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Introduction of microwave waste plastic carbonizing technology

Waste plastic has been a big problem to the world since it launched to the markets decades ago. Though recycled plastic is reused always, a lot of mixed plastic is still not well processed and damages to the environment and human health.

Plastic production grew from 15 million ton in 1964 to 311 million ton in 2014. The impact on humans is quite extensive but the convenience of obtaining and using plastic products has also resulted in a large increase in waste plastics. Take disposable plastic packaging materials as an example, 95% of plastic packaging's material value, or USD 80 – 120 bn annually, is lost after just one time use. Only 14% of plastic packaging is collected for recycling. When additional value loss in sorting and reprocessing is factored in, only 5% of material value is retained for a subsequent use.[1] This is just one of many plastic items. It can be seen how huge the loss of waste plastics is if they are not properly utilized.

How to solve waste plastic is an unavoidable problem!

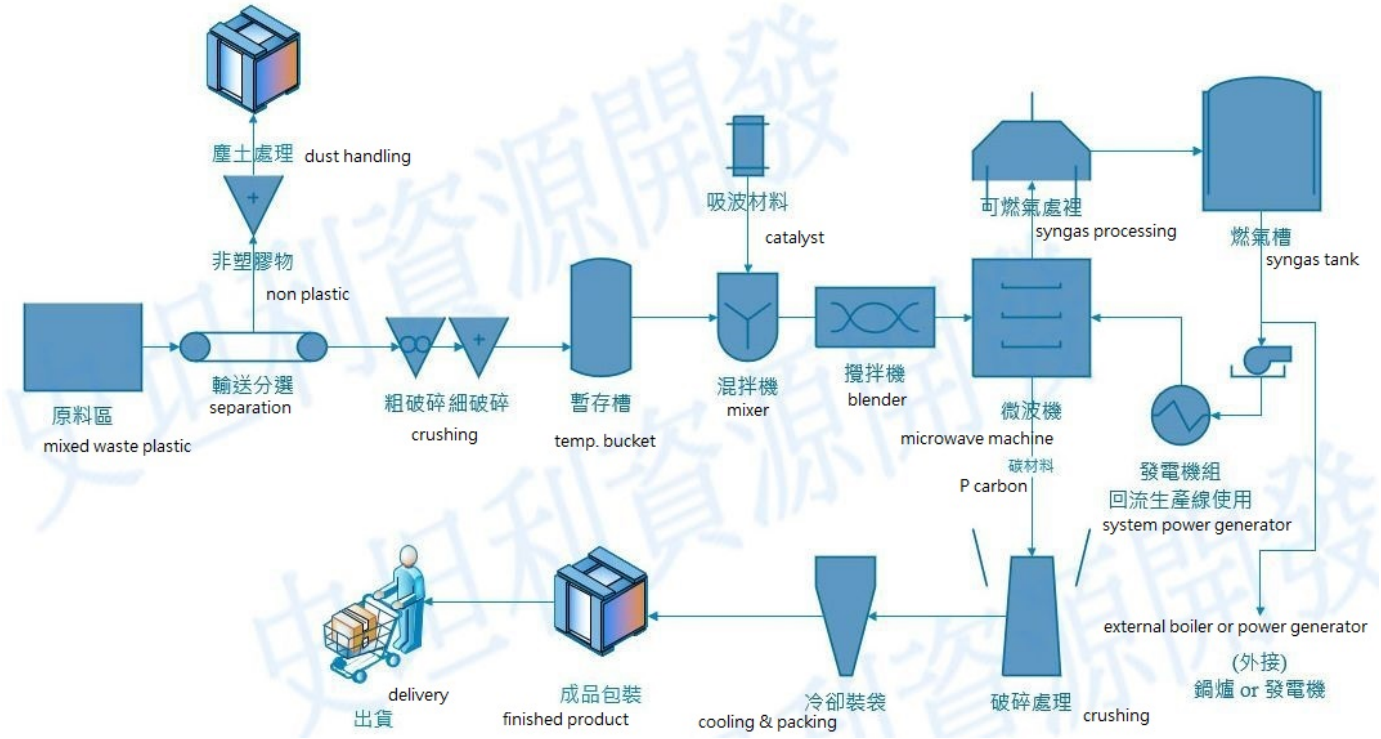
Flow chart of MWPCT

G-won have spent years in producing and exporting steel slag recycled products, such as iron briquettes, silicon carbide briquettes, iron or steel particle. We have rich knowledge about how to reduce metallic iron by carbon materials. Therefore, G-won is consultant for many companies who are doing business of steel waste recycle. Mill scale is one of the problems.

Due to China restricts the import of mill scale, it has nowhere to go and becomes a hot potato for Taiwanese recyclers. Owing to Taiwan does not produce coal, it was found that waste plastic is a very rich carbon source when G-won was thinking about carbon resources.

After uncountable testing and research, G-won finally developed a carbonization technology to break plastic molecules with microwaves. We call the tech MWPCT. At meantime, it's also found that the synthetic gas, syngas, produced during the carbonization process can be used to generate electricity or as fuel. The carbonizing flow chart of MWPCT is shown on next page.

[1] UBS reports on investing in the future.



Technical advantages

Incineration and refuse derived fuel (RDF) are widely known solid waste to energy technologies. In addition, there are melting, gasification and carbonization. The construction, operation and maintenance costs of melting are very high so that it's almost no application nowadays. As to gasification, due to the equipment cost of US and EU made is also high that only some large-scaled projects are implemented. Carbonization has a considerable technical threshold. The existing biomass carbonizing equipment has shortages of small processing capacity and slow carbonization rate. It's not suitable for industrial applications.

G-won overcome the technical bottleneck and successfully developed a microwave waste plastic carbonizing technology, MWPCT. It can be a small-scale mobile or medium-size fixed device[2] and has the following advantages.

1. In general, waste plastic to energy technologies require PVC to be separated in advance to avoid occurrence of dioxin. Under such condition, it will increase equipment and processing cost. MWPCT needs not to specifically screen waste plastics. It not only saves cost and processing time but also makes useless mixed waste plastics, including PVC, into useful carbon material. We call it P carbon.
2. Syngas produced during the carbonization process is used to generate electricity for the own use of carbonizing equipment. There is only little external energy consumed to initiate the operation. Excess syngas can be used for power generation or fuel.
3. Compared with gasification technology, syngas produced by MWPCT has almost no tar. It saves cleaning devices as well as improves combustion efficiency. Meanwhile, MWPCT system is cheaper than gasification equipment. The investment return is faster. Especially, MWPCT is movable so that it's easy to be accepted by the industries.
4. Compared with the same volume of biomass or solid waste gasification device, the carbonizing

[2] The waste plastic treatment capacity of small carbonization equipment is 1 ton per hour and medium 8 to 10 ton.

capacity (processing volume x carbonization speed) of MWPCT is up to 5 times or more. It has advantages in industrialized applications.

5. The development and machine design of MWPCT is completely implement by ourselves. There is no Know-how leakage risk of equipment manufacturing and process operation.

Who may need MWPCT

The following companies may need MWPCT to solve their waste plastic problem and/or make more value to their business.

1. Manufacturers who reuse waste plastic as power and/or fuel for the purpose, such as plastic manufacturing, petrochemical and steel industries,
2. Waste plastic recycling companies,
3. Companies that consume huge electricity looking for or required to use green power[3], and
4. Combined heat and power industry.

What G-won need

The applications of P carbon is full of possibility. It's out of G-won's capability. We need more experts to join together to do R&D and business promotion.

If P carbon can be further made into graphite, then the following are applicable areas:

P carbon

[3] Green power means power or electricity generated by non-fossil fuel, such as solar, wind, MSW etc.

1. Metallurgical industry

The largest user of graphite is metallurgy industry, which is mainly used for refractory materials, such as graphite crucibles, blast furnace linings, insulation and recarburizer. Graphite has a high melting point and vaporizes at 4,500 ° C. After adding carbon formed by graphite, it significantly improves impact and corrosion resistance of refractory material.

2. Lubrication products

Under high temperature, high speed and high pressure conditions, graphite can replace general lubricants. Solid lubricants made of graphite is applied to rotary steam joints for oil-free lubrication of various machinery, mechanical shaft sealing rings, pressing, paper making, printing & dyeing plastic cans, carbon-carrying conductive wheels for cranes, bearings for deep-water pump plywood machines etc.

3. Chemical industry

Utilizing the characteristics of graphite's corrosion resistance and good thermal conductivity, it is specially processed into impervious graphite and permeable graphite products for chemical producing processes, such as chlorine, hydrochloric acid, sulfuric acid and phosphate fertilizer. The products are mainly used as impervious carbon heat exchangers, chemical pump shaft seals, coolers, reaction towers, incinerators, condensers and graphite pipes etc.

4. Electrical industry

Graphite can be made of carbon brushes, electrodes, carbon tubes, and carbon rods for various motors, especially metal-impregnated graphite brushes for a variety of applications. The electric locomotive slider of the circuit solves a problem for the normal operation of the electric circuit locomotive with complex circuits.

5. Aerospace industry

Using the thermodynamic properties of graphite, various graphite composite materials have been developed to make nozzles and tails for rockets, missiles, aircraft nozzles, nose cones, heat shields and more.

6. Nuclear energy industry

Graphite has good neutron deceleration performance and can be used as a moderator in nuclear reactors. Uranium-graphite reactors are currently used widely.

7. Semiconductor

Graphite is an indispensable substance in various applications, including crucibles and heaters used in silicon crystal furnaces for pulling crystals or SiC, silicon carbide, graphite coatings on the surface of semiconductor wafers. It is also used in the manufacture of solar cells and liquid crystals.