NMHS
National Mission on Himalayan Studies

Standard Operating Procedure (SOP)

Conversion of waste plastics into graphene nanosheets and other value added products

NMHS Project: Environmentally Sustainable Smart Synthesis of Carbon Nano material along with the production of High Value Added Fuel and Additives for the Concrete Mixture from Waste Plastic, Hazardous Waste around the Himalayan Region

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Plastic waste is one of municipal solid waste that has become serious problem in most developing countries including India due to its non-biodegradable nature. On the other hand, the manufacturing of plastic not only shows hazardous effects on the ecosystem but also depicts energy crises with the consumption of fossil fuels. This project therefore is a sincere effort in order to eliminate the problems caused by plastics by using synthesize carbon nanomaterials such as Graphene, carbon nanotubes, high value added fuel and additives for the concrete mixture. Thus, this project is not only focuses on plastic management but also focuses on successful conversion of it into value added products (i.e. organic solar cell, materials for road), which may later be exploited for many other applications ranging from energy conversion and storage, biomedical applications such as drug discovery and delivery and many more. The synthesised products can overcome from the problem of fossil fuel, thus reducing both deforestation and energy crises. The major outcomes of the project area: optimized method to synthesize CNMs, value added fuel and concrete at very low prices.

Step 1: Collection of plastics waste:

Collection of the waste plastics (about35kg) from flea market and local municipality

Step 2: Cutting of waste plastics waste through cutter unit:

Chopping of plastics (11.21mm length, and 5.75mm width)finely in flake like shape with the help of shredder

Step 3: Washing and drying the chopped plasticStep

Deep wash in a washing unit with soap solution to remove the oily and greasy impurities and dry in dryig unit

Step 4: Mixing of nanocalyat mixing unit

The dried chopped plastics and nanoclay(disk like particle shape 70 nm diameter heavy metal was found 0.005% with a pH range of 9.0–10.5) were are thoroughly with the help of sample mixture unit inadefinite ratio.

Step 5: Low temperature pyrolysis process

Slow pyrolysis (horizontal hollow cylindrical feeder unit with the capacity of 0.41m3 made of stainless steel) process in inert atmosphere of N2 gas at 400ºC which produce of raw graphene nanosheets and lower hydrocarbon in the form of gas and higher hydrocarbon in the form of liquid.

Step 6: Grinding of raw graphene nanosheets into power form by ball milling Step

The raw graphene nanosheets(obtained from previous step)is placed in the ball mill unit to make the ultra fine powder before undergoing the secondary heating process in inert atmosphere to increase the producivity of the graphene nanosheets in the system.

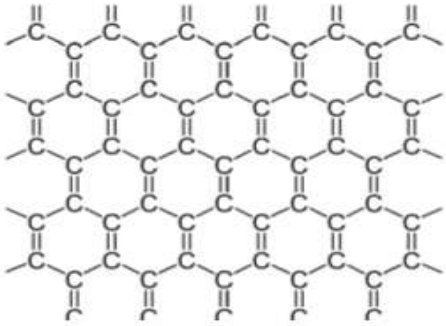
Step 7: High temperature pyrolysis process

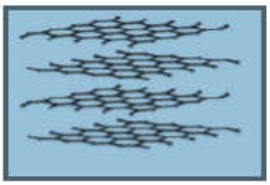
The power form of graphene nanosheets process through fast heating process in the secondary reactor (consists a vertical cylindrical feeder unit with the capacity of 0.06m3) at 750 0C with the heating rate of 10 0C/min in inert atmosphere of N2 (20ml/min), black colored graphene nanosheets was obtained

Step 8: Washing and drying

The removal of used nanoclay is necessary to maintain the purity of the product which is achieved by washing with distilled water and mild acidic treatment with 5% HCl.Finally,we get the graphene nanosheets (12-15%)

Step 9: Production of graphene sheetsStep





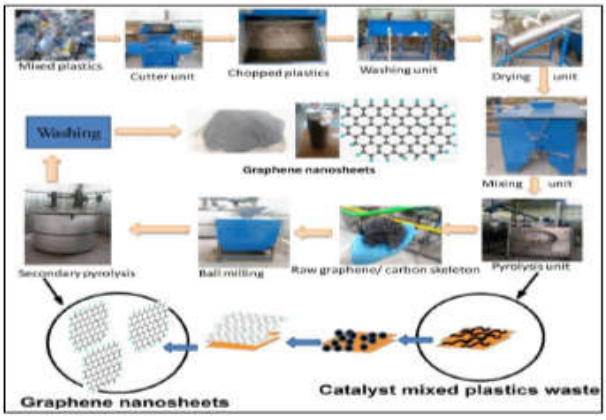


Figure Flow chart for synthesis of graphene nanosheets from waste plastics