

**Guidelines for Disposal of Thermoset Plastic Waste  
including SMC/FRP**



**CENTRAL POLLUTION CONTROL BOARD**  
(Ministry of Environment & Forests, Govt. of India)  
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## 1.0 Background:

It is well known that plastic waste are non-biodegradable & remain on earth for several years. Further, some of the plastic waste like thermoset plastic waste can't be remoulded/recycled and may cause environmental issues. In view of non-recyclable nature of the thermoset plastic, the petitioner Sh. Money Goyal & Akash Seth filed a petition No OA 124/2014 in Hon'ble NGT in respect of non-recyclability of SMC/FRP enclosures being used by some Electricity Departments in Haryana, Punjab, UP etc. Hon'ble NGT while hearing the said matter on 27.01.2015 passed the following direction:-

**"The CPCB in consultation with the MoEF shall constitute such a Committee within a period of 2 weeks from the date of receipt of the copy of the order and thereafter, we request the Committee thus constituted to study the entire aspect and give its recommendations to the CPCB expeditiously in any event within 4 weeks."**

The copy of the Hon'ble NGT's Order is attached as **Annexure-I**. In compliance of the Order of the Hon'ble NGT, Central Pollution Control Board constituted a Committee comprising officials from MoEF&CC, BIS, CIPET, IIT Delhi and Associated Cement Company (ACC). The Order for constitution of the Committee is attached as **Annexure-II**. The first meeting of the Committee was held on February 3, 2015.

## 2.0 Definition of Thermoset Polymer including SMC/FRP Plastic waste:

Thermoset plastic when cured by heat or other means, changes into a substantially infusible or insoluble product. The thermoset polymer is a kind of plastic, which due to its composite chemical structure can't be re-moulded/recycled. The thermoset plastic discarded after use are accumulated & landfilled. The SMC/FRP products are a kind of thermoset plastics commonly made from composites of glass fibres embedded in polyester resin, vinylester resin, epoxy resins etc.

### **2.1 Definition of Sheet Moulding Compound (SMC):-**

Sheet moulding compound (SMC) or sheet moulding composite is a ready to mould glass-fiber reinforced polyester material primarily used in compression moulding. This is manufactured by dispersing long strands (usually >1") of chopped fiber (commonly glass fibers or carbon fibers) on a bath of resin (commonly polyester resin, vinylester resin or epoxy resin). The longer fibers in SMC result in better strength properties than standard bulk moulding compound (BMC) products.

### **2.2 Definition of Fibre Reinforced Polymer (FRP):-**

The FRP are both thermoset and thermoplastic, FRP products having thermoset base material are discussed here. FRP composite materials consist of two or more distinct physical phases, one of which, the fibrous, is dispersed in a continuous matrix phase.



Composites offer the designer a combination of properties not available in traditional materials. It is possible to introduce the fibres in the polymer matrix at highly stressed regions in a certain position, direction and volume to obtain maximum efficiency from the reinforcement, and then, within the same member to reduce the reinforcement to a minimal amount at regions of low stress. Other advantages offered by the material are its lightness, resistance to corrosion, resilience, translucency and greater efficiency in construction compared to the more conventional materials.

### 3.0 Chemical Structure & Properties of Thermosetting Polymers:

#### 3.1. Epoxy resins

The terminology 'epoxy resin' is generally applicable to both prepolymers as well as to cured resins. The former contains reactive epoxy groups whereas the cured resin may or may not contain reactive epoxy groups. While the term can be justified in the former case, the cured resins are also called epoxy resins. Epoxy resins typically contain a three membered ring with -O- atom. Different terminologies are also used to specify the group such as epoxide, oxirane and ethoxyline group,  $RCHOCH_2$ . Commercial epoxy resins usually contain aliphatic, cycloaliphatic, or aromatic backbones. Epoxy resins are highly reactive presumably due to the strained three membered ring structures and react with many nucleophilic and electrophilic reagents. Therefore, a wide variety of organic compounds having active hydrogen atoms can be used as curatives. These include amines (both aliphatic/aromatic and primary/secondary), phenols, carboxylic acids, thiols, anhydrides etc. The general reaction of epoxy resin with these compounds are presented below;

Epoxy resins possess high resistance to chemicals and corrosion, besides having moderate toughness, flexibility and excellent mechanical and electrical behavior. Epoxy resins are also used as outstanding adhesives for different substrates. Epoxies are used in tooling, for laminates in flooring and to a small extent in moulding powders and in road surfacing. Epoxy resins are used for encapsulation of miniature components, particularly in space crafts. Epoxy resin laminates are useful in aircraft industry, while Carbon fiber/epoxy resin composites are used for structural modification in aeroplanes and epoxy/aramid fibers find uses in the design of small boats.

