The purpose of this project was to research the capabilities of nuclear energy in order to determine if nuclear energy has the potential to be an efficient energy production method for society. Specifically, my research paper answered three questions: how does the production cost of nuclear energy compare to that of other energy production methods; how does the safety of nuclear energy compare to that of other energy production methods; and how environmentally friendly is nuclear energy compared to other energy production methods?

This study is an examination of the efficiency of nuclear energy as a power production method. The purpose of conducting this research was to compare and contrast nuclear energy to other energy production methods using three research questions. How economical is nuclear power production, how safe is nuclear power production, and how environmentally friendly is nuclear power production? The investigation for the answers to these questions was conducted using articles and data from peer review journals. The conclusion from this study showed that nuclear power is currently one of the most efficient reliable sources of energy production and that it shows signs of progress in the future that could revolutionize the energy production industry. Based on these results, nuclear power should be pursued farther in this country as a primary power production method.

Nuclear energy is one of the most cost efficient methods of energy production.
Nuclear energy is an excellent source of power for large societies because of the large quantities of power it can produce with minimal fuel and space unlike popular renewables such as wind and solar.
Nuclear energy is environmentally friendly and releases no pollution into the atmosphere of any kind.
Nuclear power plants cannot explode and offer little opportunity for terrorists to create nuclear weapons with the radioactive remains.
The amount of radiation one receives from living near a nuclear power plant is less than 1/5000 of what the federal government considers an unsafe level.
Nuclear power is extremely safe and has a history of fewer accidents or deaths than any other power production method.

References
Abstract

The use and development of plastics have contributed a significant amount to negative effects on the environment from the aspects of human health, habitat, and space-usage. This study investigates the problems, and then highlights solutions and possible solutions. A discussion of the marine effects, the human health effects, and the work to combat these are presented. A main focus in this study details improvements of the recycling process. Another key effort is the work with biodegradable plastics and the reuse of plastic in general. Work to move away from use of landfills is a huge problem. Also, perhaps the most effective combat of plastic’s negative effects is in the decreased use and need for plastic.

Introduction

A heavy significance rests on the use of plastics in today’s world. Although plastic has enabled advances in the quality of life through advantages in processing, ease of packaging, boom in industry, and overall convenience, it has proved to be harmful to human, animal, and plant health; plastic also harms habitat in the form of pollution, space-usage, contamination, and especially through its quality of persistence. Fortunately, society has recognized this problem and is in hot pursuit of ways to combat these negative environmental effects as they become a huge problem.

Effects on Environment from Plastic

The effect of plastic on the ocean presents an obvious habitat and animal life problem. As the plastic production increases, the population of many marine animals, such as sea birds, turtles, fish, whales, and seals go down significantly, due to the pollution of plastic into the ocean, mainly in the form of discarded nets and equipment.

Some plastics are produced with the assistance of a substance call Bisphenol A (BPA), which is a synthetic chemical compound studied by the Environmental Health Net (2008). BPA can interfere with the regulation of both development and reproduction, through its interaction with estrogen. Some scientists conclude that the experimental results are inconsistent, therefore do not constitute further regulation of BPA. Other scientists are convinced that there is obvious toxicity of BPA in the experimented animals and this gives obvious reason to work towards lowering this substance’s exposure to humans. (Environmental Health Net, 2008)

The disposal of plastic has presented large problems, therefore has catalyzed a recycling movement to try and reduce the overcrowding of landfills and pollution of plastics. Recycling improvements are in progress, one of which is cryogenic grinding.

Work Being Done To Combat Effects

The work that has and is being done in efforts to combat the decrease in marine population problem include –

Laws that regulate disposal, with tagging systems for boat’s netting
Restriction on size of nets, punishment for plastic disposal into the oceans
Cleanup efforts, a major form being beach cleanups. (Connor, 1988)

To combat plastic’s persistence quality, (meaning that its breakdown is significantly slow, or nonexistent), the aspect of biodegradability brings hopeful possible solutions, specifically being worked on by A. Demirbas (2007). Biodegradable plastics’ components come from renewable raw materials, such as starch, cellulose, and lactic acid, which with exposure to sunlight and air, will degrade, making it environmentally friendly (Demirbas, 2007). For biodegradation to work, plastic in a biodegradable polymer form has to be put in a bioactive environment. From there, algae, fungi, and bacteria perform the degrading process by enzymatic action, changing the chemical structure of the plastic. This is possible because the plastic is composed of naturally produced components, such as celluloses, collagen, starch, and others, which are blended with plastics’ other components; the natural components in the plastic work with the natural environment. The main biodegradable plastics fall under biodegradable, compostable, hydro-biodegradable, bioerodable, photodegradable, oxo-degradable, and hydro-degradable. The process is carried out by chemical-, photo-, thermal-, and bio-degradation. Oxo-degradable is the leader in the efficiency of biodegradable plastics (Demirbas, 2007).

References

Introduction

One of the lab teacher assistants unintentionally mixed two incorrect reagents which resulted in an unknown product. We discovered that the product reacts violently with any organic compounds including cellulose in paper towels. The product seemed to have limited interaction with water, so we began a slow dilution of the compound with water. After several minutes with no outstanding events, we closed the fume hood and allowed the dilution to continue slowly. When we returned to make sure the dilution was proceeding smoothly, we found that the water made an extremely violent reaction and had exploded with enough force to shatter the graduated cylinder and spray its contents all over the fume hood.

Reactions and Mechanism

When the teacher assistant mixed equal parts of potassium permanganate and sulfuric acid in the graduated cylinder, the following reaction occurred:

\[
\text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{Mn}_2\text{O}_7 + \text{H}_2\text{O}
\]

We tried to remove the manganese heptoxide from the graduated cylinder but only succeeded in spilling a small amount of it on the counter. When one of the other teacher assistants cleaned up the small spot with a paper towel, it reacted and caught on fire. We did not know what the compound was that we had created, so we began to test it so we may be able to identify the compound:

\[
\text{Mn}_2\text{O}_7 + \text{C}_2\text{H}_4\text{O} \rightarrow \text{MnO}_2 + \text{CO}_2 + \text{H}_2\text{O}
\]

After we performed several test reactions in the graduated cylinder, we were able to identify the unknown compound as dimanganese heptoxide. When this compound comes into contact with organic compounds, it rapidly oxidizes them creating a flame, carbon dioxide and water gas, and manganese dioxide precipitate.

\[
\text{Mn}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow \text{MnO}_4^- + \text{MnO}_2
\]

We also put some in the sink and poured water over it to see how it would react with water. It converted the dimanganese heptoxide back to the less reactive permanganate ion. With this knowledge, I began a slow dilution with water to dispose of the highly reactive compound. I placed the graduated cylinder in the sink and ran a rubber tube from the faucet to the graduated cylinder. I turned the water onto a very slow drip and watched for several minutes to make sure that it was working properly.

When we were performing the tests to identify the compound, we did many of the reactions directly in the graduated cylinder. After the explosion, we decided that the manganese dioxide precipitate acted as a water soluble barrier to the reservoir of manganese heptoxide, so when all the precipitate was solvated, all of the water was then able to react with the contents of the graduated cylinder. The water reacted with excess sulfuric acid to produce heat. Upon further experimentation, I learned that when manganese heptoxide is heated above 50°C it explosively decomposes. This mechanism is in agreement with the experimental data that we gathered about the chemical and physical properties of dimanganese heptoxide.

Safety Rules Utilized

We took several precautions while handling the unknown that helped us avoid injury in lab. The first is wearing safety goggles at all times to protect the eyes from chemicals and glass.

We performed the experiments under the fume hood to protect us from any noxious fumes created during the reaction and we lowered the blast shield when we did not need to agitate the reaction.

Experimental reactions were performed with small quantities of the compounds because small reactions are easier to monitor and control.

Future Experiment and Safety rules to consider

Reagents should never be mixed in a graduated cylinder as they are intended for measuring liquids. Their thin shape and high surface area to volume ratio are ideal for measuring out precise volumes but make mixing a solution very difficult. Solutions are to be mixed in a beaker or in a volumetric flask.

When I began the dilution, I was only considering dilution the manganese heptoxide and forgot that it was in a highly acidic solution. When diluting an acid, always pour acid into water because the two react to make heat as a byproduct; it can often heat the solution to its boiling point allowing for an opportunity for injury to occur. This was especially dangerous in this experiment because when manganese heptoxide is heated it becomes very unstable.