

PHENOTAN M

Plywood

PHENOTAN M is a modified resin of vegetable origin used for exterior grade plywood, which needs water resistance.

CHEMICAL CONSTITUTION

TANAC has been working in the development of a wide range of adhesives for wood based on Wattle bark extracts.

The Wattle bark extract (or Mimosa extract) consists mainly of flavonoid polymers or polyphenolic compounds (figure 1), gums, carbohydrates and traces of amino— and imino-acids.

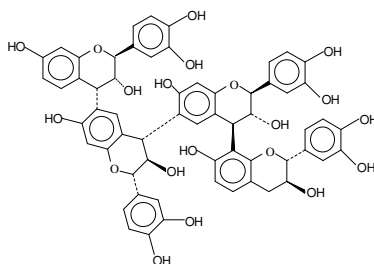


Figure 1

For the **PHENOTAN M** manufacture, the vegetable extract is modified focusing improvements on the viscosity, reactivity, strength and water resistance, through the decrease in the gums and sugar content, polymer structure rigidity and steric hindrance.

CHARACTERISTICS

PHENOTAN M is available in a powder form packed in net weight of 25-kg multiply paper bags.

The powder is slightly hygroscopic and the bags should be closed and stored in dry premises.

Moisture	5 – 8%
Viscosity at 25°C (aq.sol. 48 – 52% w/w)	1000 – 1600 cP
pH(aq. sol. 50% w/w)	4.0 – 5.0
Gelation time	130 – 180 s

THE USE OF PHENOTAN IN PLYWOOD MANUFACTURE

PHENOTAN M reacts with formaldehyde causing the formation of thermosetting adhesive through methylene linkages at induced reactive centers (ortho and para-positions of the A-benzenoid nuclei on the flavonoid molecules), as can be seen in the figure 2.

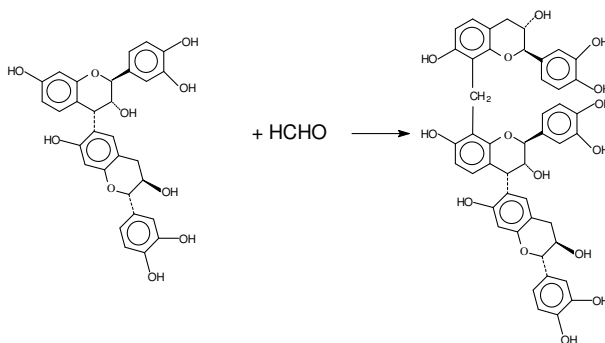


Figure 2

The reactivity shown by A-rings towards formaldehyde is somewhat closed to that of resorcinol or phloroglucinol.

The aldehydes usually employed as catalysts are formaldehyde 37% aqueous solution, hexamethylenetetramine or paraformaldehyde but the last one is recommended for **PHENOTAN M**. However, different types of commercially available paraformaldehyde have different reactivities and can be classed as a low, medium and high reactive product. Depending on the adopted type, the pH should be adjusted in order to achieve the gelation time desired.

Attention should be taken for the fact that **PHENOTAN M** polymerizes only if combined with the suitable amount of the hardener agent (catalyst) in order to reach an effective cross-linking (e.g., 6-8% of paraformaldehyde on **PHENOTAN M** solid content).

Hardener amounts lower than those suggested might result in a decrease of plywood bonds.



The adhesive pH is relevant once it determines the reaction speed with formaldehyde.

The viscosity of **PHENOTAN M** varies according to the resin concentration and the room temperature, as well. An increase in the viscosity of PHENOTAN M occurs when its solid content is over 50% (w/w). This behavior and the amount of fillers added should be taken in consideration during the adhesive formulation, in order to control the glue penetration in the veneer (related to soft or hardwood used in the plywood manufacture).

PREPARATION OF THE RESIN

The **PHENOTAN M** solution must be prepared by adding warm water over the powder under continuous stirring. The best results with **PHENOTAN M** are reached using the resin solution with 50% of solid content. Therefore, the hydration can be carried out in the following way:

	Parts by weight
PHENOTAN M powder	100
Water (40 – 60°C)	88

The usage of stainless steel or plastic container for the resin and adhesive preparation is suggested once **PHENOTAN M** complexes with metals surfaces.

RECIPE FOR GLUE MIX

An adhesive mix is prepared by blending:

	Parts by weight
PHENOTAN M (50% solid content)	100
Coconut shell flour	10
Paraformaldehyde	3 - 4

PLYWOOD MANUFACTURING VARIABLES

The application and the pressing conditions can change according to the kind of veneer, either soft or hardwood.

Conditions	Wood Density	Softwood	Hardwood
Application	Veneer moisture	6 – 8%	6 – 8%
	Glue spread (double glue line)	400 – 460 g/m ²	440 – 500 g/m ²
	Assembly time	Maximum 2 h	Maximum 2 h
Pressing	Temperature	110 – 130 ^o C	110 – 130 ^o C
	Pressure	8 – 10 kgf/cm ²	10 – 13 kgf/cm ²
	Pressing time	1 min/mm (*)	1 min/mm (*)

(*)This parameter can be increased according to the total plywood thickness.

GENERAL INFORMATION

1. The formulations, application and pressing conditions mentioned were adapted for Brazilian woods, thus the suggestions give serve, only, as a guide. Previous trials are recommended when other kinds of wood species are used.
2. Evaluation on the adhesive performance has demonstrated that **PHENOTAN M** provides plywood with low formaldehyde release.
3. The use of separate hardener, which is not incorporated in the resin, allows the formulation of **PHENOTAN M** adhesive for plywood with a longer shelf-life.

Other considerate advantage is the possibility to store the product in powder form for long periods (more than 6 months). It will be feasible to proceed the powder hydration in water according to the amount and consumption needed.

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