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ACCELERATED CURING OF BINDERS FOR WOOD PANELS USING HEAT ACTIVATED HARDENERS

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Invention outline (Patent pending)

- **Innovative hardeners** accelerating the curing of formaldehyde-based and polyisocyanate adhesives during the hot pressing stage of wood panel manufacture, enabling optimum gluing performance.
- The developed hardeners **suppress premature curing** of the adhesives during the stages of glue mix application, mat formation and transportation to the press, bringing savings in adhesive resin consumption.
- **Heat activated action and composition** the keys to effective hardening performance.
- **Cost savings** in wood panel manufacture due to increased productivity and reduction of resin loading.

Example 1

Particleboard, UF resin \rightarrow $(\text{NH}_4)_2\text{SO}_4$ vs. LH1 (240°C, 4s/mm)

Formulation	1	2	3	4	5	6
Hardener type	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$	LH1	LH1	LH1
Hardener level	3%	3%	3%	3%	3%	3%
Hardener addition method	In the core mix	In the surface mix	Sprayed on surface layers	In the core mix	In the surface mix	Sprayed on surface layers
IB, N/mm ²	0.53	0.08	0.12	0.35	0.75	0.72
MOR, N/mm ²	13.1	8.5	9.0	12.5	13.0	12.6
MOE, N/mm ²	2650	1450	1560	2430	2650	2540

Example 2

Particleboard , pMDI resin → Glycerol Ethoxylate Hardener (GEH) vs. LH2 (240°C, 4s/mm)

Formulation	1	2	3	4	5	6
Hardener type	GEH	GEH	GEH	LH2	LH2	LH2
Hardener level	15%	15%	15%	15%	15%	15%
Hardener addition method	In the core mix	In the surface mix	Sprayed on surface layers	In the core mix	In the surface mix	Sprayed on surface layers
IB, N/mm ²	0.43	0.22	0.24	0.40	0.65	0.68
MOR, N/mm ²	16.1	10.5	12.0	16.5	15.0	14.6
MOE, N/mm ²	3150	2850	2980	3140	3350	3230

Example 3

Particleboard, PF resin → Glycerol Triacetate Hardener (GTAH) vs. LH2 (240°C, 8s/mm)

Formulation	1	2	3	4	5	6
Hardener type	GTAH	GTAH	GTAH	LH2	LH2	LH2
Hardener level	5%	5%	5%	5%	5%	5%
Hardener addition method	In the core mix	In the surface mix	Sprayed on surface layers	In the core mix	In the surface mix	Sprayed on surface layers
IB, N/mm ²	0.64	0.35	0.38	0.38	0.69	0.65
MOR, N/mm ²	18.5	14.2	12.9	14.1	17.8	18.7
MOE, N/mm ²	2840	2450	2620	2570	2910	2880

Example 4

MDF, UF resin \rightarrow $(\text{NH}_4)_2\text{SO}_4$ vs. LH1 (240°C, 230°C, 210°C, 190°C, 6.5s/mm)

Formulation	1	2	3	4
Hardener type	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$	LH1	LH1
Hardener level	1%	1%	1%	1%
Hardener addition method	In the blow-line	Sprayed on mat surfaces	In the blow-line	Sprayed on mat surfaces
IB, N/mm ²	0.68	0.43	0.72	0.76
MOR, N/mm ²	28.1	22.0	26.5	25.6
MOE, N/mm ²	2650	1560	2430	2540

Example 5

Particleboard, pMDI resin → Glycerol Ethoxylate Hardener (GEH) vs. LH2 (240°C, 230°C, 220°C, 210°C, 5.5s/mm)

Formulation	1	2	3	4
Hardener type	GEH	GEH	LH2	LH2
Hardener level	2%	2%	2%	2%
Hardener addition method	In the core mix	Sprayed on surface layers	In the core mix	Sprayed on surface layers
IB, N/mm ²	0.32	0.25	0.28	0.52
MOR, N/mm ²	7.5	6.8	7.8	8.5
MOE, N/mm ²	1650	1530	1690	1870

Example 6

Particleboard, UF resin \rightarrow $(\text{NH}_4)_2\text{SO}_4$ vs. LH3 (240°C, 4s/mm)

Formulation	1	2	3	4	5	6
Hardener type	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$	LH3	LH3	LH3
Hardener level	3%	3%	3%	3%	3%	3%
Hardener addition method	In the core mix	In the surface mix	Sprayed on surface layers	In the core mix	In the surface mix	Sprayed on surface layers
IB, N/mm ²	0.45	0.13	0.09	0.38	0.42	0.39
MOR, N/mm ²	12.4	9.7	9.2	10.0	10.5	11.6
MOE, N/mm ²	2340	1550	1540	2100	2140	2280

Example 7

Particleboard, UF resin \rightarrow $(\text{NH}_4)_2\text{SO}_4$ vs. $[(\text{NH}_4)_2\text{SO}_4 + \text{LH1}]$ (240°C, 4s/mm)

Formulation	1	2	3	4	5	6
Hardener type	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{SO}_4$ + LH1	$(\text{NH}_4)_2\text{SO}_4$ + LH1	$(\text{NH}_4)_2\text{SO}_4$ + LH1
Hardener level	3%	3%	3%	1% & 2%	1% & 2%	1% & 2%
Hardener addition method	In the core mix	In the surface mix	Sprayed on surface layers	In the core mix	In the surface mix	Sprayed on surface layers
IB, N/mm ²	0.45	0.13	0.09	0.28	0.45	0.48
MOR, N/mm ²	12.4	9.7	9.2	11.5	11.8	12.6
MOE, N/mm ²	2340	1550	1540	2280	2540	2680

Results (Patent pending)

- Strong catalysis effect of the proposed novel hardeners when added only in the surface layers of the boards
- Improvement of physicomechanical properties of the boards, as compared to the reference formulations
- Complete curing of the resins in the core layers of the boards, although no hardener has been added therein

Thank you for your attention!

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