

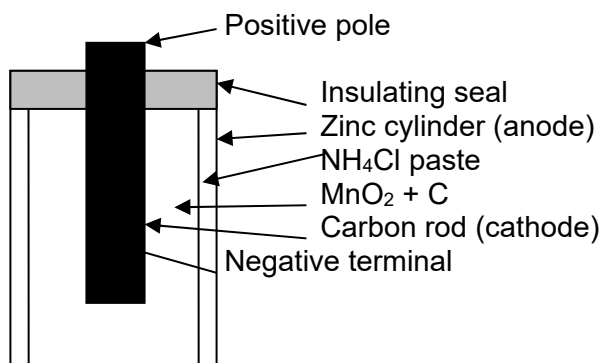
CHEMISTRY

Electrochemistry Assessment

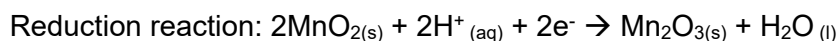
1. Dry Cell

- a. The dry cell is an energy producing battery which is commonly used in torches and other electrical appliances and it is also known as Leclanche cell. It is a primary cell because the cell cannot be recharged once it is discharged.

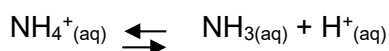
b. Structure



- i. At the centre of a dry cell, there is a rod of pure carbon in the form of graphite which is a cathode. The carbon rod is covered in a mixture of carbon powder and manganese dioxide MnO₂. The important thing is that the carbon rod is nothing to do with the production of electricity but the role of it is to allow the flow of electrons during the electrochemical reaction that will produce the current.
- ii. This carbon rod is then surrounded by an electrolyte which is a moist paste of ammonium chloride NH₄Cl, and zinc chloride ZnCl₂.
- iii. The outer layer of the dry cell is a zinc sleeve. The zinc metal in the sleeve donates electrons to flow through the electrolyte into the carbon rod in order to produce the current. Also, the zinc sleeve will get thinner as the battery produces the current and it will be unable to conduct electricity as the zinc sleeve is all used up.
- c. Chemistry: A dry cell has two half cells, the anode (Zn) and cathode (C, MnO₂). Its standard potential difference is 1.5 V
- i. Anode: the outer zinc sleeve is the anode and it oxidises to donate electrons.
Oxidation reaction : $\text{Zn}_{(s)} \rightarrow \text{Zn}^{2+} + 2e^{-}$
- ii. Cathode: A carbon which is in the form of graphite and the manganese dioxide are the cathodes.

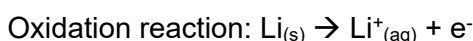


- iii. The manganese dioxide paste which contains ammonium chloride and zinc chloride works as an electrolyte for the cell and the ammonium ions provide the hydrogen ions which is needed for the cathode process of manganese dioxide shown above.

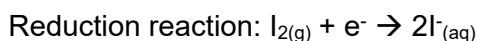


2. Lithium Cell

- a. Lithium cell is one of the latest developments of a battery. It has an anode of lithium which is a lightweight metal and a cathode of iodide. It can be recharged for many times but it needs to be replaced after its expected life. In fact, latest version of lithium batteries used in laptop computers can be recharged for about a thousand times.
- b. Chemistry: Lithium cell also has two half cells, anode (Li) and cathode (C, I₂ polymer). Its standard potential difference is 2.8 V.
 - i. Anode: Anode for a lithium cell is lithium.



- ii. Cathode: Cathode for a lithium cell is carbon and iodide polymer.



- iii. The electrolyte of a lithium cell is usually a lithium iodide (LiI)

3. Comparison of Dry cell and Lithium cell

- a. Cost and practicality
 - i. Dry cell
 - The most inexpensive type of battery because of the low cost of materials required and the ease of manufacture. (about \$2 - \$5)
 - Due to the great demand for the production, the cost of production is lower than other batteries.
 - Zinc anode in the zinc sleeve can actually form the container for the battery as well.
 - Even though it is non-rechargeable, low cost of production makes it cheap to replace with a new one.
 - It is readily available (even from any local supermarkets).
 - It has a short life.
 - ii. Lithium
 - It is very expensive comparing to the dry cell due to the difficulty of obtaining lithium (about \$7 - \$13).
 - It is rechargeable.
 - It is used of many applications due to the small size and light weight.
 - It last for a long period and produce high voltage.

b. Impact on society

i. Dry cell

- Since it is appropriate for low drainage appliances such as torches, toys, portable radio and remote controls
- The range of size is suitable for the different use.
- There is a problem of leakage and corrosion of the acidic paste.
- The introduction of a dry cell led the revolution of portable electrical devices.

ii. Lithium cell

- Due to its lightweight, small size, reliability and a long life, it is used in cardiac pacemakers.
- As it is rechargeable and produces higher voltage than any other type of batteries, it is used for mobile phones and laptop computers. The recent development of lithium-ion polymer battery made possible for laptop users to use their laptops for over 7 hours with one charge so it led the mobility of our everyday life appliances.
- It usually provides more power than other batteries. For example, it is able to supply up to five times the power of an alkaline battery.
- It allows people to use electrical devices such as GPS in a remote area.

c. Environmental impact

i. Dry cell

- If it used continuously, the ammonia produced during the reaction can expand and cause the battery to burst up. If this ammonia is exposed into the waterways, it can be very harmful to aquatic lives.
- Since it is non-rechargeable, most of them end up being dumped in the landfill which is a serious problem in the environment.
- It is relatively not harmful because of weak acidic paste and reaction products.
- Even though it is relatively not harmful to the environment, used dry cells need to be collected for the recycle practice rather than disposed to the landfill. Zinc and other chemical substances in the cell can be recycled to produce a new battery.

ii. Lithium cell

- There are no significant environment problems caused by lithium batteries.
- Even though, they are not harmful, they still need to be recycled in order to dispose the used batteries in an environmental friendly way.

Bibliography

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