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Date: 12/02/13

1. **SCOPE**
To determine the effectiveness of Rezex A additive addition supplied by Ray Roberts in the reduction of resin loadings for both surface and core.
2. **REFERENCES**
AS/NZS 1859. 1
3. **RESPONSIBILITIES**
Press operators responsible for operating and following the quality plan.
Laboratory Assistant responsible for testing to the relevant standard and preparing samples for external testing.
Raw Board Process Control Leader responsible for providing the relevant specifications and coordinating the trial.
4. **PROCEDURE**
Ray Roberts who developed the trial formulation was present on site to assist with the trial which was conducted on the 12.02.13 when producing 16mm MR wide. The Rezex A additive was dosed via the IMAL resin dosing system in in line with the below addition rates and mixed in with the resin and wax prior to injection into the blenders. A complication arose when the product was found to be non-conductive and therefore the fill probe system would no work and therefore the product had to be manually dosed on a per batch basis.
Board produced during the trial was sanded and cut and placed on hold until conformation test results cleared the product the following day.

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Trial Technical settings

	Control	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
Surface/core ratio %	38	38	38	38	38	38	38
Board density kg/m3	660	660	660	660	660	660	660
10L425 C/L resin %	9.0	9.0	8.1	8.1	8.1	8.1	9.0
Rezex A addition rate core%	-	-	0.05	0.05	0.1	0.1	-
SOA addition core %	3.5	3.5	3.5	3.5	3.5	3.5	3.5
C/L wax %	0.5	0.5	0.5	0.5	0.5	0.5	0.5
C/L glued target mc %	6.8	6.8	6.5	6.5	6.5	6.5	6.8
10L425 S/L resin %	12.5	11.2	11.2	12.5	12.5	11.2	11.2
Rezex A addition rate surface %	-	0.05	0.05	-	-	0.1	0.1
S/L wax %	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Surface SOA loading %	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Surface Urea Loading %	1.0	1.0	1.0	1.0	1.0	1.0	1.0
S/L glued target mc %	13.0	13.0	13.0	13.0	13.0	13.0	13.0

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Production settings

	units	Control	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
Line speed	mm/sec	300	300	300	300	300	300	300
Press temp deg	deg	195-200	195-200	195-200	195-200	195-200	195-200	195-200
10L425 C/L resin imal set	ltrs	90	90	90	90	90	90	90
10L425 C/L resin dose	Ltrs/100 kg chip	10.8	10.8	9.8	9.8	9.9	9.9	
Rezex A addition rate core	mls	-	-	550	550	1100	1100	-
SOA addition core	Mls/10 L resin	600	600	600	600	600	600	600
C/L wax	ltrs	7.3	7.3	8.1	8.1	8.1	8.1	7.3
10L425 S/L resin imal set	ltrs	90	90	90	90	90	90	90
10L425 S/L resin dose	Ltrs/100 kg chip	14.9	13.5	13.5	14.9	14.9	13.6	13.6
Rezex A addition rate surface	Mls	-	390	390	-	-	790	790
S/L wax	Ltrs	6.2	7.0	7.0	6.2	6.2	7.0	7.0
Surface SOA/urea loading	Mls/10 L resin	304	300	300	304	304	300	300
Surface water dose	Mls/100 kg chip	3.9	4.4	4.4	3.9	3.9	4.4	4.4

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Tested at Dardanup SO 109904

	Contro l a	Contro l b	Trial 1a	Trial 1b	Trial 2a	Trial 2b	Trial 3a	Trial 3b	Trial 4a	Trial 4b	Trial 5a	Trial 5b	Trial 6a	Trial 6b	Std
Prod Rate m ³ /h	39	39	39	39	39	39	39	39	39	39	39	39	39	39	-
Press temp deg	196	196	197	195	197	197	197	197	197	197	197	197	197	197	-
Density kg/m ³	669	670	670	657	671	669	674	680	685	682	681	676	685	680	-
IB Kpa	735	757	631	723	645	661	571	663	621	669	616	608	665	628	>300
MOR Mpa	18.3	17.6	16.8	17.1	16.3	16.4	16.9	17.5	16.6	17.5	16.4	16.0	17.1	17.1	>12.0
MOE Mpa	3333	3127	3072	3207	3234	3136	3429	3139	3064	3262	2848	2641	3251	3226	-
24 hr swell %	5.9	6.2	6.1	5.6	7.7	7.1	6.8	7.6	7.6	7.4	7.7	8.1	6.9	7.6	<15.0
2 hr boil Mpa	5.3	5.4	5.6	5.4	5.0	5.0	5.3	5.9	5.9	5.9	5.4	5.6	5.5	5.8	>4.5
Surface soundness N	1794	1751	1635	1542	1481	1418	1383	1490	1428	1541	1491	1435	1428	1403	>900

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Tested at Ballarat Test Centre SO 109904

	Control avg	Trial 1 avg	Trial 2 avg	Trial 3 avg	Trial 4 avg	Trial 5 avg	Trial 6 avg	Std
Density kg/m3	660	650	650	660	655	670	665	-
IB Kpa	760	760	670	690	680	690	720	>300
MOR Mpa	19.0	18.2	18.0	18.7	18.3	18.4	18.9	>12.0
MOE Mpa	3095	2945	3030	3085	3045	3005	3000	-
24 hr swell %	5.1	5.0	5.5	5.5	6.3	6.6	5.2	<15.0
2 hr boil Mpa	5.92	5.73	5.22	5.96	5.71	5.23	5.93	>4.5
Surface soundness N	1790	1690	1530	1700	1730	1660	1730	>900

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Trial Observations

1. The additive was found to be non-conductive and therefore will not work on our current Imal conductive probe fill system. Ray Roberts has agreed to look at the formulation with a view to increasing the electrolyte levels in the product. He also organising an additive to be sent over to add to the current container of Rezex so it can be used with our system.
2. The product has a very distinctive odour which can be offensive to some people. Ray Roberts has suggested he is working on a low odour product which will be available in approximately 6 months.
3. The product does have a negative reaction with the wax emulsion and therefore adequate stirring is required when the product is blended with the resin and wax in the IMAL resin tower. We had no issues in the core section but had some localized reaction with the wax emulsion in the surface layer mixing tank due to poor stirrer design. This can be easily overcome by welding another mixing paddle 200mm up from the existing surface layer stirrer.
4. There were no other production related issues whilst running the trial.

Conclusion,

From a board property perspective all passed with each Rezex addition and therefore the trial boards were cleared for commercial use.

Summary of the board property results,

1. 24 hr swell properties increase from the control and is typical when adding a surfactant based additive. All results are still well within spec and will not pose any issues at the customer base
2. Internal bond results did drop by approximately 13% with the addition of the rezex and 10% lower resin loading but still well within spec. Internal bonds for 16mm MR above 550 Kpa are considered adequate for this product.
3. The MOR values dropped by an average of 3-5% from the control values. All results are still well within spec and will not pose any issues at the customer base as values above 15 Mpa are considered adequate.
4. The MOR-A value improved with the addition of Rezex based on comparison with the control values for boards tested at Dardanup but were alike for the duplicate test results at Ballarat, the discrepancy between the lab results may be due to board aging and conditioning.
5. The surface soundness dropped by 17% when compared to the control values for boards tested at Dardanup which is a concern as historically, this value is directly linked to machinability issues with flat bed router customers, however, results from Ballarat suggest a smaller drop of 5% from control which may be due to aging and conditioning of testboards.

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6. The odour of the additive is a real OH&S issue and therefore will not be using it commercially in its current form. Ray Roberts is working on a low odour version which may become available within the next 6 months. We will however use the product in its current form for trial runs.

When discussing the results with Ray Roberts and raising our concern in relationship to lower surface soundness, his experience suggests that when the larger flake in the surface are not adequately coated with resin, this creates a weak point which has a propensity to chip out based on all his studies on the subject. He claims that with the addition of the Rezex additive, the surface tension of the resin is reduced therefore it spreads better on the flake and reduces the likelihood of the larger flake chipping out when exposed to the forces of the compression cutters therefore lower surface soundness does not always mean poor machinability.

Therefore our main focus moving forward is board machinability and so will form the bases for the next round of trials which will look at Rezex addition in the surface layer only, incorporating the 10% reduction in resin loading.

The trial will consist of producing panels with 0.1% and 0.2% rezex addition rates in the surface. 1 pack of 3600 x 1800 will be made from each dosage rate plus 1 control pack which will then be tested for machinability using a flatbed router at one of our cabinet making customers in Rockingham.