

ADVANCES IN ULTRA-LOW EMITTING UF RESINS FOR P'BOARD AND MDF

BY DAVE HARMON

Regulatory pressure to reduce formaldehyde emissions from composite wood panels shifted into overdrive last April when the California Air Resources Board (CARB) released its long-awaited regulations.

CARB's two-phase implementation sets limits on emissions for particleboard, MDF and the products which use them that are roughly equivalent to the strictest European and Japanese standards starting in 2009, and will far exceed them in 2011. (see chart)

These are just the latest in a long line of ever-more-restrictive VOC emission standards championed by regulators and activists. It's highly debatable whether CARB's tight restrictions are necessary, whether there is any health risk at all from formaldehyde at realistic indoor air levels, and whether we'll see any real benefits from this regulation as we

go forward. The die, however, is cast.

Particleboard and MDF producers will need to meet the ceilings established by CARB or sacrifice business in California. Recent news stories suggest that a number of other states, and even the federal government, are considering adopting similar regulations. Additionally, a number of North American (and even international) companies have announced they will only purchase CARB-compliant composite panel products. In all likelihood, CARB's ceilings will become the de facto domestic standard.

CARB PHASE 1-2

California's actions present a variety of challenges for manufacturers, but finding a resin solution to comply with Phase 1 shouldn't be an issue. Resin suppliers currently offer a range of products and technologies that can meet these standards, without sacrificing quality or significantly impacting plant production. In most cases, these solutions can be implemented today, albeit with some "fine-tuning."

It's useful to remember that resin manufacturers in partnership with board producers have reduced emissions by 80 to 90% since the late '70s and early '80s. Urea formaldehyde (UF) resins, which have historically been the adhesive of choice for the manufacture of particleboard and MDF based on their total cost and performance effectiveness, are already very low-emitting.

Meeting the emission limits set by CARB Phase 1 while continuing to derive the benefits of traditional UF resins can be accomplished in several ways:

1) One-part resins substituting melamine for part of the urea. Low mole ratio resins using this approach to

meet CARB P1 are currently available. Cure rates may be slightly slower than standard UF resins, and this option may entail some increased cost or longer cycle times.

2) Base UF resins with scavenger systems. Scavengers in a urea solution can be added to base resins to reduce emissions to below CARB Phase 1. This option may also entail some increased cost and slightly reduced productivity.

3) Scavenger resins substituted for up to 25% of a base UF resin. This technology is typically less expensive than one-part resins or scavenger systems while meeting CARB P1 levels.

4) Co-reactant technology. The latest alternative is a polymer-enhancing additive system that controls emissions by tying up residual formaldehyde in the polymer to reduce the available emittable content. Because it is an additive, not a replacement for the base resin, this technology has no adverse effect on cure rates or production speeds.

Non-UF options such as phenol formaldehyde (PF) resins, which were the original bonding agent for particleboard and fiberboard and offer less off-gassing, are also available. The cost for the typical producer, however, may be prohibitive.

Complying with CARB Phase 2 will be a much more significant challenge. Its emission limits are approximately one-half of Phase 1, approaching "background" formaldehyde levels.

ULTRA-LOW EMITTING

With classic amino-based technologies, we're finding additional opportunities to reduce emissions while maximizing performance. A new class of melamine-containing urea-formaldehyde resins is currently being tested that exhibits good storage stability, good physical properties and formaldehyde emissions at near-background levels that would actually qualify for exemption from CARB testing (averaging at or below 0.04 ppm).

This new class of resins can be used in place of the conventional resins, requiring only the normal "fine-tuning" to operate efficiently in your manufacturing process. These new resins are also available in both single-part and two-part systems.

There are several benefits to sticking with a UF- or MUF-based system for CARB Phase 2. New equipment installation is limited. Board plant productivity should remain at (or very near) current levels. Quality won't be affected,

CARB Regulation — Limits (Ceiling) ppm

Table 1					
Phase 1 and 2 Emission Standards for Hardwood Plywood (HWPW), Particleboard (PB), and Medium Density Fiber (MDF) ¹					
Effective Date	Phase 1 (P1) and 2 (P2) Emission Standards (ppm)				
	HWPW-VC	HWPW-CC	PB	MDF	Thin MDF
1-1-2009	P1: 0.08	—	P1: 0.18	P1: 0.21	P1: 0.21
7-1-2009	—	P1: 0.08	—	—	—
1-1-2010	P2: 0.05	—	—	—	—
1-1-2011	—	—	P2: 0.09	P2: 0.11	—
1-1-2012	—	—	—	—	P2: 0.13
7-1-2012	—	P2: 0.05	—	—	—

¹ Based on the large chamber test Method (ASTM E1333-96) in parts per million (ppm). HWPW-VC = veneer core; HWPW-CC = composite core, where the core material is PB or MDF. Formaldehyde level in natural wood is 0.02 ppm

and there will be minimal impact on total produced board cost. Existing resin plants will also be able to produce these solutions in the quantities necessary to meet board manufacturer demand.

Non-UF systems are showing promise as well, especially for applications where the use of urea formaldehyde is severely restricted or banned, such as to qualify for LEED credits.

PF resin systems are readily available for board manufacturers seeking to comply with LEED criteria. In addition, a variety of no-added formaldehyde (NAF) solutions are currently in test or use – including soy-based, isocyanates (pMDI) and polyvinyl acetate-based

systems. You should check with your supplier about these alternatives. You will almost certainly pay a premium for any of these options.

When can customers expect to see these new ultra-low UF products? Most of the formulations are in production trials now, and should be ready for individual plant proofing within the next three months. This will allow over two years for full implementation and certification prior to the Phase 2 deadline. (CARB mandates a third-party certification process.)

Although the new formaldehyde regulations from California will mean change – and some additional costs – for panel producers, resin manufacturers are work-

ing hard to minimize the disruption. Advances in UF technology, along with work on NAF and bio-based alternatives, are making this possible. **PW**

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