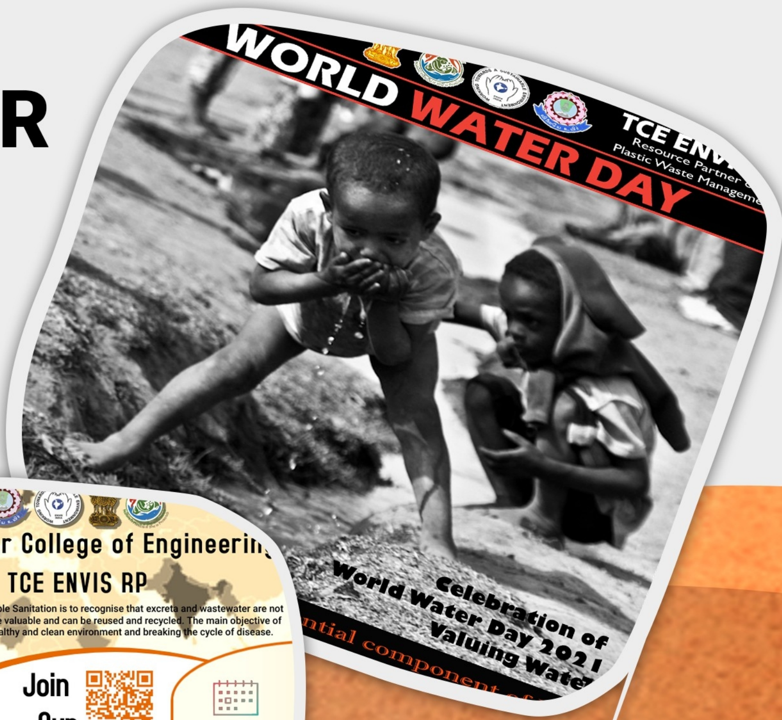
THIAGARAJAR COLLEGE OF ENGINEERING

DEPT OF CHEMISTRY

TCE ENVIS RP

RESOURCE PARTNER ON PLASTIC WASTE MANAGEMENT



NEWS LETTER

VOLUME III - ISSUE 4

Jan - Mar 2021

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"On account of World Consumer Rights Day, EPTRI ENVIS HUB/RP, Telangana organized on line webinar session on the theme "Tacking of Plastic Pollution" on 15.03.2021 Dr. R. Vasudevan., coordinator, TCE ENVIS RP delivered a guest lecture on the topic "Plastic Waste Management Think Differently"."

"Kurungkadu - Ecosystem Restoration Forest On Small Forest Thangalacheri Village, Thirumankalam Taluk, Madurai"

TCE NSS & TCE ENVIS RP

Centre funded by, Ministry of Environment, Forest & Climate Change, Govt. of India

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Bio-Mining & Bio-Remediation

INDIA'S ANSWER TO THE MOUNTING LANDFILL PROBLEM: BIO-MINING AND BIO-REMEDIATION

https://www.theweek.in/news/biz-tech/2021/01/09/india_s-answer-to-the-mounting-landfill-problem--bio-mining-and-.html

The smelly garbage mountains in our cities—with hawks hovering over them and stray dogs, cows and rats wandering at will—are the greatest reminders of our irresponsible attitude. Years of neglect and indiscriminate dumping of Municipal Solid Waste (MSW), generated from households and bulk waste generators like apartment complexes and hotels, formed these massive mountains. Many countries practise open dumping as a final disposal method for MSW, which not only causes surface water pollution, but the leachate (dark liquid) discharge from the dumpsite also pollutes the groundwater irreversibly. A dumpsite containing 0.1 million tonne of waste reportedly has a potential to generate 2,770 tonne of methane every year, which is equivalent to 69,250 tonne of carbon dioxide emissions. Methane is estimated to have a global warming potential that is 84 times greater than carbon dioxide. To make this worse, methane in the landfills is particularly dangerous—t often auto-ignites, causing fires in dumpsites and generating smoke and emissions, thereby causing severe air pollution.

What is bio-mining?

Governments around the world have recognised the problem and over the years landfill mining or bio-mining has become a popular method of excavating waste from active or closed landfills and segregating the aggregates generated with an ultimate purpose to clear them and reclaim the land. Urban India accounts for a third of India's population and generates 54.75 million tonne of MSW annually. From 2014 onwards, the Swachh Bharat Mission has been emphasising on reclamation of landfill sites to adhere to the Solid Waste Management (SWM) Rules, 2016, and the guidelines of the Hon National Green Tribunal, with an aim to recover over an estimated 10,000 hectares of urban land that is locked in these dumpsites in India. Urban India has been struggling to set up infrastructure in solid waste management, which requires a huge land bank, and land reclamation could truly solve this problem and enable a turnaround in scientific management of MSW in the country. Bio-mining was mandated by the SWM Rules, 2016, wherein it was a preferred methodology over 'capping' which simply meant covering the waste with soil. This, however, did not solve the problem of water pollution that continued unabated and the land could not be reclaimed.

B Dharmaraj, Managing Director, Zigma Global Environ Solutions Private Limited, which offers Landfill Mining services, says, "Landfills are a continuous source of pollution, and the only solution is to mine and process them. Until this happens, the water, air and soil contamination will continue steadily. Integrated landfill mining enables complete outsourcing of activity by the urban and local bodies (ULBs), thus enabling a dedicated approach toward reclamation."

Bio-Mining & Bio-Remediation

Ajith Singh Nagar dumpsite in Andhra Pradesh before and after biomining and land reclamation

This is where bio-mining or landfill mining becomes a viable solution for the reclamation of these large sites. Different fractions of aggregates are segregated from the dumpsite and recycled, reused or repurposed in a suitable way, thereby cleaning the environment and also resulting in financial value and resource flow. Bio-mining is the best way to remediate open dumpsites to achieve zero emission of landfill gases and leachate, and reclamation of land to be used for other purposes.

"There is a misconception that bio-mining is just segregation," says A. Rajasekaran, President- Technical, Zigma Global Environ Solutions Pvt. Ltd. "These landfills are quite often biologically active, owing to the haphazard dumping, which does not allow the organics to degrade completely. Hence, the waste needs to be first stabilised or bio-remediated, as a result of which the fly menace, odour, scavenging animals and birds just vanish. It also results in the moisture getting onto optimum levels wherein the waste is now apt for segregation and processing."

The CPCB Guidelines on Disposal of Legacy Waste 2019 provides a detailed methodology on how the process has to be carried out and the means by which the aggregates generated can be responsibly disposed. This requires sophisticated machinery and a flawless approach towards maintaining the quality of aggregates so that they can be disposed responsibly. In India, the waste is delivered in the landfills after multiple levels of scavenging, as a result of which most of the aggregates which can fetch commercial value cease to exist. Hence, there needs to be a certain amount of cost involved to dispose these aggregates.

Kumbakonam dumpsite in Tamil Nadu before and after biomining and land reclamation

Glimpse on Research Articles:

1. CURRENT STATUS ON THE BIODEGRADABILITY OF ACRYLIC POLYMERS: MICROORGANISMS, ENZYMES AND METABOLIC PATHWAYS INVOLVED

Itzel Gaytán1 & Manuel Burelo2 & Herminia Loza-Tavera1

Abstract:

Acrylic polymers (AP) are a diverse group of materials with broad applications, frequent use, and increasing demand. Some of the most used AP are polyacrylamide, polyacrylic acid, polymethyl methacrylate's, and polyacrylonitrile. Although no information for the production of all AP types is published, data for the most used AP is around 9 MT/year which gives an idea of the amount of waste that can be generated after products' lifecycles. After its lifecycle ends, the fate of an AP product will depend on its chemical structure, the environmental setting where it was used, and the regulations for plastic waste management existing in the different countries. Even though recycling is the best fate for plastic polymer wastes, few AP can be recycled, and most of them end up in landfills. Because of the pollution crisis the planet is immersed, setting regulations and developing technological strategies for plastic waste management are urgent. In this regard, biotechnological approaches, where microbial activity is involved, could be attractive eco-friendly strategies. This mini-review describes the broad AP diversity, their properties and uses, and the factors affecting their biodegradability, underlining the importance of standardizing biodegradation quantification techniques. We also describe the enzymes and metabolic pathways that microorganisms display to attack AP chemical structure and predict some biochemical reactions that could account for quaternary carbon-containing AP biodegradation. Finally, we analyse strategies to increase AP biodegradability and stress the need for more studies on AP biodegradation and developing stricter legislation for AP use and waste control.

Key points:

* Acrylic polymers (AP) are a diverse and extensively used group of compounds.
* The environmental fates and health effects of AP waste are not completely known.
* Microorganisms and enzymes involved in AP degradation have been identified.
* More biodegradation studies are needed to develop AP biotechnological treatments.

To read more about this article visit our website
[Article ID: NL_JM21_001] Scan the QR Code

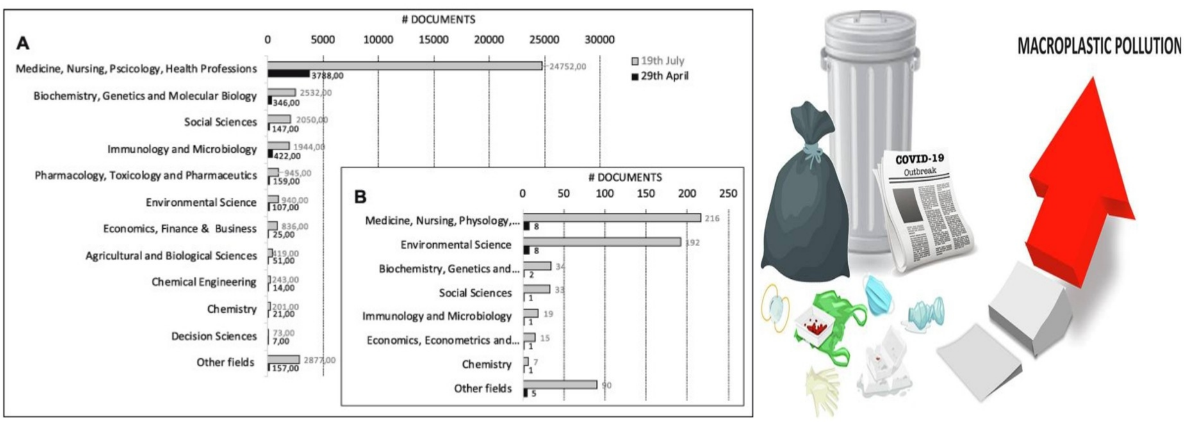
Glimpse on Research Articles

2. INCREASED PLASTIC POLLUTION DUE TO COVID-19 PANDEMIC: CHALLENGES AND RECOMMENDATIONS

Ana L. Patrício Silva, Joana C. Prata, Tony R. Walker, Armando C. Duarte, Wei Ouyang,Damià Barcelò, and Teresa Rocha-Santos

Abstract:

Plastics have become a severe transboundary threat to natural ecosystems and human health, with studies predicting a twofold increase in the number of plastic debris (including micro and nano-sized plastics) by 2030. However, such predictions will likely be aggravated by the excessive use and consumption of single-use plastics (including personal protective equipment such as masks and gloves) due to COVID-19 pandemic. This review aimed to provide a comprehensive overview on the effects ofCOVID-19 on macro plastic pollution and its potential implications on the environment and human health considering short- and long-term scenarios; addressing the main challenges and discussing potential strategies to overcome them. It emphasises that future measures, involved in an emergent health crisis or not, should reflect a balance between public health and environmental safety as they are both undoubtedly connected. Although the use and consumption of plastics significantly improved our quality of life, it is crucial to shift towards sustainable alternatives, such as bio-based plastics. Plastics should remain in the top of the political agenda in Europe and across the world, not only to minimise plastic leakage and pollution, but to promote sustainable growth and to stimulate both green and blue-economies. Discussions on this topic, particularly considering the excessive use of plastic, should start soon with the involvement of the scientific community, plastic producers and politicians in order to be prepared for the near future.



To read more about this article visit our website
[Article ID: NL_JM21_002] Scan the QR Code

Glimpse on Research Articles

3. PLASTICS IN MARINE ECOSYSTEM: A REVIEW OF THEIR SOURCES AND POLLUTION CONDUITS

Md. Simul Bhuyan a, Venkatramanan S. b,c,□, Selvam S. d, Sylvia Szabo e, Md. Maruf Hossain a, Md. Rashed-Un-Nabi f, Paramasivam C.R. g, Jonathan M.P. h, Md. Shafiqul Islam a

Abstract:

Oceanic marine plastic contamination was an increasingly global issue due to increased demand. This has a significant effect not only on marine biodiversity, but also on public safety and numerous infectious diseases found in both aquatic and human species. A huge amount of money was spent worldwide on plastic waste. In the 1940s, plastics development began and is increasing massively. This crucial analysis intends to accomplish goals such as defining plastic materials, origins, detecting aggregation, and validating appropriate techniques to analyse plastic abundance spatio-temporal trends. This further addresses the possible impacts of plastics on marine species, humans, and future chemical emission control strategies together with advice. Plastics are primarily distributed along the coasts and mid ocean vortex in large amounts. The broad variety of plastics, as eaten by aquatic animals finds their way to the human body through the food chain. Research articles should help learn the origins, deterioration mechanisms, and harmful effects of plastics on both the human body and the ecosystem. Until recently, the science community and politicians have generally ignored plastic waste, but ecological implications, as well as plastic pollution's economic/health effects, have now gained greater global interest. In the past decade, marine plastics have been widespread in the oceans and documented data have shown dramatic growth with time. Marine litter primarily comes from shore, ships, and other causes that have been accumulated on the sea after transportation to long distances. Failure to identify size and plastic sampling technology complicates the study of the spatial and temporal patterns of pollutants. Nonetheless, a systematic approach is required to accurately measure and classify marine debris to achieve global solutions. The largest amount of plastic is found along the coast and mid-ocean gyres, but the future of plastics is very unclear. The marine species that consume these plastics face health issues such as mortality, morbidity, and reproductive complications. The toxic chemicals detected by biota through plastic ingestion have become a major global problem. Throughout the 1960s and 1970s awareness of the hazards of marine debris slowly increased among people. Other than alternatives to plastics polluting the aquatic environment is the rising concern (Law and Thompson, 2014).

To read more about this article visit our website
[Article ID: NL_JM21_003] Scan the QR Code

Glimpse on Research Articles

4. CURRENT PLASTICS POLLUTION THREATS DUE TO COVID-19 AND ITS POSSIBLE MITIGATION TECHNIQUES: A WASTE-TO-ENERGY CONVERSION VIA PYROLYSIS

Tadele Assefa Aragaw1* and Bassazin Ayalew Mekonnen1,2*

Abstract:

Background:

The extensive use and production of PPE, and disposal in the COVID-19 pandemic increases the plastic wastes arise environmental threats. Roughly, 129 billion face masks and 65 billion plastic gloves every month are used and disposed of on the globe. The study aims to identify the polymer type of face masks and gloves and sustainable plastic waste management options.

Results:

The identification of polymers, which can help for fuel conversion alternatives, was confirmed by FTIR and TGA/DTA analysis and confirms that the polymeric categories fit for the intended purpose. Moreover, the handling technique for upcycling and the environmental impacts of the medical face mask and glove were discussed.

The FTIR result revealed that face masks and gloves are polypropylene and PVC thermoplastic polymer, respectively and they can be easily transformed to fuel energy via pyrolysis. The endothermic peaks around 431 ℃ for medical glove and 175 ℃ for surgical is observed tells that the melting point of the PVC and polypropylene of plastic polymers, respectively.

The pyrolysis of the face mask and glove was carried out in a closed reactor at 400 ℃ for 1 h. Conferring to lab-scale processes, liquid, and wax fuel rate of 75%, char of 10%, and the rest non-condensable gases were estimated at the end.

Conclusions:

It can be concluded that the medical plastics can be recycled into oil due to their thermoplastics nature having high oil content and the waste to energy conversion can potentially reduce the volume of PPE plastic wastes.

Keywords:

PPE plastics, COVID-19, Characterization, Pyrolysis, Fuel

To read more about this article visit our website
[Article ID: NL_JM21_004] Scan the QR Code

Glimpse on Research Articles

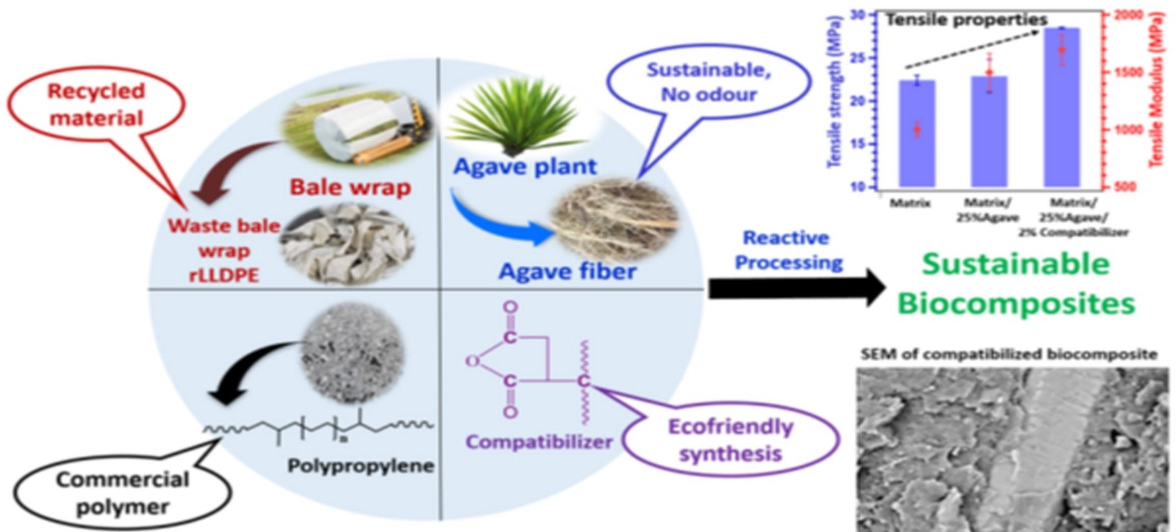
5. SUSTAINABLE BIOCOMPOSITES FROM RECYCLED BALE WRAP PLASTIC AND AGAVE FIBER: PROCESSING AND PROPERTY EVALUATION

Iftekhar H. Chowdhury, Mohamed A. Abdelwahab, Manjusri Misra,* and Amar K. Mohanty

Cite This: ACS Omega 2021, 6, 2856−2864

Abstract:

Plastic recycling to make sustainable materials is considered one of the biggest initiatives toward a greener environment and socioeconomic development. This research aims to investigate the properties of a blend of recycled bale wrap linear low-density polyethylene (rLLDPE) and polypropylene (PP) (rLLDPE/PP 50:50 wt % matrix), which was further reinforced with 25 wt % agave fiber prepared by injection-molding. Different ratios of a combined industrial compatibilizer (maleic anhydridegrafted PP/PE) were used (1−3 wt %), which were compared with a synthesized compatibilizer made from maleic anhydride−PP/rLLDPE in terms of mechanical and thermomechanical properties of the biocomposites. Incorporation of the compatibilizer in the composite improved the interfacial adhesion between the hydrophobic matrix and the hydrophilic agave fiber, which further increased the mechanical properties and heat deflection temperature of the composite. Scanning electron microscopy showed enhanced compatibility and adhesion between the fiber and the matrix by inclusion of 2 wt % compatibilizer. The synthesized compatibilizer-blended composite showed better mechanical properties than the industrial one, which indicates the potential application of this composite (around 62% recycled material) in the manufacture of packaging materials and commodity products.



To read more about this article visit our website
[Article ID: NL_JM21_005] Scan the QR Code

Plastic Waste into Jet Fuel

CONVERTING PLASTIC INTO ULTRA-CLEAN JET FUEL TO REDUCE CO2 EMISSIONS

By Sarah MooreMar 8 2021 - https://www.azocleantech.com/article.aspx?ArticleID=1183

In February 2021, green-energy organization, Clean Planet Energy, revealed its revolutionary technology that will convert non-recyclable plastics into ultra-clean jet fuel. The innovation provides a solution to two significant environmental issues: rapidly rising plastic waste and increasing CO2 emissions in the aviation sector.

CO2 Emissions and Plastic Pollution: Two Significant Environmental Threats

Global plastic pollution has become a crisis and is one of the world’s most pressing environmental issues. Although many countries in the developed world have ramped up their recycling efforts in recent years, plastic's annual production continues to increase, and many developing countries struggle to implement recycling strategies. Nearly half of all plastics ever made were produced in the last 15 years, representing an increased production rate, which is predicted to continue.

The cost to the environment and human health is huge. Around 8 million tons of plastic waste end up in our oceans each year. In addition, the slow degradation of plastic releases microplastics into the environment. Research has shown that microplastics enter the human body via numerous routes and negatively impact our health, with studies linking microplastic exposure to a range of serious illnesses. There is a clear need for new strategies that help recycle large amounts of non-recyclable plastics to help reduce the plastic industry's negative impact.

In 2019, the aviation industry was responsible for adding 915 million tons of CO2 emissions into the atmosphere. This accounted for 12% of all CO2 emissions attributed to transport and 2-3% of all CO2 emissions.

The International Air Transport Association (IATA) has set the aviation industry a target of reducing net aviation CO2 emissions by 20% in relation to 2005 levels. While emissions have recently dropped, it is expected that much of this is related to worldwide travel bans implemented to curb the spread of COVID-19 throughout much of 2020. There are concerns carbon emissions will not only bounce back but possibly exceed previous levels. Therefore, there is also a pressing need for more strategies to reduce emissions associated with aviation.

This year, green-energy company, Clean Planet Energy, announced that it had achieved a breakthrough that would significantly impact CO2 emissions in the transport industry. The breakthrough will tackle aviation-related emissions and plastic pollution.

POLYSTYRENE

1.INTRODUCTION

Polystyrene (PS) is a synthetic aromatic hydrocarbon polymer made from the monomer known as styrene. Polystyrene can be solid or foamed. General-purpose polystyrene is clear, hard, and brittle. It is an inexpensive resin per unit weight. It is a poor barrier to oxygen and water vapour and has a relatively low melting point. Polystyrene is one of the most widely used plastics, the scale of its production being several million tonnes per year. Polystyrene can be naturally transparent, but can be coloured with colourants. Uses include protective packaging (such as packing peanuts and in the jewel cases used for storage of optical discs such as CDs and occasionally DVDs), containers, lids, bottles, trays, tumblers, disposable cutlery and in the making of models.

As a thermoplastic polymer, polystyrene is in a solid (glassy) state at room temperature but flows if heated above about 100 °C, its glass transition temperature. It becomes rigid again when cooled. This temperature behaviour is exploited for extrusion (as in Styrofoam) and also for molding and vacuum forming, since it can be cast into molds with fine detail.

2. HISTROY

Polystyrene was discovered in 1839 by Eduard Simon, an apothecary from Berlin. From storax, the resin of the Oriental sweetgum tree Liquidambar orientalis, he distilled an oily substance, a monomer that he named styrol. Several days later, Simon found that the styrol had thickened into a jelly he dubbed styrol oxide ("Styroloxyd") because he presumed an oxidation. By 1845 Jamaican-born chemist John Buddle Blyth and German chemist August Wilhelm von Hofmann showed that the same transformation of styrol took place in the absence of oxygen.They called the product "meta styrol"; analysis showed that it was chemically identical to Simon's Styroloxyd. In 1866 Marcellin Berthelot correctly identified the formation of meta styrol/Styroloxyd from styrol as a polymerisation process. About 80 years later it was realized that heating of styrol starts a chain reaction that produces macromolecules, following the thesis of German organic chemist Hermann Staudinger (1881–1965). This eventually led to the substance receiving its present name, polystyrene.

The company I. G. Farben began manufacturing polystyrene in Ludwigshafen, about 1931, hoping it would be a suitable replacement for die-cast zinc in many applications. Success was achieved when they developed a reactor vessel that extruded polystyrene through a heated tube and cutter, producing polystyrene in pellet form.

POLYSTYRENE

Otis Ray McIntire (1918-1996) a chemical engineer of Dow Chemical rediscovered a process first patented by Swedish inventor Carl Munters. According to the Science History Institute, "Dow bought the rights to Munters's method and began producing a lightweight, water-resistant, and buoyant material that seemed perfectly suited for building docks and watercraft and for insulating homes, offices, and chicken sheds. In 1944, Styrofoam was patented.[Before 1949, chemical engineer Fritz Stastny (1908–1985) developed pre-expanded PS beads by incorporating aliphatic hydrocarbons, such as pentane. These beads are the raw material for molding parts or extruding sheets. BASF and Stastny applied for a patent that was issued in 1949.The molding process was demonstrated at the Kunststoff Messe 1952 in Düsseldorf. Products were named Styropor. The crystal structure of isotactic polystyrene was reported by Giulio Natta. In 1954, the Koppers Company in Pittsburgh, Pennsylvania, developed expanded polystyrene (EPS) foam under the trade name Dylite. In 1960, Dart Container, the largest manufacturer of foam cups, shipped their first order.

3. STRUCTURE

Polystyrene is flammable, and releases large amounts of black smoke upon burning. In chemical terms, polystyrene is a long chain hydrocarbon wherein alternating carbon centers are attached to phenyl groups (a derivative of benzene). Polystyrene's chemical formulaisC8H8 n; it contains the chemical elements carbon and hydrogen. The material's properties are determined by short-range van der Waals attractions between polymers chains. Since the molecules consist of thousands of atoms, the cumulative attractive force between the molecules is large. When heated (or deformed at a rapid rate, due to a combination of viscoelastic and thermal insulation properties), the chains can take on a higher degree of confirmation and slide past each other. This intermolecular weakness (versus the high intramolecular strength due to the hydrocarbon backbone) confers flexibility and elasticity. The ability of the system to be readily deformed above its glass transition temperature allows polystyrene (and thermoplastic polymers in general) to be readily softened and molded upon heating. Extruded polystyrene is about as strong as an unalloyed aluminium but much more flexible and much less dense (1.05 g/cm3 for polystyrene vs. 2.70 g/cm3 for aluminium)

4. PROPERTIES OF POLYSTYRENE

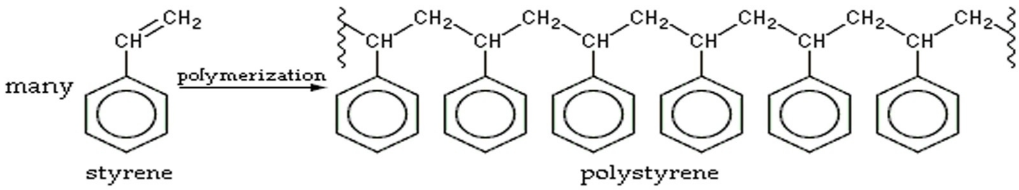
PS exists in an amorphous state because of the presence of bulky phenyl groups, packing of polystyrene chains is not efficient. Polystyrene is non-polar in nature. Polystyrene melting point is 240 degrees Celsius. polystyrene density is 1.05 g/cm3. Polystyrene specific gravity is 1.054.

POLYSTYRENE

polystyrene has a good optical property like it is transparent polymer allowing high transmission of all wavelengths. Moreover, its high refractive index gives it a particularly high brilliance. Due to the chain stiffening effect of the benzene ring, polystyrene is hard but brittle. It emits a characteristics metallic sound when dropped. Being a non-polar amorphous polymer, its softening temperature is low. It cannot withstand the temperature of boiling water. Polystyrene has a low tendency for moisture absorption. Moreover, it has good electrical insulation characteristics. Therefore, used in making polystyrene insulation products. Polystyrene has reasonable chemical resistance but mediocre oil resistance.

5. PREPARATION

Polystyrene is an addition polymer that results when styrene monomers interconnect (polymerization). In the polymerization, the carbon-carbon π bond of the vinyl group is broken and a new carbon-carbon σ bond is formed, attaching to the carbon of another styrene monomer to the chain. Since only one kind of monomer is used in its preparation, it is a homopolymer. The newly formed σ bond is stronger than the π bond that was broken, thus it is difficult to depolymerize polystyrene. About a few thousand monomers typically comprise a chain of polystyrene, giving a molecular weight of 100,000–400,000 g/mol.



Each carbon of the backbone has tetrahedral geometry, and those carbons that have a phenyl group (benzene ring) attached are stereogenic. If the backbone were to be laid as a flat elongated zig-zag chain, each phenyl group would be tilted forward or backward compared to the plane of the chain.The relative stereochemical relationship of consecutive phenyl groups determines the tacticity, which affects various physical properties of the material.

6. APPLICATIONS

- Medically it is used for sterilizing test tubes, diagnostic components, and other medical devices.
- It is used to manufacture car parts which include knobs, instrument panels, sound dampening foam, etc.
- Polystyrene food service packaging keeps the food fresh for a longer period of time and is less expensive than alternatives.

POLYSTYRENE

- It is used in packaging consumer goods such as DVD cases, egg cartons, to protect against spoilage or damage.
- It provides thermal insulation and is used in refrigerators, freezers, etc.
- Used in housing in all IT equipment such as Television, computer, etc.

Is polystyrene a plastic?

Polystyrene (PS) plastic is a thermoplastic that is naturally transparent and available both as a standard solid plastic and in the form of a rigid foam material. PS plastic is widely used in a number of consumer product applications, and is also particularly useful for commercial packaging.

Where does polystyrene come from?

Polystyrene is one of the best known synthetic polymers there are polyethylene, polypropylene and polyester among others. Styrene, the liquid hydrocarbon from which EPF is made, was extracted from storax balsam in the late 19th century, which comes from a tree in Asia Minor called the Oriental sweet gum.

Is polystyrene toxic to humans?

Polystyrene contains the toxic substances Styrene and Benzene, possible carcinogens and neurotoxins that are harmful to humans. In fact, hot foods and liquids begin a partial breakdown of the Styrofoam allowing certain contaminants to be absorbed into our bloodstream and tissues.

Why is polystyrene useful?

Polystyrene is the packaging material of choice, because it is light and cool. Snapping in half or collapsing is easy but, crucially, it is high in compression and thus protects fragile objects if dropped or crushed. Polystyrene is also a very strong insulator which means that it accumulates electrical charge easily.

Is polystyrene polar or non-polar?

Because polystyrene contains only carbon hydrogen bonds, it is non-polar and can dissolve only in non-polar solvents, much as dissolves. The general starch structure is depicted below. Starch contains bonds of oxygen carbon and oxygen hydrogen which make it a polar molecule.

STANDARD OPERATING PROCEDURE FOR REGISTRATION OF PRODUCERS, IMPORTERS & BRAND-OWNERS (PIBOs) UNDER PLASTIC WASTE MANAGEMENT RULES 2016 (AS AMENDED)

Introduction

As per the provision of PWM Rules, Extended Producers Responsibility (EPR) for management of plastic waste packaging is entrusted with the PIBOs who introduce the products in the market. They are required to establish a system for management of plastic waste generated due to their products by engaging with local bodies.

Local bodies are responsible for setting up of PWM system with assistance from Producers & Brand Owners.

Further, PIBOs who are operating in more than two states, are required to obtain registration from CPCB and those operating in one or two states have to obtain registration from the concerned SPCB/PCC. EPR Action Plan for PWM has to be submitted for obtaining the registration.

CPCB prepared format for EPR Action Plan required for obtaining registration as per provision of PWM Rules (Annexure I) in June 2019. Based on interaction with various stakeholders during the intervening period, the procedure for grant of Registration has been reviewed and necessary updations have been worked out.

This SOP delineates various alternatives for fulfilling EPR by PIBOs as well as documents the procedure for obtaining the registration so as to facilitate easy filing of application and progress reports by the PIBOs as well as to ensure effective implementation of EPR plan.

Various provisions of PWM Rules taken into consideration for framing the SOP are given in Annexure II.

Detailed Rules is provided in the website www.tceenvis.in

TRIPURA GETS FIRST ROAD MADE FROM PLASTIC WASTE

Agartala: Tripura will get the first plastic road by the end of January, almost two years after Tripura chief minister Biplab Kumar Deb asked the Agartala Municipal Corporation (AMC) to construct a road using plastic waste. In July 2018, during a review meeting, Biplab Kumar Deb had asked AMC officials to construct at least 500 metres of a road using waste plastic to reduce pollution.

Speaking with reporters, West district magistrate and Agartala Smart City Limited Director said, "We are constructing a plastic road, and some work has been completed under the Smart City project," Yadav said.
He also said that there were 55 encroachments on this road, including a hotel. The smart city project funded the construction of drainage and footpath.

"The chief minister wanted to have a plastic road in the state as a model. We had requested the PWD, but they expressed their invalidity saying they don't have the expertise," Yadav added. The BK Road from Boys Budhjung School to women's college, which is around 650 metres, would be made plastic road using the waste materials. The state has no plastic road. So, we decided to take this project.

"The footpath work has been completed, and the surface will be completed in the next 15 days. The top layer, which is around 9 inches thick, was removed so that the road does not become higher. It is a mixture of bitumen and plastic which is used at a 40: 60 ratio," Yadav said. He also informed that the construction work would be completed within January 26 and inaugurated for the public.

"Very few states have plastic roads, and we would love to have more roads in the state in future. A local agency has been awarded the construction work with an estimated cost of Rs 70 lakh," Yadav said.

Plastic Waste into Natural Gas

CATALYST TURNS MIXED PLASTIC WASTE INTO NATURAL GAS

BY JAMES URQUHART12 FEBRUARY 2021 - https://www.chemistryworld.com/news/catalyst-turns-mixed-plastic-waste-into-natural-gas/4013218.article#/

Details:

Plastic waste can now be efficiently converted into methane using a ruthenium-based catalyst. The patented technology could help mitigate the planet's growing plastic waste problem while producing methane for use as a fuel or chemical feedstock in a more environmentally friendly way than fracking. Recovering chemicals and fuel from plastic waste streams is nothing new. Processes including pyrolysis and gasification, which break down plastics using high temperatures and catalytic processes, can recover useful materials. However, these approaches create several products, including waste, and require additional processing and purification.

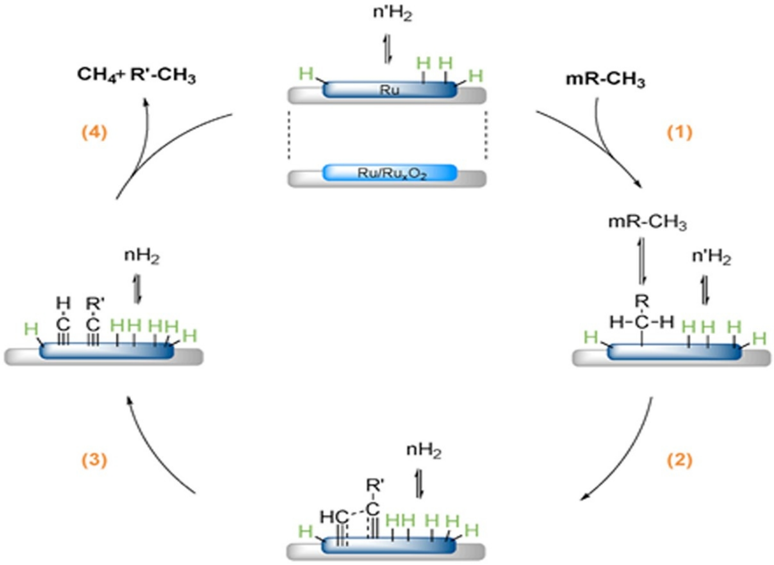
Another process called hydrocracking, which is often used in refining oil to make jet fuel and diesel, can convert plastic too. This reacts a feedstock with hydrogen and a catalyst at much lower temperatures and produces less waste. However, using the approach with plastic has been hampered by a lack of efficient and selective catalysts that can outperform thermal methods.

Now, Paul Dyson and colleagues at the Swiss Federal Institute of Technology in Lausanne (EPFL), have shown that hydrocracking with a ruthenium modified zeolite catalyst efficiently and selectively transforms polyethylene, polypropylene and polystyrene into methane that could be directly fed into natural gas networks. The team have since created an EPFL spin-off company called Plastogaz to scale up the technology.

'What was really impressive about our work is the unprecedented methane selectivity that we have not seen described anywhere else,' says study co-author Felix Bobbink who is now chief executive of Plastogaz. 'The goal of our research is to give value to plastics that are considered waste, notably the plastics that cannot easily be recycled.'

Bobbink says the initial idea came when working on indirect carbon dioxide methanation. The team observed that all carbon atoms in a cyclic carbonate were converted into methane, with the oxygens combining with hydrogen to produce water. 'As carbonates are a motif in plastics (polycarbonates), we decided to work with polycarbonates and polyesters, and later with polyolefins,' Bobbink explains.

Plastic Waste into Natural Gas



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Proposed reaction mechanism for the catalytic breakdown of plastic waste into methane by a ruthenium catalyst

In search of an efficient catalyst, the researchers looked to ruthenium for its known efficiency in hydrocracking processes. First, they made several catalysts by loading varying amounts of ruthenium nanoparticles on zeolite supports. These were then tested by hydrocracking the liquid alkane hydrocarbon, n-dodecane, to arrive at the best catalyst relative to cost, dubbed RuZ.

Further recycling experiments with RuZ revealed it could efficiently convert polyethylene, polypropylene and polystyrene into methane in yields of 97%, 95% and 92% respectively after four hours. When plastics were converted together, simulating mixed plastic waste, the methane yield reached 99%.

'The work demonstrates the chemical recovery of polyolefins with a very high selectivity to methane production, providing an efficient way for limiting by-products from the complex processes of polyolefin decomposition,' comments Xiangyu Jie, who investigates heterogeneous catalysis at the University of Oxford, UK. 'But with a process that uses large amounts of hydrogen and an expensive ruthenium catalyst to produce low-value methane it may be difficult to recoup the costs of recovery and separation.'

Bobbink explains that there is 'no simple yes/no answer to whether the process is economically viable'. 'We are currently studying an integrated process wherein the process is coupled to existing industrial systems to decrease cost associated to heat, logistic of feedstock, seasonal variations, and more.'

References

W-T Lee et al, Cell Rep. Phys. Sci., 2021, DOI: 10.1016/j.xcrp.2021.100332

Plastic Waste Info

Rajasthan Teen's Startup Converts 1,000 Kg Plastic Waste to Fabric Every Day

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