Technical White Paper

JDS-ADHESIVE

THE HPA

Eco-friendly Adhesive

HPA Formaldehyde-Free
NAF Eco-Friendly Adhesive Powder
Technical White Paper
for the European Market

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TECHNICALWHITEPAPER (MAY.2026.JDS-NAF-2026-01)

DOCUMENT INFORMATION

Scope of Application:

For technical evaluation, sample testing, commercial technical filing, and customer audit documentation for plywood manufacturers within the European Union.

Product Positioning:

A low-emission, bio-based adhesive powder specifically designed for indoor plywood applications.

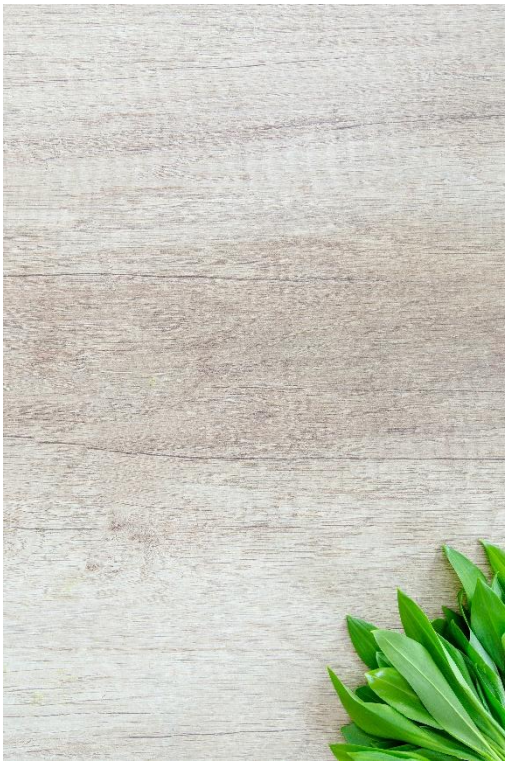
Confidentiality Statement:

This document is intended solely for technical evaluation purposes. All data and descriptions herein are provided for reference only for customer production validation and third-party testing.

PREFACE

About JDS & Executive Summary

Jiadesai(JDS) is a materials technology company focused on the R&D and production of environmentally friendly, high-performance bio-based adhesives for wood-based panels. HPA is an adhesive technology based on nano organic–inorganic composite materials.



Since 2026, Regulation (EU) 2023/1464 has been formally implemented, alongside the update to Entry 77 of Annex XVII of the REACH Regulation, which clearly stipulates that formaldehyde emissions from wood-based panels must comply with the EN 717-1 limit of ≤ 0.062 mg/m³. This further standardizes the environmental market access requirements for wood-based panels.

Traditional formaldehyde-based resin adhesives, such as UF, MUF, and PF, present potential risks of exceeding formaldehyde emission limits under the new regulatory framework, leading to increasing compliance pressure across the industry. At the same time, some low-emission adhesive products available in the European market are relatively costly, thereby increasing the raw material cost burden for panel manufacturers.

With the continuous tightening of indoor air quality standards in Europe, the market is gradually shifting toward adhesive solutions with low formaldehyde content and low volatility. HPA Formaldehyde-Free NAF Eco-Friendly Adhesive Powder is developed based on a low-emission, bio-based adhesive technology, focusing on indoor wood-based panel applications. It can serve as a low-risk and optimized alternative to traditional formaldehyde-based adhesives, meeting the compliance and performance requirements for indoor panel production within the European Union.

CORE COMPLIANCE TESTING DATA

(SGS / TÜV Laboratory Test Results)

General Testing Boundary Statement:

All test data presented below are based on standardized laboratory conditions and selected sample panels. Actual performance may vary depending on production conditions. Customers are advised to conduct third-party re-verification tests in accordance with their own production line conditions.

Test Item	Test Standard/Method	Measured Result	EU Reference Limit	Compliance Statement	Report No.
Formaldehyde Emission of Panels	ASTM D6007-22 (CARB/TSCA)	0.03 ppm	≤0.05ppm	Below the reference limit, helping to reduce regulatory compliance pressure under evolving standards.	GZIN2603001825PC02_EN
Free Formaldehyde in Adhesive Powder	GB 18583-2008, Annex A	BDL (Below Detection Limit)	No Mandatory Limit	No intentional addition of formaldehyde during the production process	CANPC25024146701
Benzene Content	GB 18583-2008, Annex B	BDL	Strictly Prohibited	No detectable benzene-related hazardous substances	CANPC25024146701
Toluene + Xylene (Total)	GB 18583-2008, Annex C	BDL	Restricted and Controlled	No detectable aromatic benzene compounds	CANPC25024146701
Total Volatile Organic Compounds (TVOC)	GB 18583-2008	169g/L	/	Demonstrates low volatility under laboratory test conditions	CANPC25024146701
REACH SVHC (Substances of Very High Concern)	EC 1907/2006	< 0.01%	≤0.1%	Meets EU SVHC regulatory requirements, helping to reduce compliance risks	178227761a 001
Phthalates / Organotin Compounds / Heavy Metals	REACH Annex XVII	BDL	Strictly Prohibited	Complies with EU hazardous substances control requirements	178227761a 001
Bio-based Content Ratio	USDA Biobased Testing Standard	Contains a certain proportion of bio-based content	/	The formulation contains bio-based raw materials, aligning with low-carbon material trends	/

2. CORE COMPLIANCE TESTING DATA

Compliance Qualification Statement

1. Holds official declaration of No Added Formaldehyde (NAF)

2. Passed full REACH substance screening by TÜV Rheinland, with no restricted substances exceeding regulatory limits

3. Passed SGS low-emission testing for formaldehyde, aromatic compounds, and TVOC; hazardous substances either not detected or below regulatory limits

4. Panel sample testing complies with CARB P2 / TSCA Title VI formaldehyde emission requirements

Important Notice

This product has not obtained official environmental certifications such as French A+, German Blue Angel, LEED, BREEAM, EPD, or LCA yet. All statements related to low VOC performance and environmental compatibility are based solely on laboratory test results and are provided for reference only; they do not constitute certification claims.

3.1 Product Definition

HPA Formaldehyde-Free NAF Eco-Friendly Adhesive Powder is a bio-based, no-added-formaldehyde adhesive system designed for indoor applications, including plywood, interior decorative wood-based panels, and furniture-grade boards. It is suitable for use in applications where indoor air quality is a key concern and can serve as a low-emission, lower regulatory-risk alternative adhesive solution.

3.2 Core Technical Characteristics of the Product

(1) No intentional formaldehyde addition, reducing compliance pressure

No formaldehyde is intentionally added during the production process, and free formaldehyde is below the detection limit. This helps reduce regulatory compliance pressure and risks associated with evolving EU formaldehyde regulations.

(2) Low hazardous substance emissions, suitable for indoor applications

Under laboratory test conditions, benzene, toluene, and xylene were not detected, and overall volatile emissions remain at a low level, making the product suitable for wood-based panel applications requiring strict indoor air quality control.

(3) Dual-formulation flexibility with controllable cost structure

The formulation can be flexibly adjusted according to factory production practices, supporting different capacity levels and cost requirements, providing room for overall cost optimization.

Standard reference mixing ratio:

1 ton adhesive powder + 3 tons water + 2 tons flour = 6 tons finished adhesive

Cost-optimized mixing ratio:

1 ton adhesive powder + 5 tons water + 4.5 tons flour = 10.5 tons finished adhesive

Note:

Highly diluted formulations must be validated based on actual panel performance requirements. Only after confirming that strength, stability, and durability meet mass production standards can such formulations be applied.

(4) Potential for Production Line Compatibility

The powder can be mixed at room temperature without the need for special heating equipment. With process optimization, it demonstrates potential compatibility with certain existing plywood production lines.

(5) Good Compatibility with Multiple Wood Species Processes

Under test conditions with certain wood species, the product demonstrates a degree of process compatibility and can meet the basic bonding requirements for some indoor-use panel applications.

3.3 Basic Process Reference Parameters (For Trial Adjustment Only)

The following parameters are provided for laboratory and pilot-scale reference only and do not represent universal production standards. Factories should adjust and validate them according to their own equipment, wood species, and environmental conditions:

Adhesive mixing temperature: 20–25°C (room temperature)
Mixing time: 12–15 minutes, until the adhesive is fully homogeneous and free of particles
Recommended veneer moisture content: ≤20%
Reference hot-press temperature: 110°C–130°C
Reference hot-press pressure: 1.0–1.4 MPa
Reference hot-press duration: 18–25 s/mm (adjust according to panel thickness)
Pot life after mixing: Performance remains relatively stable within 8 hours

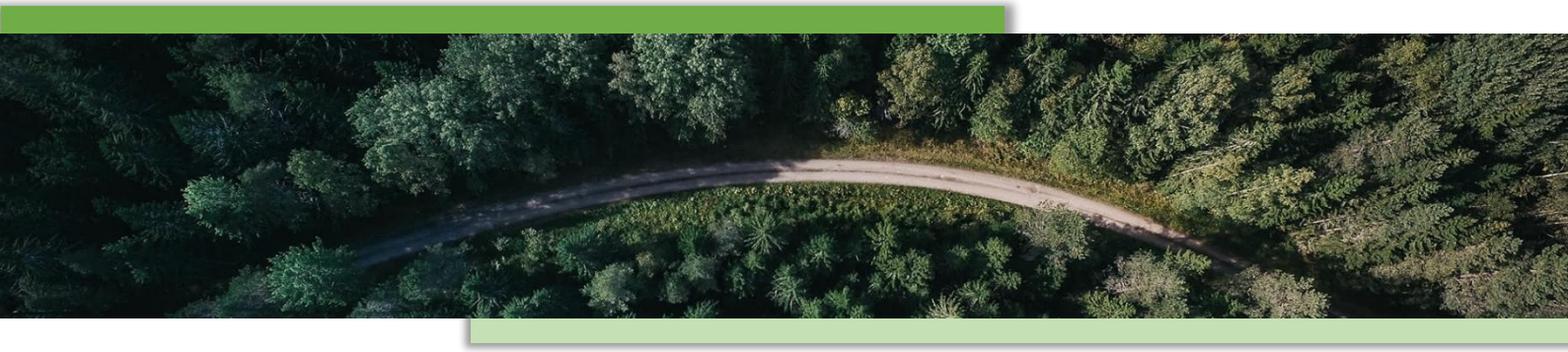
Performance Boundary Statement:

Under certain indoor panel test conditions, the product can meet basic bonding requirements for some interior applications. However, it has not been specifically tested or optimized for high water-resistance or high-strength industrial standards such as EN 314 classification, WBP, or BWP grades.

OBJECTIVE COMPARISON OF MAINSTREAM ADHESIVE SYSTEMS

Based on laboratory test data and industry-standard operating conditions, an objective comparison of three adhesive systems is presented below for reference only in factory material selection.

Comparison Criteria	Conventional Formaldehyde-Based UF/MUF Adhesives	European Low-Emission Adhesive Systems	HPA Formaldehyde-Free NAF Adhesive Powder
Formulation System	Formaldehyde-Based Resin System	No Intentional Formaldehyde Addition	No Intentional Formaldehyde Addition
EU Regulatory Adaptability (2026)	High compliance pressure due to tightening regulations	Stable adaptability	Test indicators comply with EU reference limits, helping to reduce regulatory upgrade pressure
Volatility Performance	Moderate level	Low volatility	Demonstrates low volatility under laboratory test conditions
European Market Procurement Cost	Low	High	Mid-range with potential for cost optimization
Flour Compatibility in Adhesive Preparation	Compatible	Generally not recommended	Good compatibility, allowing flexible optimization of production cost
Production Line Adaptation Difficulty	Native compatibility, no adjustment required	Requires process optimization	After minor process optimization, demonstrates potential compatibility
Technical Service Support	Basic after-sales support	Limited local service coverage	Provides sample testing, process adjustment, and technical consulting support
Application Scenarios	General low-end consumer wood-based panels	All-purpose applications	Suitable for indoor wood-based panel applications where indoor air quality is a key concern



Product Application Boundaries and Applicable Scenarios

5.1 Recommended Applications

This product is specifically designed for indoor plywood applications, and is recommended for:

- Indoor furniture plywood for the European market
- Wood-based panels for interior decoration and renovation
- Standard panel applications requiring low formaldehyde emissions and improved indoor air quality compliance

5.2 Non-Recommended Applications Without Validation

The following applications have not been specifically validated. Direct mass production use is not recommended. If required, dedicated testing and evaluation must be conducted prior to application:

- Outdoor panels requiring high weather resistance or high humidity resistance
- Structural-grade or high-load-bearing engineered panels
- Industrial-grade panels requiring high boiling-water resistance and high mechanical strength

5.3 Market Value Proposition

- Helps panel manufacturers reduce compliance risks associated with updated EU formaldehyde regulations and aligns with the industry' s environmental upgrade trend
- Offers cost advantages compared to high-end European low-emission adhesive systems, supporting optimization of raw material costs
- Provides relevant test reports and technical reference documents to support basic product compliance evaluation and technical documentation requirements for enterprises

6. COOPERATION & VALIDATION

Cooperation Services and Sample Validation Process

*To ensure compatibility with customers' production lines, all new line substitutions follow a standardized process of **laboratory trial, pilot-scale testing, and full-scale** production validation, in order to minimize adaptation risks.*

- Standard samples are provided to support customers in conducting laboratory panel testing and small-scale trial production

- Standardized adhesive preparation and hot-pressing reference parameters are provided to assist customers in optimizing production processes

- A complete set of bilingual (Chinese/English) test reports, NAF No-Added-Formaldehyde declaration, and SDS safety data sheets are provided for technical evaluation purposes only

- Stable mass production and supply capability is currently available, with final delivery capacity subject to confirmation based on order requirements

- Ongoing technical support is provided, including process optimization consulting, compliance documentation updates, and technical Q&A assistance

Key Validation Recommendation:
Customers are strongly advised to conduct third-party re-testing based on their own production conditions.

To ensure product compatibility under different processing conditions, customers are advised to follow the industrial validation process below:

1. **Laboratory Panel Testing:**
Verify basic bonding performance and initial process parameters.

2. **Pilot-Scale Trial Production:**
Validate product compatibility and process stability under actual production line conditions.

3. **Process Parameter Optimization:**
Adjust adhesive mixing and hot-pressing parameters based on wood species, moisture content, and pressing equipment.

4. **Third-Party Testing Verification:**
It is recommended to commission independent laboratories to re-test formaldehyde emissions and related performance indicators.

5. **Mass Production Evaluation:**
After trials and testing, assess long-term stability and feasibility for large-scale production.

Technical Disclaimer and Limitations

1. Testing Data Limitations:
All performance and compliance data presented in this white paper are based on standardized laboratory conditions and selected sample panels. Actual production performance may vary due to multiple factors, including wood species, veneer moisture content, hot-press parameters, workshop temperature and humidity, and operational processes.

2. Application Scope Limitations:
This product is primarily intended for indoor plywood and certain interior wood-based panel applications. It does not claim universal compatibility across all industrial conditions. All mass production applications must be independently validated by customers through sampling, trial production, and process verification.

3. Certification Limitations:
All statements related to low VOC and low formaldehyde emissions are based solely on laboratory test results and do not imply possession of any official certifications, such as French A+, German Blue Angel, LEED, or EPD.

4. Regulatory Responsibility Disclaimer:
This document and its accompanying test reports are provided for technical reference only and do not constitute legal compliance certification. Final regulatory compliance, customs clearance suitability, and market access requirements shall be determined by the latest local regulations and third-party verification results. All compliance and regulatory responsibilities lie with the user.

5. Performance Standard Limitations:
The product has not been specifically certified for high-performance industrial standards such as EN 314, WBP, or BWP. It may meet basic bonding requirements for certain indoor wood-based panel applications.

6. Supply Capacity and Qualification Statement:
This document confirms stable supply capability only and does not constitute absolute commitments regarding production capacity levels, system certifications, or factory qualifications. Relevant qualifications may be subject to separate verification upon request.

Project	Content
Document Title	European Market Technical White Paper
Version	V2.0
Revision Date	2026-05-23
Prepared by	Guizhou Jiadesai New Material Co., Ltd.
Intended Use	For technical evaluation purposes only

Issued by: Guizhou Jiadesai New Material Co., Ltd.
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THANKS FOR YOUR TRUST AND SUPPORT

JOINT
DURABLE
SUSTAINABLE

HPA
We Lead the Way