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THE IMPORTANCE OF LI-ON BATTERIES RECYCLING

The battery has become a very important source of energy as a wide variety of electrical devices rely on portable energy. With the popularity of electrical vehicles (EV) increasing thanks to their promotion as green cars, the battery as an energy source has become a focus of research. This has also caused an increase in battery production. According to the Paris Declaration on Electro-Mobility and Climate Change and Call to Action, 100 million electric cars will be in use by 2030.

Lithium Ions (Li-Ions) batteries are currently the most commonly used type and, according to the Financial Times, they will take up to 90 percent of the electric vehicle market by 2025. The battery is an expendable item and has its lifetime. The logical question here is what will be done with the tons and tons of dead batteries after they have served their purposes. According to the Financial Times' estimation, 11 million tons of spent Li-Ion batteries will be in the market by 2025. To protect our environment from pollution and toxic waste, the battery resources need to be used in the best possible way.

The first solution would be the battery re-use principle, where the EV batteries in "bad condition" could be used in other applications such as in households or energy backups. When the capacity of a car battery drops below 70-80 percent, they are no longer suitable for an EV but still strong enough for many other applications. The EV batteries have quite a long lifecycle, estimated up to 10 years, and by re-purposing them, this lifecycle can be prolonged even up to about 20 years.

Battery recycling is a second solution which could be combined with the first solution. The battery is made by combining different materials inside, thus its recycling is a complex and expensive process. Lithium is a valuable material. To reclaim one ton of lithium, about 30 tons of batteries need to be recycled. However, for extracting one ton of raw lithium from a mine, about 1375 tons of soil must be excavated as well.

As mentioned above, a battery is composed of different items: the electrolyte, separator, foils, and casing which are all made from different materials. They need to be disassembled and then recycled, which makes this process quite complicated. Bolts are preferred over glue, and electronic modules and copper connectors should be simple to separate.

Carbon, which is the most expensive battery component, is almost always used as the anode material. Cobalt and lithium are quite limited materials and they are interesting due to their scarcity. Nickel is highly toxic for the environment, but manganese is not as worrisome as the others mentioned.

Several battery recycling methods are already in use, such as pyrolysis, hydrothermal recycling, and direct physical recycling. These have their advantages and disadvantages. Direct and hydrothermal methods use the chemistry-specific process and require sorting the batteries by content. Direct physical recycling requires improving and adaptations, such as unpacking the cell interior and enabling efficient removal of materials for processing.

Generally, it is expected that no issues will occur with recycling the cobalt or nickel, but recycling lithium requires introducing new processes. Using the pyrolysis method is unlikely to be cost effective. Hydrothermal and direct physical methods could help solve this issue, however, upgrading the methods is required.

The main issue with battery recycling is that it is currently expensive. Basically, it is cheaper to buy new material than recycle the used one. The environmental issues are definitely an important aspect in the case of battery materials. The recycling methods need to be improved in order to be more cost-effective, but government regulations must also be adopted to enforce battery recycling.