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Original Research Article

Hybrid sustainable nanomaterials using for nanofluids of advance applications and challenges of future scope

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ABSTRACT
This paper is offers new social solutions that enhance user demand quality of lifestyles such that as education or school training , medical scientific , fitness, protection or safety, protection of personal records or social solution for growing international locations. Good Strength-efficient or low-carbon products of nanomaterials Such as resulting from eco-design evaluation of merchandise protected in cease-person programs that contribute to saving electricity or other source of environmental protection like that water or hydropower, chemical compounds or chemical bonding energy, emissions or producing renewable energy power. In support of the ambitions of the world Green Deals, aims of this paper to decreasing environments emissions by at least 50% by 2035 compared to 2020. The main advantages compared to standard nonmaterial's (TiO_2, SiO_2, and CO_2) substrates are decreasing lower power consumption, minimum application size and weight of sustainable nanomaterials. The first of this article's three major goals is to provide a survey of prospective renewable energy sources, together with information on their properties and potential uses. This paper describes a variety of applications. Finally, we discuss about the challenges and potential future study directions.Sustainable Nanomaterials have become an area of research interest in recent years due to their potential applications, particularly in heat transfer. These two sustainable nanomaterials have shown significant promise in improving the efficiency and life of system. In this paragraph, I will discuss the properties of these sustainable nanomaterials in more detail and their potential applications.

1. Introduction

Nanofluids have been a topic of research for decades, with their potential applications in various engineering fields. Two of the most common nanofluids are those made up of SiO_2 and TiO_2 nanoparticles. These nanofluids have become increasingly popular due to their unique thermophysical properties. The thermal conductivity and heat transfer coefficient of these nanofluids are significantly higher than those of traditional fluids. Nanofluids have gained much attention in recent years due to their unique thermophysical properties. These fluids, which consist of nanoparticles dispersed in a base fluid, exhibit significantly enhanced thermal conductivity and convective heat transfer coefficients relative to traditional heat transfer fluids. SiO_2 and TiO_2 are two commonly used nanoparticles in the production of nanofluids due to their high thermal conductivity and stability. In this section, we will introduce the thermophysical properties of SiO_2 and TiO_2 nanofluids and their potential applications in various industries. Sustainable nanomaterials have been developed to meet the growing demand for environmentally friendly materials to be used in different fields. Nanomaterials offer a number of benefits, such that smaller size of nanomaterials, enhance surface area, and better microelectronics, thermal, and chemical characteristics [1]. They can also be used in pharmaceutical and medicine delivery methods and enhance sustainable nanomaterials performance of products such as batteries, fuel cells, and sensors. Sustainable nanomaterials are typically made up of organic or non-organic materials that are either biodegradable or non-toxic [2]. Nanomaterials have recently become a hot research topic due to their potential to revolutionize various industries. Engineers, scientists, and chemists are all developing new ways to use nanomaterials in their fields. Sustainable nanomaterials are of particular interest due to their potential to reduce our reliance on finite petroleum resources [3].

Nanotechnology and nanomaterials are expected to important play role of various fields. The fields of sustainable nonmaterial have wonderful opportunities to demanding the challenges of sustainable nanomaterials development of advance modern applications and challenge of various fields. Nanomaterials have enhanced surface area for the equally masses of material than their bulk materials [4]. Impact of hybrid nanomaterials using of sustainable nonmaterial Nanotechnology has important played as a role in the innovation, designing and syntheses and identification for the processing of fuel from fossil fuel sources such as coal, oil, and natural gas, of different new energy materials and catalysts.

The usage of fossil fuels, which still make up 95% of the world's energy consumption, is anticipated to reach its peak in 2060. One of the biggest challenges facing humanity is providing enough and healthy food for the growing world population. We must increase production in a way that is sustainable nanomaterilas for future generations. Additionally, this entails avoiding food waste and maximizing the utilization of existing resources [5].

2. Requirement for sustainable and environmental friendly infrastructure development

Sustainable and environmental friendly infrastructure development has become essential to the functioning of modern society, and it is essential to ensure that any development or design of new infrastructure is done in a manner that minimizes any damage to the environment. One way to achieve this is through incorporating sustainable and green development technologies, as well as complying with relevant regulations and standards [6]. Doing so will reduce the long-term costs of any infrastructure development, and help create a healthier and more balanced environment for future generations. Consequently, it is paramount to ensure that the development of new infrastructure is done with the utmost care and attention to detail [7].

Sustainable infrastructure development is becoming increasingly important for towns and cities across the world. It is essential that these developments not just meet the needs of the people and businesses involved, but also serve to protect local ecosystems and promote the health of those living in the area. To do this, developers must consider the environmental impact of the development at the planning stage and make sure to incorporate sustainable practices such as renewable energy sources and green building materials into their plans [8]. Additionally, it is important to recognize that sustainable infrastructure is not limited to large-scale projects but can involve small-scale initiatives which make a huge difference in the long run. Sustainable nanomaterials and environmental friendly infrastructure development is of paramount importance in today's world. The need for sustainable infrastructure that can withstand the effects of climate change and other environmental impacts is essential. Towns, cities, and countries must consider the long-term implications of their infrastructure investments. Doing so will ensure that the infrastructure will remain beneficial to the environment and provide more benefits to the people using it [9, 10].

3. Different types of sustainable nanomaterials and methods of preparation

Sustainable nanomaterials have gained significant attention in recent years due to their potential to revolutionize various industries. These materials, which are designed to have minimal environmental impact and long-term durability, are paving the way for innovative advancements in fields such as energy, healthcare, and electronics. In particular, there are various types of sustainable nanomaterials that researchers have been exploring, each with unique properties and applications. By harnessing the power of nanotechnology, scientists are able to create materials that are not only environmentally friendly but also offer enhanced performance and functionality. Different types of sustainable nonmaterial are shown by the Figure 1. Nanotechnology has revolutionized various industries by offering promising solutions for a wide range of applications. In recent years, there has been a growing interest in sustainable nanomaterials that not only possess exceptional properties but also minimize their environmental impact. Sustainable nanomaterials represent a more eco-friendly alternative to conventional materials, as they are derived from renewable sources and exhibit biodegradability. They hold immense potential for advancing technological advancements while promoting sustainability.

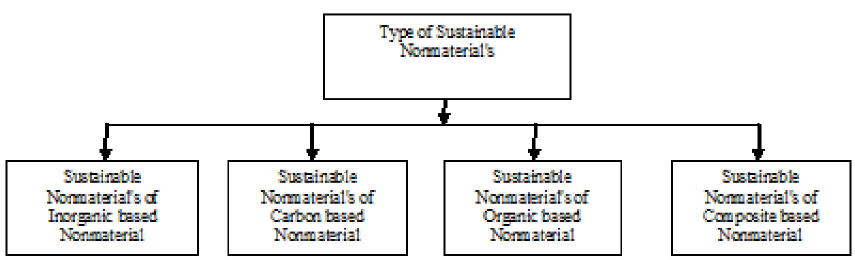

Figure 1: Different types of sustainable nanomaterials

3.1 Sustainable nanomaterials of inorganic based nanomaterials

One of the most exciting applications of nanomaterials is in the medical field, where they have been used to create more effective drug delivery systems. Nanomaterials have also been used in energy storage systems, helping to make renewable energy more efficient and reliable. Prepared for inorganic materials such as metals, semiconductors, and oxides, which are manipulated at the nanoscale to create materials with unique properties [11]. The unique size of the nanomaterials allows scientists to manipulate the atomic forces, charge, and chemical bonds of the materials. This allows for a variety of applications ranging from medical to environmental. Nanomaterials are being studied for their potential to act as catalysts and help us better understand materials on the nanoscale [12].

3.2 Sustainable nanomaterials of carbon based nanomaterials

Modern materials research has lately incorporated carbon-based nanomaterials (CBMs) as a key technique. CBMs are lattice-like nanomaterials that are composed of carbon atoms on a microscopic scale. CBMs have special physical and chemical characteristics that make them suitable for usage in a range of fields, including optoelectronics, electronics, and medicine. Additionally, CBMs are inexpensive to produce and simple to work with in the lab [13].

Sustainable nanomaterials, due to their special characteristics and potential to be altered at the nanoscale, carbon-based nanomaterials are becoming more and more well-liked. Among the newly developed carbon-based nanomaterials are carbon nanotubes, graphene, and carbon nanohorns. These materials can be employed in a multitude of applications because of their exceptional mechanical, thermal, and electrical qualities. Due to their small size or delicate nature, structures and devices that were previously impossible to produce have now become possible thanks to recent advancements in the field of carbon-based nanomaterials [14].

3.3 Sustainable nanomaterials of organic based nanomaterials

Organic-based, sustainable nanomaterials are now being used in a variety of industries. These nanomaterials are helping to reduce the amount of waste produced while also having less of an environmental impact. Moreover, they also have increased durability and strength, making them ideal for a range of products and applications. Finally, they are being used in medical treatments to deliver drugs and other treatments more precisely to target areas in a patient's body. With this revolution, the development of organic-based sustainable nanomaterials has become possible [15, 16]. For instance, nanomaterials have been used to create products that are more durable, flexible, and resistant to corrosion. These nanomaterials are now being used in industries such as aerospace, healthcare, and construction to create lighter and stronger products. Additionally, nanomaterials are being used to develop renewable energy sources that are more efficient than traditional methods [17].

3.4 Sustainable nanomaterials of composite based nanomaterials

Sustainable nanomaterials composite based nanomaterials, as the need to invest in sustainable infrastructure increases, scientists and engineers are researching new materials and technologies that can be used to make infrastructure more durable and reliable. One such material is composite based sustainable nanomaterials, which have the potential to create structurally sound buildings and bridges with less environmental impact [18]. Nanomaterials are an exciting way to reduce the overall impacts of the environment of the infrastructure and ensure that it will endure for years to come. Furthermore, nanomaterials are strong, lightweight, and require less energy to produce than traditional materials [19].

One of the most promising avenues for sustainable infrastructure development involves the use of composite based sustainable nanomaterials. These nanomaterials have a wide range of properties that make them ideal for the construction of sustainable infrastructure [20]. They are lightweight, strong, and durable, while also being environmentally friendly. Nanomaterials can be used to build bridges, roads, and other large-scale infrastructure projects [21]. One of the industries today most creative and promising technologies of sustainable infrastructure development is the use of composite-based sustainable nanomaterials. These materials are stronger than existing construction materials, while being lighter, more durable and recyclable. This means they can be used to create structures and buildings which are more resistant to natural disasters and environmental changes. Additionally, nanomaterials are more energy efficient, allowing for reduced energy consumption and, ultimately, a reduced carbon footprint [22].

3.5 Methods of preparation of sustainable nanofluids

Sustainable nanomaterials are increasingly being used in a multitude of sectors, including energy and healthcare and education to environmental remediation. Preparation of these materials is a complex process that requires careful consideration of parameters such as particle size, morphology, and surface chemistry. Generally, sustainable nanomaterials are synthesized using techniques such as hydrothermal, solve thermal, and electrochemical methods. Each approach has its advantages and disadvantages, which must be weighed before choosing the best method for a given application [23]. Sustainable nanomaterials rely on the use of renewable resources, making them a promising alternative to traditional materials. To prepare these materials, we need to understand the unique properties of nanomaterials to ensure their efficacy and stability. This involves a combination of research and development of new methods, using existing knowledge and adapting it to the needs of nanomaterials. Finally, the material must be purification and processed for use in a variety of applications [24].

4 Emission of green house gases sustainable nanomaterials industries and its environmental impact

Nanomaterials can be used to reduce green house gas emissions in many industries. As they are lightweight and stronger than traditional materials, they help reduce fuel consumption and thus lower the amount of pollutants released into the atmosphere. The use of sustainable nanomaterials in the industry has great potential to significantly decrease impact the on environmental production, leading to a more sustainable future. Furthermore, by using nanomaterials that are recyclable, industry can have an even greater positive on the environment impact [25]. Along with the myriad of benefits that sustainable nanomaterials provide, it is also important to consider their environmental impact (Figure 2). Although NMs have the potential to decreasing the power energy consumption and pollutant emission, their properties can also lead to increased levels of greenhouse gases in the atmosphere. In addition, industrial processes used in their production can lead to emissions of toxic materials that can potentially harm the environment. As such, it is essential that all industries using nanomaterials are held to the highest standards of environmental protection to ensure that their use is sustainable and safe [26].

4.1 Types of emission effect sustainable nanomaterials on environmental impact

Emission effect of sustainable nonmaterial on environmental impact is shown by the Figures 2.

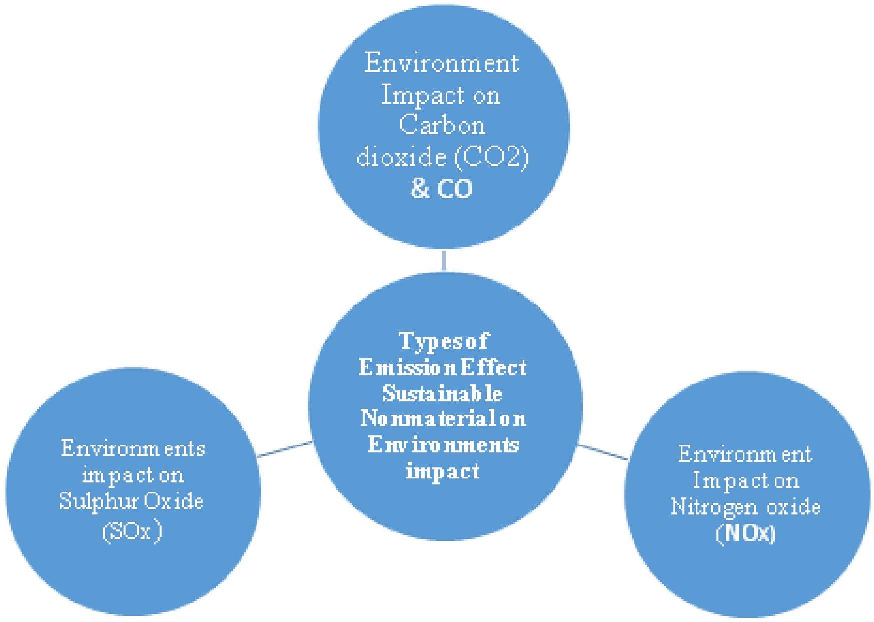

Figure 2: Emission effect of sustainable nonmaterial on environmental impact

4.2 Environmental impact on sulphur oxide (SO_x)

Technology has already proven to be effective in reducing sulphur oxide (SO_x) emissions, as well as decreasing energy consumption in the manufacturing process. Nanomaterials are also being used to create more efficient and cost-effective ways to generate electricity. They are even being used in water purification systems to remove contaminants and make water safe to drink. In short, nanomaterials are proving to be a powerful tool in the fight against climate change and environmental degradation, and their potential is only beginning to be explored [27]. Technology could also be used to reduce sulphur oxide (SO_x) emissions, a major contributor to air pollution and global warming. By using organic-based sustainable nanomaterials that are more efficient, less polluting, and more cost effective, companies can reduce their carbon footprint and help move the world towards a more sustainable future. Nanomaterials are also a great option for creating smaller, more powerful components that can be used in a variety of applications [18, 28].

4.3 Environmental impact on nitrogen oxide (NO_x)

The effect of sustainable nanomaterials on nitrogen oxide (NO_x) is a topic that has not been fully explored. In few recent years, researchers have begun to investigate the potential of nanoparticles as a means to reduce NO_x levels in the environment [29]. For example, nanostructure zinc oxide has been shown to catalyze the green oxidation of NO_x, leading to its conversion to harmless nitrogen gas. Additionally, nanostructure iron oxide has been used to reduce NO_x by catalyzing the reverse reaction of nitric oxide to nitrogen and oxygen [30]. Sustainable nanomaterials have revolutionized the ways in which nitrogen oxide (NO_x) is managed. Unlike traditional methods, the utilization of nanomaterials allows for the capture of NO_x at a much smaller level. Their small size allows them to reach inner parts of machinery and equipment, enabling them to effectively reduce the output of NO_x [31]. Studies have shown that, when used in combination with other techniques, nanomaterials can reduce the amount of NOx output by up to 80% [32-33].

4.4 Environmental impact on carbon dioxide (CO_2 and CO)

Sustainable nanomaterials have also been shown to have a significant effect on Carbon dioxide (CO_2) and carbon monoxide (CO). These gases are the primary contributors to air pollutants, and their effects on health and the environment cannot be overstated [34]. Nanomaterials have demonstrated an ability to reduce emissions of these pollutants, providing a "green" alternative for reducing their presence in the atmosphere. By using nanomaterials, companies are able to reduce their carbon footprint while still meeting the regulatory standards established by the Environmental Protection Agency [15, 23, 35]. Sustainable nanomaterials can also be used to reduce carbon dioxide (CO_2) and carbon monoxide (CO) emissions. Nanoparticles have been shown to efficiently convert CO_2 and CO into other compounds, such as carbonates or formates, which are not as harmful to the environment. In addition, the use of nanomaterials can reduce the amount of energy required for exhaust gas treatment, leading to a decrease in the production of CO_2. Furthermore, nanoparticles can catalyze the oxidation of CO to CO_2, further reducing the amount of carbon-based emissions [36].

5 Applications and challenges of sustainable nanomaterials

Sustainable nanomaterials have a wide range of applications beyond information technology and construction, shown by Figure 3, application and challenge of sustainable nanomaterials. Nanomaterials can be used in agriculture to create better crop yields, in the health sector to create more effective treatments, and in energy production to make renewable resources more efficient [37]. In all these sectors, nanomaterials can play an important role in creating sustainable solutions that reduce environmental damage and provide real benefits to the public. The potential of nanomaterials is vast and their applications are likely to grow significantly in the coming years [12, 16, 25, 38].

Figure 3: Applications of sustainable nanomaterials.

The applications of sustainable nanomaterials are not limited to just the construction and information technology industries. NMs are used in various other fields, such as automotive engineering, medical devices, energy storage, telecommunications, and aerospace engineering. NMs enable the production of lighter and stronger materials that require less energy to fabricate or process [39-41]. They also have an increased resistance to temperature, corrosion, and wear, thus making them ideal for a wide range of applications [42].

5.1 Sustainable nanomaterials application of agriculture industry

Nanomaterials are rapidly becoming integral components in the agriculture industry. For example, nanomaterials are being used to create more efficient fertilizers that can be tailored to specific soil types and environments [43]. Nanomaterials are also being used to create coatings and films that can be used to protect plants from pests and diseases. Additionally, nanomaterials are being used to create more durable and efficient irrigation systems and water filters [44]. Nanomaterials are also being used to create sustainable applications in the agriculture industry. For instance, nanomaterials can be used to create coatings for seeds and soil that can improve germination rates, reduce water and nutrient loss, and reduce the need for heavy machinery [45]. Nanomaterials are also being used to create more efficient fertilizers and pest control methods, which can reduce environmental impacts and increase crop yields. Additionally, nanomaterials are being used to create improved irrigation systems that better manage water resources and reduce water loss [46-48].

5.2 Sustainable nanomaterials application of aircraft industry

Nanomaterials are also being used to create more sustainable applications in the aircraft industry. For instance, nanomaterials are now being used to improve the durability and strength of aircraft components, as well as reduce their weight [49]. This helps to reduce fuel consumption and lower the cost of operation for aircraft manufacturers. Nanomaterials are also being used to create more efficient engine components and materials that are more resistant to wear and tear [50]. Nanomaterials are also now being used in the aerospace industry to create more sustainable aircraft. The use of nanomaterials in the construction of aircraft can result in lighter, stronger, and more efficient aircraft designs that can reduce fuel consumption and emissions. Nanomaterials are also being used to improve the durability and performance of aircraft engines and other parts of the aircraft. Additionally, nanomaterials can be used to create sensors and detectors that can monitor the health of the aircraft during flight and provide early warnings of potential issues [51].

5.3 Sustainable nanomaterials application of food

Nanomaterials are also being used to create sustainable applications in the food industry. For instance, nanomaterials can be used to create packaging materials that are stronger than traditional materials, while also being resistant to water and air [52]. Additionally, nanomaterials can be used to create food additives that improve the shelf life of food products, as well as provide improved nutritional benefits and reduce waste. Nanomaterials can also be used to create more effective food preservatives and other products that help maintain the quality of food throughout the distribution chain [53].

Nanomaterials are also being used to create sustainable applications in the food industry. For instance, nanomaterials can be used to create more efficient and effective packaging materials that can protect food products from spoilage. Nanomaterials can also be used to create improved food additives that can increase shelf life and reduce the need for preservatives. Additionally, nanomaterials are being used to create more efficient production processes that reduce energy and water consumption and increase quality control [54-57].

5.4 Sustainable nanomaterials application of water treatment

The application of nanomaterials in water treatment is an area that is gaining more attention. Nanomaterials can be used to remove toxic substances, such as heavy metals and organic pollutants, from wastewater. Additionally, nanomaterials can be used to improve the efficiency of water treatment processes and reduce the cost associated with these processes [58-61]. As such, nanomaterials have the potential to be used in sustainable applications for water treatment.The application of nanomaterials in water treatment is one of the most sustainable applications of nanotechnology. Nanomaterials can be used to capture and remove pollutants from water, while also helping to maintain water quality [62]. Nanomaterials are also used in water filtration systems, as they are able to remove contaminants such as bacteria or heavy metals. Additionally, nanomaterials can also be used to improve the efficiency of solar-powered water treatment systems, reducing energy costs and providing clean, safe drinking water [18, 39, 60, 64].

5.5 Sustainable nanomaterials application of medical and pharmaceutical industries

Nanomaterials have also been used to develop more sustainable methods for the medical and pharmaceutical industries. For example, nanomaterials are being used to create biodegradable medical devices and implants, as well as drug delivery systems that reduce the need for invasive surgeries [61]. Additionally, nanomaterials are being used to create materials for prosthetics and implants that are both strong and lightweight, as well as materials that are able to regenerate and repair themselves. Nanomaterials are also being used to create diagnostic devices and systems that can quickly and accurately diagnose a variety of ailments [65-68]. Nanomaterials are also now being used to develop more efficient and sustainable applications in the medical and pharmaceutical industries. For example, nanomaterials are now being used to create new drugs and therapies that are tailored specifically for certain diseases and conditions. Nanomaterials are also being used to create drug delivery systems that have enhanced bioavailability and improved targeting capabilities [69-73]. Additionally, nanomaterials can be used to create materials for medical implants, such as artificial joints and prosthetics, that have superior strength and durability, as well as improved biocompatibility [74].

5.6 Sustainable nanomaterials application of environmental industry

Nanomaterials offer a range of sustainable applications in the environment and industry. They are able to capture pollutants from water and air, as well as increase the efficiency of water treatment processes [75]. In addition, nanomaterials can be used to reduce energy costs associated with water treatment processes, such as solar-powered systems. Furthermore, nanomaterials can be used to create more efficient filtration systems, and even help to keep air pollutants at day [73].

Nanomaterials offer a sustainable solution to many environmental issues faced by the industry [74]. Not only can nanomaterials be used to capture and remove pollutants from water, but they can also be used to monitor, assess, and control the environment [67-70]. For example, nanomaterials can be used to detect oil spills, monitor air and water quality, and detect hazardous chemicals. Additionally, nanomaterials can be used in wastewater treatment plants to reduce the energy required for water filtration and purification, resulting in significant cost savings for industry [75-79].

5.7 Miscellaneous application and molecular sustainable nanomaterials

Nanomaterials can be used in a range of sustainable applications beyond environmental remediation, such as in medical and food applications [80-83]. Nanomaterials can be used to detect and monitor biomarkers in the body, which can lead to earlier detection of diseases [83-86]. They can also be used to create new types of food products, such as nanofoods, with added benefits such as improved nutritional value and increased shelf life [80]. Nanomaterials are even being developed for use in molecular agriculture, which can help to reduce water and energy use in food production [87].Nanomaterials can also be used for a variety of miscellaneous applications. For instance, they can be applied to create biosensors and nanomaterials that are capable of detecting and responding to environmental changes [88]. Additionally, they can be used to improve the performance of molecular machines, such as DNA nanostructures and nanomedicine. Finally, they can help create more efficient filtration and purification systems, which can help to ensure sustainable water and air quality.

6 Problem of sustainable nanomaterials

Nanomaterials are becoming increasingly important for the development of sustainable and efficient technology solutions. They are seen as a viable alternative to conventional materials due to their unique properties, such as increased strength and decreased weight. However, the manufacturing of nanomaterials is often difficult and time-consuming, and the sourcing of raw materials can be a challenge. As such, it is important to consider potential issues that may arise and develop strategies to address them.Nanomaterials have the potential to revolutionize fields from energy production to medical treatments, but the manufacturing processes used to produce them can be both expensive and unsustainable. For example, many processes use toxic solvents which not only damage the environment, but also make the nanomaterials themselves more expensive. As such, it is essential for nanomaterial manufacturing to become more sustainable in order to fully unlock the potential of these materials. Therefore, a new approach to nanomaterial production must be explored in order to reduce environmental impact and achieve cost savings.

Nanomaterials provide great potential to solve broad-scale global challenges such as energy production, water purification, and drug delivery. Despite this potential, current nanomaterials are inherently unsustainable due to their reliance on scarce or toxic precursors. To ensure nanotechnology is a viable solution for the long-term future, it is essential to develop new sustainable nanomaterials. This paper will discuss the research into sustainable nanomaterials, the challenges that remain, and suggest strategies for future development.

7 Challenges on sustainable nanomaterials

Despite the promising results of nanomaterials for reducing emissions, there are still challenges that need to be addressed before these technologies can be widely adopted. For instance, the cost of nanomaterials is still relatively high, making them difficult to use in large scale applications. Additionally, the long-term effects of nanomaterials on the environment are still not fully understood, making it difficult to assess their sustainability. Finally, there is a lack of research and development into new sustainable nanomaterials, which is essential for advancing their use in emissions mitigation.

While sustainable nanomaterials have demonstrated great potential for mitigating the effects of climate change, there are still many challenges to their implementation. Cost is a major concern - nanomaterials are expensive, and the costs associated with their production and implementation can be high. Additionally, the efficacy of nanomaterials can vary depending on their composition, specific application, and environmental conditions, making it difficult to accurately predict the effects of using them. Finally, the long-term environmental impacts of these materials are still largely unknown and need to be carefully assessed before widespread implementation.

8 Sustainable nanomaterials around the world

Across the world, sustainable nanomaterials are being developed and implemented in various sectors. Governments, academic institutions, and private companies are all exploring the potential uses of these materials for mitigating climate change. In the transportation sector, for example, these materials are being used to create lighter, more fuel-efficient vehicles, while in the construction industry they are being utilized to create more durable, energy-efficient buildings. As researchers continue to explore the potential uses of sustainable nanomaterials, their implementation around the world is likely to increase, providing a promising solution for mitigating the effects of climate change.

9 Conclusions

The use of sustainable nanomaterials is becoming increasingly popular around the world, with many countries investing in their research and implementation. As their costs decline and their environmental advantages become more evident, their use for mitigating the effects of climate change is likely to increase. The potential for sustainable nanomaterials to reduce emissions and slow the pace of global warming is immense, although challenges remain in terms of cost, efficacy, and environmental safety. Careful research and development into these materials is essential in ensuring that they can be used safely and effectively.

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