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मानक

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IS 15684 (2006): Extenders for use in synthetic resin adhesives (Urea-Formaldehyde) for plywood - Code of practice [CED 20: Wood and other Lignocellulosic products]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

प्लाइवुड के लिए सिंथेटिक रेजिन आसंजकों
(यूरिया-फार्मेल्डिहाइड) में प्रयुक्त एक्सटेन्डर —
रीति संहिता

Indian Standard

EXTENDERS FOR USE IN SYNTHETIC RESIN
ADHESIVES (UREA-FORMALDEHYDE) FOR
PLYWOOD — CODE OF PRACTICE

ICS 79.060.10; 83.040.30; 83.180

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Wood and Other Lignocellulosic Products Sectional Committee had been approved by the Civil Engineering Division Council.

Adhesive is a substance capable of holding materials together by surface attachment and form one of the most important raw materials used in the plywood industry. The selection of an adhesive and its correct use are important factors that affect the quality of the plywood produced. Adhesives for bonding plywood are primarily based on synthetic resins, namely, phenol and aminoplastic, the requirements of which are laid down in IS 848 : 2006 'Specification for synthetic resin adhesives for plywood (phenolic and aminoplastic)'. The requirements governing the quality of the chemical raw materials used in the manufacture of these resins are laid down in the respective Indian Standards. The adhesives based on synthetic resins, namely, phenol and aminoplastic require compounding with one or more additives such as solvents, fillers, extenders, catalysts, hardeners, fortifiers and preservatives so as to obtain the adhesives for bonding plywoods.

An extender is a substance having some adhesive action primarily based on organic materials of starch or protein in nature, is added to an adhesive to reduce the amount of the primary binder required per unit area, thereby reducing the cost of the joint and to also reduce penetration of the adhesive through the veneers or both. Generally extenders are in powder form. The main requirements of an extender are that:

- a) it should readily disperse in the liquid resin giving a smooth and uniform adhesive mix which maintains its viscosity during its application,
- b) it should improve the bonding capacity of the adhesive and give adequate pot life to the adhesive, and
- c) it should help in spreading a specified quantity of adhesive solids without excessive dripping or squeeze out.

Extenders may also serve the purpose of fillers when used in small proportions to alter the characteristic behaviour of an adhesive during its application as well as in the cured product. The proportion of extender that can be added to an adhesive mix varies considerably, depending on the density, particle geometry, chemical composition of the material, etc, and finally the bond quality and grade of the plywood intended to be produced. Extenders are used in the range of 15 to 30 percent on solid resin basis, while fillers normally are limited to 10 to 15 percent on solid resin basis.

As the incorporation of extenders in adhesives are expected to have a direct influence on the overall performance of the adhesive during its application as well as on the panel bonded with the resin adhesives, it is important to assess the quality parameters of such additives and employ appropriate methods of mixing and use. As commonly used extenders for synthetic resins (phenolic and aminoplastic) for bonding plywood are based on starch and proteinous materials originating from cereals, oil bearing seeds, etc, it is imperative to ascertain the quality of such materials. The important requirements are moisture content, fineness of the granules, fat content, nitrogen content and ash content, as well as acidity as these materials are perishable in nature and are expected to deteriorate in storage and become rancid due to bio-deterioration. The relevant quality requirements and the criterion for their acceptability as extenders to be suitably used with synthetic resins are described in this standard.

This standard is primarily based on IS 1508 : 1972 'Specification for extenders for use in synthetic resin adhesives (urea-formaldehyde) for plywood (*first revision*)' and is intended to serve as a guide to good practice.

Indian Standard

EXTENDERS FOR USE IN SYNTHETIC RESIN ADHESIVES (UREA-FORMALDEHYDE) FOR PLYWOOD — CODE OF PRACTICE

1 SCOPE

Extenders covered under this standard covers materials used with synthetic resin adhesives (urea-formaldehyde) for plywood, their method of use and the desired quality requirements when tested.

Extenders covered under this standard are proteinous materials and starch based or amylaceous materials and that are widely used in the plywood industry.

2 REFERENCE

The following standard contains provision, which through reference in this text, constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

<i>IS No.</i>	<i>Title</i>
1508 : 1972	Specification for extenders for use in synthetic resin adhesives (urea-formaldehyde) for plywood (<i>first revision</i>)

3 MATERIALS

3.1 Extenders are substances, generally having some adhesive properties, which are added to an adhesive to reduce the amount of primary binder required per unit, without impairing the bond quality. Proteinous and amylaceous materials are included in this category. Extenders improve the tackiness of the film. They also help to reduce the penetration of the adhesive into the wood substrate and improve the gap filling property of the adhesive. When added to the synthetic resin, extenders increase the pot life of the adhesive mix and impart greater assembly time tolerance.

3.2 Extenders used shall be of uniform colour.

3.3 On visual examination, extenders shall be free from weevil or other insects and also free from mould or fungus attack. Extenders that have been infested with weevil or insect are not suitable for use as their protein or starch content would be reduced to a considerable level due to the weevil or insect attack.

4 CLASSIFICATION OF EXTENDERS

Extenders are broadly classified as protein based and starch based or amylaceous.

4.1 Proteineous Extenders

These types of extenders contain protein to the extent of 40 to 60 percent. When added to the resin in the presence of an alkali, they swell and increase the volume of the resin. In addition, the protein extracted, uncoil to avail the reactive positions to react with the formaldehyde present in the resin, thus exhibiting better strength properties compared to starch extenders. Typical examples of porteineous extenders are de-oiled groundnut cake powder, de-oiled maize gluten, de-oiled soybean meal, casein, blood albumin, etc.

4.2 Amylaceous Extenders or Starch Extenders

These type of extenders contain starch to the extent of 90 to 95 percent. When added to the resin, they swell and increase the volume of the basic resin. Starch by itself being an adhesive when modified, contribute to the adhesive property of the basic resin. Typical examples of starch extenders are tamarind seed powder, tapioca starch, *MAIDA* and wheat flour.

5 REQUIREMENTS FOR QUALITY

5.0 Extenders that meet the requirements of the following tests as specified by the purchaser shall be considered to be of acceptable quality. The tests shall be carried out in accordance with the respective test methods specified in IS 1508.

5.1 Fineness of Granules

The powder shall completely pass through IS sieve No. 100. Though extenders of higher particle size can be softened by the addition of small percentages of sodium hydroxide or liquid ammonia, they tend to separate in the adhesive mix thereby creating non-uniform spread of the adhesive on to the veneer, which in turn lead to poor bonding or patchy bonding sometime leading to blisters.

Proteinous extenders perform better if protein is extracted by treating them with small percentage of

sodium hydroxide or liquor ammonia (preferably liquor ammonia). The extraction is achieved by mixing the chemicals with extenders in presence of water and allowing more time in mixing. An ideal time of mixing would be around 15 to 20 min.

5.2 Moisture Content

The moisture content of extender may be kept around 12 to 14 percent, as a higher moisture content may cause fungus or mould attack thus leading to deterioration of the extender material.

5.3 Ash Content

Ash content of starch based and proteineous extenders normally vary from 0.3 to 3 percent. Higher ash content indicates the presence of inorganic materials and result in the abrasive action on saws and other cutting tools used in the panel industry. Another problem envisaged is the settling of the extenders as the inorganic materials do not swell and are of higher density compared to starch and proteineous extenders.

5.4 Fat Content

Fat content of 2 to 3 percent in the extenders do not normally exhibit any adverse effect on the quality of bond. However, higher percentage of fat content especially in proteineous extenders can cause foaming in the spreader as these types of extenders are generally dispersed with low percentage of alkali before they are admixed with synthetic resin. Fat in the proteineous extender react with sodium hydroxide resulting in soap formation which cause foaming in the adhesive mix, specially while on the mechanical roller spreader. This foam in turn would result in poor bonding as sometimes foam alone would get spread on to the veneer.

5.5 Nitrogen Content

The nitrogen content in the extender indicates the percent of protein present in the material. This value depends upon the type of proteineous extender and may be as agreed to by the purchaser and the manufacturer.

5.6 Acidity

The titratable acidity of the material is termed as acidity of the extender. The quantity of 0.1 N sodium hydroxide expressed in millilitre used by one gram of moisture free and fat free material is termed as the acidity of the sample. Higher acidity may necessitate corrective measures so as to maintain the final pH of the adhesive mix to the desired level. If the pH of the final adhesive mix is not corrected, there are chances of the adhesive mix applied on the veneer getting pre-cured before the veneer assembly is hot pressed leading to poor bonding.

6 METHOD OF MIXING

Extenders are mixed with a part of the resin and stirred thoroughly to obtain a paste like mix. Addition of the entire quantity of resin to the extenders would result in extender powder floating on the surface, forming small lumps. If proteineous extenders are used, a small percent of liquid ammonia is added to extract and uncoil the protein. Balance quantity of the resin is then added to the paste and stirred thoroughly to obtain a smooth resin mix of the required viscosity. To this mix other ingredients are added as required. This order of mixing shall be followed to obtain best results.

If the resin is in powder form, then part of the water required for converting powder resin into liquid resin is used for making a paste of extender before adding the remaining quantity of water and powder resin to the mix.

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