Reuse of spent warm package for producing magnetic composite carbon adsorbent

1. Developing Staff Members : Reuse of spent warm package for producing magnetic composite carbon adsorbent

2. Developing Staff Members

Department	Name	Position
Graduate Institute of Bioresources	Wen Tien Tsai	Professor
Graduate Institute of Bioresources	Tasi-Jung Jiang	Ph.D. student
Department of Tropical Agriculture and International Cooperation	Raquel Ayestas	Undergraduate student

3. Development Idea

Most people will use the disposable warm package when the winter cold comes. However, this exhausted product (also called " spent warm pack ") becomes general waste, which it is generally treated in the incineration plants without reusing it as a valuable resource. This work is based on its main components (i.e., magnetic iron oxides and activated carbon) . This precursor was first produced by washing out salts, and then calcinated at high temperatures (250-750℃) for producing magnetic composite carbon material, which can be applied to purify water quality. Furthermore, the exhausted material can be easily separated and recycled by using a powerful magnet.

4. Technological Competition and Industrial Application

In this work, spent warm pack was reused as valuable precursor for producing magnetic composite carbon material via simple water-washing and thermal treatment. The resulting products are mesoporous materials, which mainly contain pores with diameters between 2 and 50 nm and also have specific surface area of over 100 m^2/g. This product has been tested for its dye removal efficiency, showing that it is an excellent adsorbent in aqueous solution. Therefore, it can be applied to the purification of non-drinking water like aquarium, irritation and washing. It is also used as a soil-modifying biochar. More significantly, the exhausted product could be easily separated and further recycled by applying external magnet.

5. Merchandise Statement of Achievement

Figure 1 depicted the nitrogen adsorption/desorption isotherms (upper) and pore size distribution(lower)of magnetic composite carbon material. It can be found that this resulting product is a mesoporous-macroporous material, as seen in Figure 2.

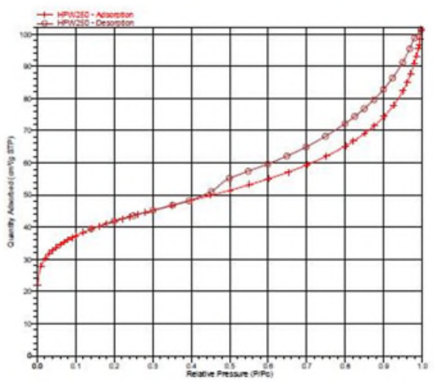

Fig 1

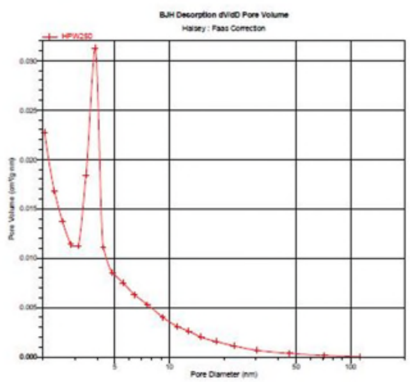

Fig 1

Figure 2 showed the porous texture on the surface of magnetic composite carbon material from the scanning electron microscope (SEM, upper) . It was also confirmed to see the coexistence of iron oxides and carbon in the resulting material by the Energy Dispersive X-ray spectroscopy (*EDX, lower*) .

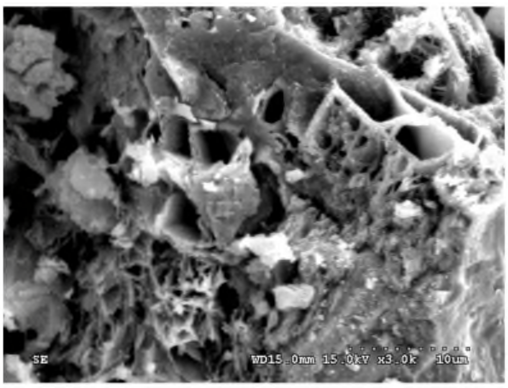

Fig 2

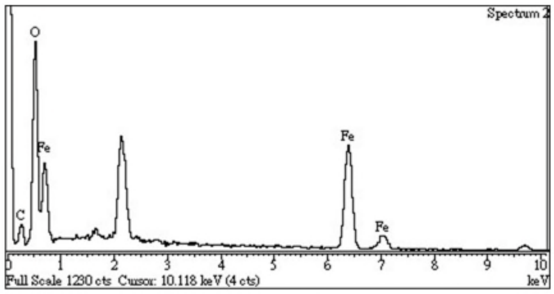

Fig 2

Figure 3 indicated the removal of methylene blue from the aqueous solution using the magnetic composite carbon material, verifying its extents of adsorption at 1, 5, 10, 20, 30, 40, 50 and 60 min (from the left tube to the right tube). More significantly, the exhausted carbon material could be easily separated and further recycled by applying external magnet.

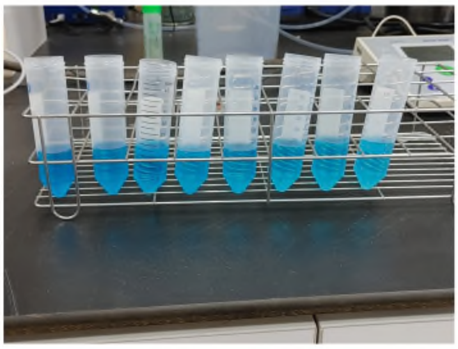

Fig 3

Figure 4 showed the resulting product (magnetic composite carbon material) .

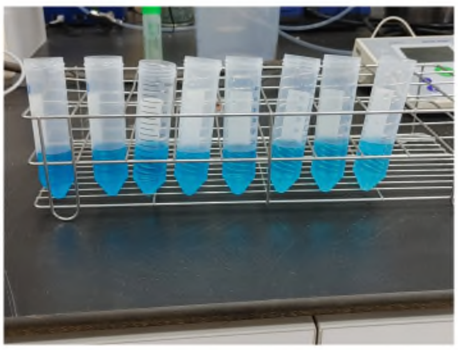

Fig 4