Impact of Used Battery Disposal in the Environment

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Abstract---Different types of batteries (BT’s) are also used every day and a significant amount of waste BT’s are created at the end of the day. Waste BT’s can lead to grave contamination of the atmosphere. Currently, the major waste BT processes are incineration and waste disposal, solidification management, manual processing, wet recuperation technology, dry recovery techniques and bio metallurgical (BM) technology. This paper describes many waste BT disposal practices and its impact in recent years.

Keywords---disposal methods, environment, used battery, waste.

Introduction

Global demand for BT’s is mostly due to the exponential rise in the number of mobile phones and video cameras, toys, and notebook computers. Billions of BT’s, all with poisonous or corrosive chemicals are available per year to customers (Pistoia et al., 2001; Boyden et al., 2016). Some BT’s contain toxic metals such as cadmium and mercury, lead and lithium that become hazardous waste which, if inappropriately disposed of, pose a danger to health and the environment. Manufacturers and suppliers increasingly reduce BT’s environmental effects by
making more recycled and less harmful designs (McManus, 2012). Four key metrics measure the worldwide environmental effects of BT’s. The effect of disposable and rechargeable BT’s is further calculated by these indicators (Bankole et al., 2013).

**Consumption of natural resources**

BT production, transport and distribution use natural resources, which helps to speed up the loss of natural resources (Matheys et al., 2009). Rechargeable BT’s use less renewable resources than discarded BT’s and the same volume of electricity demands less rechargeable BT’s (Meshram et al., 2020).

**Climate change and global warming**

A growing green house gases (GHG) influence is responsible for the rise in the Earth’s medium surface temperature. BT production and transport release exhaust and other contaminants to the atmosphere, adding to the greenhouse effect (Dunn et al., 2012; Dehghani-Sanj et al., 2019). Rechargeable BT’s contribute less than disposable BT’s to global warming per unit of energy generated. Since the production and transport of rechargeable BT’s was linked to fewer GHG emissions (Peters et al., 2017).

**Photochemical (PHC) smog pollution and air acidification**

PHC reactions in exhaust emissions resulting in toxic compounds including ozone, other unhealthy gases and particulates (Sivaramanan, 2013). The heat inversions of major urban centres, which are known to cause human deaths, will lead to harmful PHC smog. Air concentration of atmospheric pollutants consists of an accumulation of acidic liquids. The rain deposited these particles damage soil and habitats (Cherry et al., 2009; Van den Bossche et al., 2006). BT’s that can be recharged add less to these air impacts than BT’s that can be disposed of and they contribute less to air emissions (Balcombe et al., 2015).

**Ecotoxicity and water pollution**

The leakage of BT chemicals into marine environments was correlated with possible risk toxicity (Gaines & Dunn, 2014). Failure or careless treatment of waste BT’s may lead to a release from plant and animal-toxic corrosive liquids and dissolved metals. Incorrect storage of BT’s in sites of waste disposal will contribute to the release in groundwater and the atmosphere of radioactive substances (Hischier et al., 2005).

**Recycling**

Now almost 90% containing the BT’s of platinum acid are recycled. Companies of reclamation send collapsed BT’s to reprocessing and manufacturing plants of new goods (Shao et al., 2018). The same recycling methods extend to non-automotive plumbing BT’s approved by many vehicle and waste agencies (Nordelôf et al., 2014). Several reclamation businesses are manufacturing all sorts of dry-cell BT’s today, including alkaline (AK) and carbon-zinc (C-Zn), mercuric (Hg) and silver
oxides (Ag2O), zinc (Zn) and lithium (Li), both removable and rechargeable (Yu et al., 2014).

**What Do BT's do to the environment if not properly recycled?**

We live in a world powered by BT's in many respects. Modern life works on BT's from our mobile phones, tablets and other portable gadgets to toys and vehicles for children. But not only in consumer products are they used (Dijkgraaf & Vollebergh, 2004; Panagopoulos et al., 2019). BT's will keep medical machines going and trains running as floods take out the power grid (Tsoulfas et al., 2002). You will also send and accept calls while you have a fixture, so the BT's are running the phone lines. However, if the BT's do not dispose correctly, they can severely harm the atmosphere and human health (Wanger, 2011).

**How BT’s work**

The power generation required a direct link to the source of energy before the BT was conceived. That’s because it’s impossible to contain energy (Ahmad & Baddour, 2014; LI et al., 2016). By transforming chemicals to electricity, BT's operate. An electric circuit is created on the opposite ends of the BT – the anode and the cathode – with the aid of chemistry called electrical electrolytes which transmit power to a device like a cell phone when the device is plugged into the BT (Daniel et al., 2004).

Demand for BT's and the development and history of the BT have increased enormously. This is because billions of consumers are supplied with electricity-using electronics (Dhakal et al., 2005; Ra & Han, 2006). This includes mobile phones, tablets and compact cameras. By transforming chemical energy into electric energy, BT's fuel our toys and gadgets (Yang et al., 2020). An electro circuit is produced from the opposite end of a BT called the anode and the cathode, which transfers power to an electronic device. When this circuit is exhausted, BT's can be disposed of safely, but millions of BT's are discarded every year into the garbage (Ahmadi et al., 2014; Dijkema et al., 2000). Although it can sound innocuous to throw away BT’s, it can have a serious environmental impact. There is a dangerous, poisonous and corrosive element in each BT such as mercury (Hg), cadmium (Cd), lithium (Li) and plumb. When you ask what detrimental environmental impact BT’s could have, here are things about BT’s and our atmosphere that you should read (Wang et al., 2014).

**Improperly disposed BT’s contribute to water and air pollution**

As depleted BT's are thrown into the garbage, they fall down and spill. Their toxins soak into soils as BT’s corroded and contaminate land and surface water (Calabrò & Grosso, 2018; Sharholy et al., 2007). When packed with battery chemicals, our habitats, which include thousands of marine plants and animals, become compromised. This ensures that we will consume harmful metals while drinking from tap water rods. Would you have been aware that unsuitable BT’s with Li could be very unstable? Li BT’s can cause long years of waste fires (Huang et al., 2018). This has a negative effect on our breathing and leads to global warming with toxic contaminants released into the Environment. The vaporised
battery is also captured in the atmosphere, polluting lakes and streams in the form of rain (Li et al., 2020).

**Improperly disposed BT’s negatively affect human health**

Burns and hazards to our skin and eyes will cause the atmosphere to lead and strong corrosive acids found in BT’s. Toxic metals such as nickel and cadmium present in BT’s are identified in human carcinogens according to the Toxic Substance and Disease Registry Agency (Syofiarti et al., 2021; Priadko et al., 2021). Carcinogens are any material that serves as a cancer-causing agent with radiation or radionuclides (Wang et al., 2020). We fear having cancer disabilities if these agents interfere with our air and water. Lead (Pb), which has been attributed to serious medical problems such as developmental and nervous injury and congenital defects, is another poisonous metal that can be used in BT’s. In 1996, because of its highly toxic nature, especially vapour, the Government enacted legislation banning Mercury. This current legislation now permits users to use lesser BT’s without risk of Mercury (Hg) toxicity, for example single-use alkaline BT’s (Li et al., 2014).

**Rechargeable BT’s consume fewer natural resources**

Were you aware that rechargeable BT’s use less natural resources than single BT’s in general? One big good thing is that, because of their power to regenerate, less BT’s are required to provide the same electricity. This means fewer materials are used during the production process. The cost saving is another advantage of using rechargeable BT’s over single BT’s. Because of their reusability, rechargeable BT’s save customer money (Yu et al., 2012).

**Difference between Li and AK BT’s**

The two most frequent types of personally powered BT’s are alkaline and Li BT’s. These variations are growing with Li BT’s transferring to AA and AAA markets, where AK BT’s once dominated, in various chemical compositions and voltage ranges (Hawkins et al., 2012).

**Function**

Zinc (Zn) and manganese oxide (MnO2) are the source of energy for AK BT’s, and Li BT’s use Li metal or compounds for their anode (Hischier et al., 2005).

**Types**

The BT’s of Li are mostly regarded as small BT’s for coins, for which clocks, calculators and smaller remote controls can be driven. Li BT’s have however been expanded into models AA and AAA in order to cope against AK BT’s (Richa et al., 2017).
Effects

Li BT’s produced twice the intensity of AK BT’s and gives them longer life and therefore cost more than their AK equivalents for AA and AA (Wang et al., 2014).

Misconceptions

The BT’s of Li are not the same as the BT’s of Li-ion. Li BT’s are not rechargeable, as opposed to Li ion (Shao et al., 2018).

Warning

Due to the high risk of discharge in short circuits the Transportation Safety Administration greatly reduces the transport of Li BT’s on aircraft (Matheys et al., 2009).

Li Ion BT’s vs NiCad BT’s

There are various parallels between BT’s with Li ion and BT’s with NiCad. Both BT types can be recharged and are suitable for many uses. Significant variations still exist (Van den Bossche et al., 2006).

Applications

In consumer electronics including Smartphone’s, portable cameras and mobile telephones Li-ion BT’s are also used. NiCad BT’s are used by many handheld instruments and bidirectional communications (Wanger, 2011).

Shelf life

All BT types have a reasonably long life expectancy. BT’s may be processed or used for up to five years, using NiCad. BT’s of Li-ion can last for 2 to 3 years anywhere (Li et al., 2014).

Cycles

NiCad BT’s can provide over 1,000 loading and discharge cycles if properly managed. BT’s with Li-ion capabilities give charge and discharge periods of between 300 and 500 (Cherry et al., 2009).

Self-discharge

If they were kept without use for several months, NiCad BT’s would need to be reloaded. In the other hand, Li-ion BT’s can be unused for several months before auto-discharging starts (Tian et al., 2021).

Voltage

Compared with NiCad BT’s Li-ion BT’s run at higher voltages. A regular 3.7 volt BT with Li-ion BT and 1.2 volts with NiCad BT (Shao et al., 2018).
Li BT hazards

In household trash conditions lithium and in particular Li ion BT’s poses risks (Cicconi et al., 2012; Pellow et al., 2020). If a garbage truck with flames coming from behind or from top ever saw pictures or video recordings, it may have resulted from the loss of a Li or Li ion BT with daily waste. Many BT’s of this kind contain no flame retardant liquid that may superheat itself, which may contribute to the chain reaction leading to a significant BT failure when the BT is fried or shortcuts are exposed to intense heat or flame (Üçtug & Azapagic, 2018). These faults will cause BT’s to smoke, flash, burn, or, at extremes, burst in ways that could harm the people around the BT in Li and Li-ion BT’s. This requires the processing and handling of these BT’s in specialised environments. Although Li 3V BT’s, generally regarded as button BT’s, have very little Li and too little energy for dramatic failure, they are not yet disposable in the regular household waste or recycling. They are not easily removed (Vandepaer et al., 2017).

Identifying Li BT’s

Identifying Li BT’s is the first step towards proper disposal. Typically the BT is labelled or etched as Li on cylindrical and Button-style BT’s. The label listing specifics of the BT should take into account BT composition on pouch BT’s as well as Li ion BT’s designed for smartphone’s, cameras and related electronics (Olivetti et al., 2011).

Proper Li BT disposal methods

If your Li BT has been found, you can properly dispose of it. This method is the same, no matter the BT-style: dump it in a special BT-recycling centre or BT-leaving bin at your favourite electronics store to ensure the safe operation of your BT’s. You could order a BT collection from the local government website if you have vast numbers of these BT’s to be dispatched at once (Parsons, 2007). It is advised to connect the battery terminal or terminals with an unconductive tape and package them depending on their form while packaging the BT’s for pick-up. Similarly, it is advised that the Li ion dumping be done before the BT’s are taken for recycling (Haque et al., 2014).

Conclusion

Ubiquitous BT’s are frequently forgotten, squeezing in the background when using electronic devices, laptops and other life pieces. They are also central to the environmental puzzle, as energy storage BT’s can boost volatile renewable such as wind and solar. They will carry more energy. But the environmental disadvantages of BT’s are still there. They include chemicals that are poisonous and often inflammable. And they use a lot of power to produce, which is high emissions of greenhouse gases. This is one of the questions posed in the future brief: a new study by Science for Environmental Policy Service of the European Commission, About the BT of the Future. The study describes many areas for development, as engineers begin experimenting with new materials and designs and regulators aim at forming policies (Nyandra et al., 2018).
During the lifespan of the BT, the study states that extraction and processing have some of the worst environmental effects. Metals such as cobalt (Co) and nickel (Ni) are important to drive energy in many BT's, but they leave behind waste that can spill into areas surrounded by poisonous compounds. If the material is extracted, the workers have to remove it from their rocks, a process which produces high quantities of pollutant sulphur oxide (SO2), which is incorporated into them. The study calls for further reusability and recycling of BT components in order to minimise these impacts. Researchers are designing higher density BT's, which is another valuable approach in the Study. These BT’s use less metal by concentrating more electricity in a smaller area. Compared to less dense BT's, you can fuel a battery for a longer period so that electric cars can go faster until they need to refuel, for example. The study further highlights the large quantities of electricity required by BT’s to store energy. “The most effective way to reduce (GHG) BT-generating emissions," says the paper, "is to produce cells entirely in plants fuelled by renewable energy" (Omer, 2017; Calderero et al., 2018).

The study claims that limiting energy waste will also produce large profits. Rechargeable BT’s are able to discharge much of their energy into telephones, vehicles and other equipment but not all. The rest is missing, with different amounts: Standard BT’s with plumbing waste 20-30% of their energy over their whole lifespan, while the loss of energy for lithium-ion BT’s is near 10%. The study says that improving the performance even in limited quantities will reduce the environmental damage incurred by the production of electricity for charging BT’s. The study also considers that BT’s are longer, recycled and, if possible, reused for less intense purposes, after losing their ability to fulfil their original purpose. Other factors require the reuse of components for less expensive roles. Electric BT’s, for example, have been renovated and used for the conservation of electricity often. The BT designers, for their part, can allow recycling and reuse by building easily separate BT’s, transparent labels, a relatively small number of modules, and less hazardous materials. Many battery technologies are in progress, and three of them are outlined in the report:

- Li solid-state BT’s substitute the electrolyte with solid ceramic or polymer steel, which is a main component of a BT that is usually liquids. The study states that these BT’s are cleaner and can last for longer, but that they will be available on the market for at least a decade.
- Redox flow BT’s store energy differently from traditional solutions. They are not as effective, but last longer, making demand for the natural resources and for polluting manufacturing processes on which BT’s depend easier. Researchers seek to reduce redox flow BT’s " expense and scale in order to achieve their maximum capacity.
- Some market success has also been noticed in print BT’s. They are used with cards, tags and medical surveillance equipment often smaller than a millimetre. The study reports that little is understood about the effect of printed BT’s on the environment.
- The study concludes that "altering design and manufacturing could offer significant environmental benefits." But continuing growth and invention will do more to mitigate them.
References


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