Research exercise: Tired of rubber landfills: From environmental hazard to sustainable use potential of discarded tire materials

Follow this and additional works at: https://ecommons.udayton.edu/stander_posters

Part of the Arts and Humanities Commons, Business Commons, Education Commons, Engineering Commons, Life Sciences Commons, Medicine and Health Sciences Commons, Physical Sciences and Mathematics Commons, and the Social and Behavioral Sciences Commons

Recommended Citation
https://ecommons.udayton.edu/stander_posters/749

This Book is brought to you for free and open access by the Stander Symposium at eCommons. It has been accepted for inclusion in Stander Symposium Posters by an authorized administrator of eCommons. For more information, please contact frice1@udayton.edu, mschlangen1@udayton.edu.
Tire(d) of rubber landfills!
From environmental hazard to sustainable use of tire waste
Keith Abankwah, Abdulelah Bajbair, Feras Melibari, Bjoern Oliver Winter
Department of Mechanical and Aerospace Engineering, Renewable and Clean Energy
Advisor: Jun-Ki Choi, Ph.D.

Motivation and Needs
- A dramatic increase in tire waste in the past years is putting pressure on our recycling system. Each year, over 279 Million waste tires are added to an existing stack of about 2 billion tires.
- Tire stacks are a fire hazard. Once lit by accident or on purpose, these tires are virtually impossible to extinguish. A tire pile in Rhinehart, Virginia for example was reported to burn for nine months on end.
- Tires are built for durability, so they do not degrade over time.
- However, tires are largely made out of rubber and steel, which are valuable materials. A number of ideas and concepts exists to recycle the material and put it to good use in the future.
- The way you discard of your tires can make a huge difference!

Assessment of tire waste impact

Hazards linked to tire discarding
- Burning tires causes emissions that can be harmful for human health and contribute to climate change.
- Especially uncontrolled burning processes, where tire piles are just lit on fire, are not supplied enough oxygen. The result carcinogenic and toxic substances are produced. Keep away from burning tire piles!
- Tires are landfilled without shredding, they provide a source of standing water after rainfall. This provides a breeding ground for mosquitos and rodents.
- Tires do not degrade. If discarded into nature, they are there to stay!

Emissions and landfill usage attributed to tire waste
- Emissions and landfill usage for waste tires from 2004-2019 were modelled based on emission tests and car sales statistics.
- Waste tires in this period account for about 4.7 Million tons of CO2. You could operate a typical coal power plant about 1.5 years for the same emissions.
- Landfill usage is about 240 M cubic meters. That is about 100,000 swimming pools full of tires.

Results and findings from the analysis
- Greenhouse gas emissions are reduced by pyrolysis.
- However, carcinogenic emissions might actually go up!

Easiest answer? Reduce amount of waste tires!

What can we get from tire pyrolysis?
- Tire-Derived fuel: Has been shown in studies to be able to power conventional diesel engines. If tire-derived fuel were added to conventional diesel, this could reduce the amount of oil needed for fuel.
- Carbon products: Can be treated with acid in a process called activation. Activated carbon is useful in many industrial processes as filtering substance. The carbon can for example be used to clean water, or to purify air from toxins.
- Metal scrap: Can be recycled and reintroduced into products that use steel in order to reduce raw ore usage.
- 1 kg of tire yields about 290g of fuel, 170g of carbon, and 100g of metal scrap.

Alternative to tire waste: Pyrolysis

The tire pyrolysis process
- Tires can be heated without oxygen in order to extract oil, scrap metal, and carbon from them.
- The process can be varied to maximize oil or carbon gain.

Is pyrolysis better for the environment? A Life-cycle analysis
- This model was set up to answer the question if processing tires to replace fossil products can reduce overall emissions.