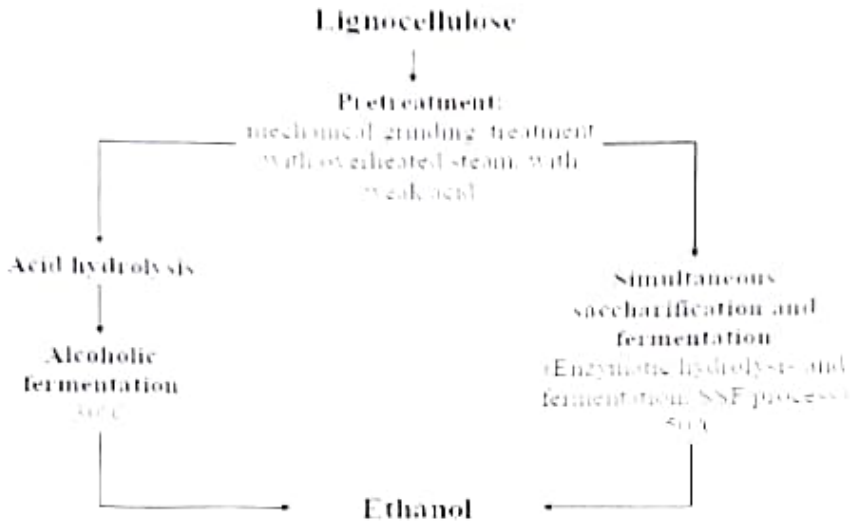

Figure 3

Ethanol production from biomass (Lignocellulose)

Lignocellulosic feedstocks are also referred to as lignocellulosic biomass or simply biomass[3]. Biomass consists of three main components, which are cellulose, hemicellulose, and lignin. The cellulose and hemicellulose are hydrolysed to fermentable sugars, which are subsequently fermented to produce ethanol.

4.Conclusion

Ethanol has been produced from molasses and starch for long period of time, however, ethanol production from starch leads competition for food regarding land and price. Therefore, lignocellulosic agricultural residues are potentially used for ethanol production to solve such challenges. But, its industrial production is not successful due to low ethanol titer and different inhibitors in lignocellulosic hydrolysates. The low ethanol titer is circumvented using a variety of optimization techniques. The lignocellulose pretreatment and the yeast fermentation technology is an area of research interest.

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A review on recent development in solar cells for energy harvesting applications

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Abstract

The fast-growing population and world economy have led to growing energy demands. The enormous consumption of traditional fossil energy has led to resource exhaustion and environmental pollution. Over usage of these non-renewable and hazardous substances has directed to global warming, ozone depletion, and further destruction of the earth. Hence, it is essential to look for an alternate energy source that is more efficient with minimum usage of natural resources. One of the best alternative sources of energy is solar energy. The amount of solar energy intercepted by the earth in one hour is more than the annual world energy consumption. Solar energy can be utilized in solar cells, batteries, fuel cells, and supercapacitors. The present review focuses on energy conversion devices such as solar cells. Solar cell devices are renowned for the efficient conversion of solar energy to electrical energy which has been attracting the scientific community due to their remarkable consistency with the principles of sustainability. Choice of materials and architecture of device has led to the category of three generations of solar cells. The key factors in photovoltaics are power conversion efficiency, device stability and reproducibility, and large-scale commercialization. This review describes the architecture and working of solar cells, followed by generations of solar cells and their benefits as well as the improvements needed to enhance photo-conversion efficiency, and future prospects were examined. Solar energy is sustainable and long-lasting making it an excellent candidate to achieve the goal of a cleaner environment.

Keywords: Renewable energy sources, Photovoltaic, solar cells, efficiency, generations.

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1 Introduction

The energy crisis has been one of the most challenging problems for the human race. Due to the growth of population and economy simultaneously. Coal and oil are prominent energy providers used globally. These products are not only non-renewable but hazardous at the same time. Though they are cheap, they harm our environment in all possible ways. The condition is worse when viewed from the perspective of harming nature[1,13].

Hydroelectricity and wind energy is all clean energies but due to their periodic changes, low efficiency, and less yield, made man explore further and look into clean and abundant energy sources such as the sun, which has been emitting radiation for billions of years on this earth. While digging into the facts it is known that the energy required for all human activities for one year is emitted by the sun in just 60 minutes and can single-handedly fulfill the energy requirement of the whole world. This makes it the hope for renewable and harmless energy[2,14].

The realization lead to the invention of these solar cells. These cells generate electricity by absorbing the sun's radiation and converting it into electricity. These cells work on the principle of the photo voltaic effect. This effect was demonstrated experimentally by French physicist Edmond Becquerel. In 1839, he built the first photovoltaic cell in his father's laboratory. And further, by the contribution of various physicists and scientists, many analysis and theories were brought to light, and the development and advancement of these solar cells were made.

This review aims at looking further deep into all three generations of solar cells and their working and excavate their pros and cons and to give its futuristic aspects.

2. Solar cells

A solar cell or photovoltaic cell is an electrical device that converts light energy to electrical energy. It generates electricity with the help of an effective method called the photo voltaic effect also called as PV effect. When light is made to shine on a system, with two electrodes connected to each other with a liquid or solid system, an electrical voltage is generated. This effect is known as the photovoltaic effect or PV effect.

The material plays a vital role in the efficiency and competency of solar cells. In conducting various research and studies, researchers have come up with some parameters, which when followed, PV cells work as an ideal cell[3].

Large reproduction.
Non-hazardous and more easily obtainable.
A direct band structure could make it more efficient.
High efficiency in energy conversion.
A band gap of 1.1 and 1.7eV should be maintained while manufacturing.
The stability factor must be considered for prolonged usage.

Since it is hard to attain the ideal conditions, many kinds of solar cells were discovered and classified as the first generation, second generation, and third generation.

3. Generations of Solar cells

Solar cells are classified according to the material used in manufacturing and based on their efficiency. They are first-generation, second-generation, and third-generation solar cells[4,11].

3.1. First-generation solar cells

The first silicon-based solar cell was invented in Bell laboratories with 6% efficiency in 1954 and is now the most prominent solar cell used for residential purpose. It accounts for about 85% of the solar panels sold and used around the world. Silicon is the most abundant semiconductor available with a band gap of 1.1 eV making it a suitable material for its manufacture.

The crystalline silicon cells are classified into two types namely

- Monocrystalline cells
- Polycrystalline cells

Monocrystalline cells are cells manufactured with single crystals of silicon. Large ingots are being sliced to get silicon crystals. During the manufacturing process, these large crystals undergo recrystallization consisting of many stages and are expensive, also productions are made with utmost care. Their efficiency lies between 17% - 18%[11,12].

Polycrystalline cells are formed when many crystals of silicon are combined and coupled to each other to form a cell. They are produced by placing molten silicon in graphite mold under cooling. These polycrystalline cells are more economical. It is known that 48% of such solar cells are occupied in the world. Unlike mono crystalline solar cells, polycrystalline solar cells are easier and cheaper to fabricate, these polycrystalline solar cells are much less efficient than those of mono crystalline solar cells with an efficiency of 12% to 14%.

The advantages of first-generation solar cells include,

1. They have a broad and vast spectrum range.
2. High carrier motilities are one of its prominent features.
3. Monocrystalline solar cells have the highest efficiency compared to other generations.

Disadvantages are,

1. These solar cells require expensive manufacturing devices and materials for manufacturing.
2. Growing and sawing ingots is a highly energy-intensive process.
3. An electron formed in another molecule can easily hit a hole left behind in a previous photoexcitation.
4. At the blue and violet end of the spectrum, much of the energy of higher energy photons is wasted as heat.

3.2. Second-generation solar cells

Second-generation solar cells are also called thin-film solar cells. These second-generation thin-film solar cells are much more economical when compared with those first-generation silicon wafer-based solar cells. The light-absorbing layers in the silicon wafer solar cells of the first generation are about 350 micrometers thick whereas the second generation thin-film solar cells have 1 micrometer thick light-absorbing layers.

These thin-film solar cells are further classified as

- a-Si (amorphous silicon)
- CdTe (cadmium telluride)
- CIGS(copper indium gallium diselenide)

Amorphous silicon solar cells are the first kind of solar cells to be manufactured in industries. The ability of these amorphous silicon solar cells to get manufactured at low processing temperatures has led to the usage of cheap materials, substrates, and polymers. The requirement of smaller energy by these substrates makes these second-generation solar cells widely available and cheap. These thin-film solar cells leave behind definite arrangements, crystalline or highly arranged structures. Hence the word amorphous is being added to these solar cells. The substrate or the glass plate is being coated with doped silicon on its backside in process of fabrication. The color combo of these solar cells is dark brown and silver. The dark brown on the reflecting side and silver on the conducting side.

The mainly focused trouble in these second-generation solar cells is their low and not stable efficiency. At the PV module level, the efficiency of the thin-film solar cells automatically comes down. These solar cells are best suited in climate-changing areas, with the least amount of sunshine

Cadmium telluride (CdTe) thin-film solar cells are the leading and prominent growing and developing solar cells in sectors of cheap, economical photo voltaic devices. These are the first thin-film solar cells available at a cheap price. CdTe is the most attractive material for designing these thin-film cadmium telluride solar cells. This is justified by the following properties.

- ✓ The high optical absorption coefficient
- ✓ The band gap of 1.5 eV
- ✓ Chemical stability

CdTe has the ability to absorb light easily and improve the solar cell's overall efficiency. This semiconductor is an extraordinary band gap crystalline compound. The construction in simple terms can be explained as sandwiching cadmium sulfide layers to form a p-n junction.

Moving in detail, with its two-step manufacturing process, in step 1: glass is used as a substrate, and polycrystalline materials are synthesized to get CdTe solar cells. Step 2: with the usage of different economical methods multiple layers of CdTe are being coated onto the substrate. Polymers can be used as substrate, however, due to the environmental impact due to the toxic cadmium component of the solar cell, they are being ignored. In human bodies, animals, plants, and heavy and toxic agents like cadmium can be accumulated. It is highly expensive and hazardous to dispose or recycle these Cadmium materials to the environment, making its supply limited.

Copper indium gallium di selenite solar cells are the combination of four different elements namely copper, indium, gallium, and selenium combined to form one semiconductor solar cell. These solar cells are also direct band gap semiconductors. The efficiency of Copper indium gallium di selenite solar cells is (10%-12%) more compared to cadmium telluride solar cells.

Electron beam deposition, evaporation, printing sputtering, and electrochemical coating are all techniques used in processing the CIGS solar cells. Moreover sputtering may have a single reactive step or a multi reactive step with deposition and selenium interaction. Glass plate, steel, polymer substrate, and aluminum can be used as the substrate for Copper indium gallium di selenite solar cells materials

Advantages of second-generation solar cells are,

The reduced mass of solar panels
Cost-efficient per unit current
Cheap manufacturing cost
Could be independently placed

Disadvantages

Second-generation solar cells like CdTe are toxic and hazardous to the environment.
Lack of stability in amorphous silicon in solar cells.
Low efficiencies compared to silicon wafer-based first-generation solar cells

3.3. Third-generation solar cells

Third-generation solar cells or emerging solar cells are having lesser costs compared to first-generation PV cells and are non-hazardous and flexible compared to second-generation solar cells. It has become a major topic for research in the field of solar technology. These third-generation solar cells differ from the rest of the solar cell generation. These new generation PV cells are manufactured from a wide range of materials[4,5].

Other than silicon, materials like organic dyes, Nano materials, and conductive polymers are used. The main purpose was to make the solar cells available in market, more efficient and commercial. A solar cell which can be used by majority of the population due to its good efficiency in using wide band of solar energy, which very economical and less toxic.

Third generation solar cells are being classified into the following types:

3.3.1 Nano crystal solar cells

Nano crystal based solar cells, which are also named as quantum dots (QD) solar cells. Semiconductors from transitional metal groups are being composed to make the solar cells. These semiconductors are of the form Nano crystal materials. Attempts are being made to replace the bulk materials like si, CdTe, CIGS with the Nano crystals of semiconductors, due to the advancement in the Nano technology. The Si substrate is being coated with the Nano crystals into a bath, due to the centrifugal force all crystals they turn very fast and flow far away.

Generally a photon incidents on an electron, exciting it and leaving behind an electron whole pair in the case of conventional compounds. But in QD solar cells, the photons hits the electron and forms numerous electron hole pair ranging from 2-3 and can go till 7 in few cases.

3.3.2 Polymer solar cells

In Polymer solar cells or organic solar cells, the conducting polymer substrate is used which makes them flexible solar cells.

It is made of functional layers which are thin and coated on to polymer foil or ribbon and are arranged in series. Basically it was the integration of acceptor and a donor. In 2000 a new type of polymer material called the conducing polymers was discovered by Heeger, MacDiarmid, and Shirakawa. They were awarded the noble prize in chemistry for this discovery. Like all other two generations, these PSC work on the principle of photovoltaic effect.

The primitive polymer cells was obtained with high conversion efficiency by Yu et al. He and co-workers obtained that by mixing poly[2-methoxy-5-(2'-ethylhexyloxy)-p-phenylene vinylene]

(PPV), C60 and its other derivatives to develop the first solar cell of polymers material. This development acted as the triggering point for the rise of new age of solar cells with polymers to capture solar power[7,8]. Researches by setting all the parameters achieved an efficiency of 3% in this polymer solar cell.

Textiles and fabrics were also being included for the manufacturing of these solar cells which opened the gates for new application.

3.3.3. Dye sensitized solar cells (DSSC)

Molecular enhancement for improvising the efficiency of solar cells, usage of nanotechnology has been the modern research goingon in the modern world. Michael gratzel first introduced the DSSC in Swiss Federal Institute of Technology. The dye molecules are being employed in between different electrodes in the third generation DSSC[9,10]. The dye sensitized solar cells consist of four major components namely redox mediator, counter electrode, dye sensitizer and a semiconductor diode.

Due to their low cost, transparent nature, and good flexibility and simple conventional techniques, the dye sensitized solar cells are considered attractive. The visible optically active dyes are coated with Nano grained Tio_2 and photosynthesized causing a rise in novelty in dssc. This increases the efficiency by 10%. However the dyes in dye sensitized solar cells undergo degradation and hence are less stable. The reason is the low conversion efficiency due to their weak optical absorption. The degradation of the dye molecules when exposed to ultraviolet and infrared radiations affects the lifespan and stability of the solar cells.

3.3.4 Concentrated solar cells

Since 1970, concentrated photo voltaic cells have existed. In the field of solar research and development technology, it is the newest member undergoing research and development. The PV cells collect a large amount of solar energy and gather them into a small region, which is the principle of these concentrated solar cells. Optics plays a vital role in this process, in focusing sun lights using large mirrors and lenses onto tiny regions of solar cells. A large amount of heat energy is produced due to the converging of sun radiations. A power generator controls the heat engine which drives all the heat energy produced in the

solar cells. These concentrated solar cells can be classified into low, medium, and high concentrated solar cells based on the power of their lens.

Advantages of solar cells are,

- They have Low-energy, high-throughput processing technologies.
- Polymer solar cells are solution process able and chemically synthesized
- Materials used in manufacturing these solar cells, particularly polymer cells, are budget-friendly.
- Dye-sensitized solar cells are rechargeable and upgradable

Disadvantages are,

- Efficiency is low compared to the first-generation solar cells
- Degradation of the electrodes from the electrolyte makes it less reproducible.

4. Construction

A solar cell basically consists of two types of semiconductors i.e n-type semiconductor and p-type semiconductor. In other words, it is also defined as a photovoltaic cell and can be defined as an electrical device that converts solar energy into electrical energy. The solar cell's surface is covered with a glass usually referred to as an anti-reflection coating to prevent the direct reflection of the sunlight rays from the surface.

The n-type semiconductor(emitter) is assembled on the surface, and the p-type semiconductor(base) is at the bottom. The n-type semiconductor is thin and is highly doped with free electrons whereas the p-type semiconductor is thick and is highly doped with holes. Doping is defined as the inclusion of some chemical elements in the semiconductor material.

When these both are sandwiched i.e merged together, some of the free electrons tend to pass through the p-type semiconductor to occupy the holes, and the holes occupy the voids in the n-type semiconductor. The region developed by the transportation of free electrons and holes is called the depletion region and the charge in these regions is neutral.

Figure 1. Schematic representation of working of solar cells.

4.1. Working of Solar cell

In a Solar cell, an active layer is sandwiched between two contacts. The active layer absorbs photons from incident light, and excitons are generated in the donor material.
The strong coulombic force of attraction between photoexcited electrons and holes reduces the probability of exciton dissociation under ambient conditions. These excitons are dissociated into free holes and electrons at the donor-acceptor interface. Holes will be transferred throughout the HOMO (Highest Occupied Molecular Orbit) of donor and collected at the anode and electrons

are transferred from LUMO (Lowest Un-occupied Molecular Orbit) of acceptor and finally transported to cathode and collected. There will be a Hole Transport Layer (HTL) and Electron Transport Layer (ETL) to improve the selectivity of electrons and holes.

5. Environmental Impact

Solar cells being beneficial to humankind in so many ways have an indirect impact on the environment.
Starting from the manufacturing process, materials used in the process, size and design of the plant, location, and weather conditions[4][5].
Considering all these factors, solar cells affect the environment in many ways. The main areas being affected due to the usage of solar cells are:
1) Land Use

2) Water Use

3) Manufacturing Materials

5.1. Land Use

Based on the location, utility-scale, solar cell facilities have raised concerns about land degradation, soil erosion, and habitat loss. Total land area requirements differ depending on the technology used in that particular model, weather conditions in that area, and the efficiency of the solar cell. On an estimation, photovoltaic systems range from 3.5 to 10 acres per megawatt. Keeping the agricultural usage of the land, there are fewer chances for using solar cell utilities on land. However, to overcome this land crisis, small-scale solar cells can be installed at low-quality locations such as abandoned mining land, and brownfields. Smaller scaled photovoltaic cells on the rooftops or terraces have minimal land usage impacts.

5.2 Water Use

Solar cells use water for the cooling purpose of the solar plant. They do not use water directly, but the manufacturing of their components and cooling require water. Unlike all electric plants, concentrating solar thermal plants require water for cooling. The usage of water in Solar cells depends on the plants' design, plant location, and the type of cooling system. Some harmful chemicals used to manufacture the solar cells indirectly pollute water. For e.g cadmium is used to manufacture thin-filmed solar cells and thus pollutes the water.

6. Conclusion

In a world full of growing energy demand and an increase in environmental concerns, an alternative for non-renewable and harmful fossils was investigated. The best alternative found was solar energy. Solar cells were invented with much research and great efforts of various scientists and physicists. In this paper, the generations of solar cells have been mentioned in detail with their advantages and disadvantages. It also emphasizes that though the third-generation solar cells lag behind first and second-generation solar cells in efficiency, much research are being made to upgrade its efficiency. Unlike the first generation solar cells which are bulky and the second generation solar cells which have toxic elements included in their manufacturing process, the third generations are eco-friendly and needs less space to function.

With improved efficiency and less manufacturing cost these solar cells will be the most prominent and highly marketed in nearing future.

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1.	Bhavana	Causes of Global energy causes in electrical vehicles using mathematics	6.5	6.5	6.5	6.5	26
2.	Rishisankar	Tilt Angle, Agriculture	7	6	7	7	~~25~~ 27
3	Varun H.D	Current trends in Biotechnology	7	7	7	6	27

4	Devi Shree RV	Technical Solutions in Global energy crises	5	6	6	6	23
5	Devi P Deepthi V	Global energy crisis Multidisciplinary approach.	6.5	6.5	6.5	6	25.5
6	Jagothi singh Shalini Sangavi	Wireless power transmission using solar panel	6.5	6.5	6.5	7	26.5
7	Auxiliya.	Bioenzymes ..	7	7	7	6.5	27.5
8.	ROTA.E Pavithra Aravindha	Augmenting the performance of Solar photovoltaic cell Through various methods ..	6.5	6.5	6.5	6.5	26

9.	Chaula Vandana. V	Mathematical approach	6	6	6	6	24
10.	Ashish Arun Kubal	perovskite Solar Cell	7	7	7	~~7~~ 8	29
11	Poojashree Chandana BN	Enzyme base Fuel cells — A Review	7	7	6.5	6.5 ~~6~~	~~26~~ ~~26~~ ~~26~~ 27
12	Sufia Paul H Ashish	Energy Harvesting Techniques.	7	6.5	7	7	27.5
13.	Navya G Kalavati	Over population	6	6	7	7	26

14.	Monisha Swathi L	Smart Grid	6	7	6	7	26
15	Sabil Sreefa	Radio frequency energy harvesters in cordless communication devices	6	7	6	6	25
16.	Santhosh Velu	An approach on mathematical modeling of photovoltaic solar cells	6	7	6	7	26
17	Sandeep K Shashikiran	Mathematical approach for Traffic accidents	6	7	6	7	26

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1	Bhavana Rathod		8	5	5	5	23

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2	Rini	Tilt & Solar Panel	8	8	8	8	32
3.	Varun Ringku	Electrolas Rifuel.	10	10	8	10	38 (2)
4	Devishree	Energy Conv	10	8	4	8	30
5	Devi & Deepthi	Mostly Solar Energy conv	6	5	8	6.	25
6	Jyothi	Wireless Power transfer.	8	8	10	9	34

7	Auxiliya	Bioenzymes Heavy Metal	8	8	8	8	32
8	Punitha Roja	Solar PVC	8	8	8	8	32
9	Chaitra	Res waste	10	10	8	8	36
10	Ashish	Perovskite	10	10	10	10	40
11	Chandana	Enz based Fuel Cell	~~10~~ 8	10	8	8	34

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12	Sujan Hiremath	Energy Harvesting Wireless Charging	10	10	8	8	36
13	Kalavathi, Navya	Overpopulation	10	10	8	8	36
14	Monisha Swathi	Smart Grid	8	8	5	8	29
15.	Shahil Sreeja	Radio frey.	8	6	6	6.	26
16.	Santhosh Velu.	Moth model PV. Solar Panel.	7	7	5	7	26.
17.	Shashi. Sandeep.		10	10	8	8	36

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Judging Criteria for Best Presentation (Online)

Sl No.	Name of the Presenter	Title of the Presentation	Point allotment				
			Content (10)	Relevance of the topic (10)	Communication Skill (10)	Overall Presentation (10)	Total 40
1.	1. Sanjana B Gowda 2. Vaishnavi. M	Mathematical modelling in energy systems: A review.	7	8	9	7	31
2.	1. Sayada Tasmiya 2. Gayathami. V	The recent development of Solar energy in Power technology	—	—	—	—	—

3.	1. Prachi parihar. P 2. Paresh 3. Samual. G	A review on recent development in Solar cells for energy harvesting application	8	8	9	8	33
4.	1. Lavanya. K	Sustainable Chemicals & Biofuels	—	—	—	—	—
5.	1. Mary Chaitra 2. Lekha	Technical solutions for the global energy crisis	6	6	9	6	27
6.	1. Vidya. S 2. Benita C. R	Biofuel – A sustainable energy source for future.	7	7	9	7	30

Best Presenter Name 1. Prachi parihar. P, Paresh Samual. G Title A review on recent development in Solar cells for energy harvesting application Points 33

Name & Signature of the Session Chair

Dr. M. Pandikani M.

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Judging Criteria for Best Presentation(Online)

Sl No.	Name of the Presenter	Title of the Presentation	Point allotment				
			Content (10)	Relevance of the topic (10)	Communication Skill (10)	Overall Presentation (10)	T 40
1.	Sanjana B Gowda & Vaishnavi M.	Mathematical Modelling in energy System	8	5	8	8	29
2.	Sayada Tasmiya & Gowthami V	— AB —					

3.	Prachi Parihar P Paresh, Samuel G and Gayatri Mohan	A Review on recent development in Solar Cells for energy harvesting application	9	9	9	9	36
5.	Mary chaithra A Lekha	Technical Solutions to the global energy Crisis	6	7	8	8	29
6.	Vidya S. C.R Benita	A Sustainable energy Source for future	6	7	9	8	30

Best Presenter: Name Prachi Parihar P Paresh, Samuel G and Gayatri Title A Review on Recent development in Solar Cells for energy Points 36

Name & Signature of the Session Chair

Padmavathi. V

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Presentation / paper award.

Criteria for Best ~~Paper Award~~ (Recommendation by the Chair) (Offline & Online)

Sl No.	Name of the Presenter	Title of the Presentation	Point allotment				
			Content (10)	Relevance of the topic (10)	Structure (10)	Overall Impression(10)	Total 40
1	Bhavana Rathod	EVs using Maths	6	5	5	5	21
2	Rimi.	T.I.T 4 Solar panel	8	8	8	8	32

Best papers - Varun

Paper

3	Varun	Bioethanol	10	10	10	10	40
4	Devishree	Energy Conservation	10	10	5	8	33
5	Devi 4 Deepthi	Math solns Energy Conservation	8	6	10	7	31
6.	Jyothi	Wireless Power transfer	8	10	10	9	37
7.	Auxiliya	Bioenzyme on Heavy Metal.	10	10	10	10	40
8	Pumitha Raja	Solar PVC	8	8	8	8	32
9	Chaitra	Res Waste	10	10	8	8	36

Paper

10.	Ashwath	Perovoxite	10	10	10	10	40
11	Chandana.	Liq based fuel cell	8	8	8	8	32
12	Sujin Hiresh	Energy Harvest Wireless charging	10	10	10	10	40
13	Kalavathi. Navya	Over population	10	10	10	8.	38
14	Monisha Swathi	Smart Grid	8	8	8	8	32
15	Sahil Sreeja	Radio freq.	8	8	8	8	32
16	Santosh Vely		7	7	7	7	28
17.	Shashi. Sandeep		10	10	8	8	36

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Best Paper- Name..... Title..... Points.....

Name & Signature of the Session Chair

Department of Science

ANKURAM 2022-Student National Seminar

Best Presenter OFFLINE

Presenters name: Ashish Robin Bara, Arun M, Kunal Thakur

Title of the paper: Emergence of perovskite solar cell

Name of the College: St Francis de Sales College

Best Presenter ONLINE

Presenters name: Prachi Parihar P, Samuel G & Gayathri Mohan K V

Title of the paper: A review on recent development in solar cells for energy harvesting application.

Name of the College: Christ Academy Institute for Advanced Studies.

Best Paper

Presenters name: Ringku Mushahary, Varun H D

Title of the paper: Studies on Current trends in Bioethanol as a biofuel

Name of the College: St Francis de Sales College