

# RESIN EXTENDERS

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Resin extenders have been associated with the wood based panels adhesives for many years. However, with the general acceptance of urea formaldehyde (UF) resins as the conventional most-widely used binders in the 20<sup>th</sup> century automated board manufacturing, the advantages of 'extended' formaldehyde resins over neat resins were soon realized. This article nonetheless will refer mainly to the resin extenders used in the particleboard (PB) and medium density fiberboard (MDF) manufacture and not to other types of the so-called 'glue extenders' (i.e. wheat-, corn-, sorghum- based proteins, etc.) typically used in the plywood industry.

The advantage of using an extender in a UF glue mix is clear; that is, as less base resin is required, significant cost savings on resin costs occur. Resin extenders applied in the production of PB and MDF usually improve the efficiency of standard binders, while simultaneously maximize the usefulness of the base resin by maintaining or improving properties. It should be noted that this is done with almost no change in the industrial production parameters.

Chemically, the resin extenders are monomers fortified usually with activators and/or stabilizers. They are compatible with all types of formaldehyde-based resins (UF, MUF, PF and MUPF) and can be typically used at 10-15% substitution levels, higher in some cases (up to 25% maximum), calculated on a liquid basis.

A.C.M. Wood Chemicals was a pioneer in resin extenders. In fact, the company's growth in the first years - since its foundation in 1978 - was based merely on a patent relating to the development and industrial application of a special resin extender which could substitute a large portion of the UF binder used for particleboard manufacture to make boards that had the effect of 'extending' the resin, which meant at that time much less base resin was really required.

A.C.M. today markets a series of resin extenders that are based on the same raw materials as standard formaldehyde-based resins (i.e. urea, formaldehyde), and when they are applied, the industrial production parameters, process and resultant board properties remain unchanged. The same handling procedures apply to the extenders as the resins they substitute. Formaldehyde emissions are not increased by using extenders. As a matter of fact, A.C.M. has developed a formaldehyde scavenger (catcher) that also functions as a resin extender.

A.C.M. has been working closely with resin producers and backward-integrated PB and MDF producers in over 30 countries worldwide to create resin extenders tailored in their production conditions and requirements. A.C.M. usually licenses the resin extenders to the resin and/or board producers so they can produce the A.C.M. product themselves (on-site production).

Technically, the advantages of using these resin extenders in the PB and MDF production are summarized as follows:

- Up to 10% savings on binder cost
- Special grades for all types of resins and composite boards
- No change in board production and properties
- No additional investment needed
- Tailor-made according to customer needs and raw materials.

The A.C.M. resin substitutes include a series of resin extender products which are listed below and described in detail:

**SACOL<sup>®</sup> 100 Series**

General use low viscosity liquids that substitute a part of the UF resin.  
(41-42% solids)

**SACOL<sup>®</sup> 1000S Series**

Types to be used on the surface mixture of particleboard as well as in MDF production.  
(27-36% solids depending on molar ratio and can be used with E2 or E1 class resins)

**SACOL<sup>®</sup> 1000HS**

A high solids (40-42%) urea formaldehyde resin substitute for MDF production.

**SACOL<sup>®</sup> 355**

Special grade extender for high substitution levels of low emission resins.  
(45-46% solids).

**SACOL<sup>®</sup> 115**

Special grade for high substitution levels of low emission resins to produce boards with very low free formaldehyde (45-46% solids).

The pH of these resin extenders is slightly alkaline and they should not be used when it is less than 7.5. For PB, the resin extenders are added to the glue mixture in amounts up to 20% by weight based on the UF resin used and calculated on a liquid basis. They are used to replace part of the resin, i.e. the resin is reduced in the formulation by the same amount that the substitute is added. In early days (1975-1985), when the F/U molar ratio of resins was high (1.3-1.6), up to 40% of the resin used in PB production was substituted. For MDF, up to 10% of the resin can be substituted. All other additives, except for the hardener, remain constant unless specific conditions arise that would require some adjustments. The mixture with extenders should give the same or a slightly shorter gel time than the control. Extenders should be handled with the same care and precaution as taken with a normal UF resin. Depending on the type, the shelf life varies between 2-4 weeks on the average.

A.C.M. Wood Chemicals, as one of the most research-focused players in the formaldehyde based resin industry today, is continually working to improve the resins and resin additives, such as resin extenders, through its R&D wing, the **Adhesives Research Institute Ltd. (ARI)** based in Thessaloniki, Greece, (Internet: [www.ari.gr](http://www.ari.gr)), whose aim is to constantly identify and explore the opportunities for new products and processes for the wood panel industry. Apart from R&D projects totally funded by the A.C.M.'s own resources and carried out at its own premises, ARI is being involved in several cooperative projects financially supported by the European Commission at the national or EU level.

A major focus of ARI at the present is the industrial application of **a newly developed extender for phenol-formaldehyde (PF) resins**. The innovative extender, which can be mainly applied in the OSB and plywood production, allows the substitution of phenol in PF resins by using the oil obtained by the pyrolysis of renewable biomass as well as special natural products containing phenolic compounds. Through appropriate modification of these materials, up to 50% of the phenol needed can be replaced, and the PF resins obtained become less toxic and more environmentally friendly. A simultaneous reduction in the binder cost of up to 10% can be achieved with the use of the new resin extender.

In conclusion, A.C.M.'s research provides constant updates on its products and leads the industry research on extenders for the wood panels industry creating a new generation of resin extenders that exceed the toughest environmental, commercial and industrial standards.

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