Bio-based coating formulation and application testing

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Coatings are everywhere - Providing protection, decoration and much more!
Target areas of application for project PERFECOAT are:

	Architectural coatings	UV curable wood coatings
Market	Construction, interior & exterior paints, trim, DIY	Parquet floor, furniture
Typical substrates	Mineral surfaces	Wood
Application method	Brush, Roller	Roller (industrial), Spray
Key features	Broad range of paints with very different properties (gloss, binder technologies) Importance of storage and color stability High mechanical resistance & barrier properties	Ultra low VOC Excellent film building and hardness Extremely high efficiency and limited loss of material (roller) No oven needed
Challenges	Regulatory compliances Wet scrub resistance and water resistance	Need UV light for curing Limitation for application, especially for complex structure and in house application Matting

Bio-based fillers: Assessment of the basic properties within an architectural coating formulation
Key properties: Decorative aspect / White color / Mechanical resistance

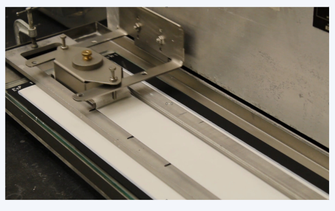
Test formulation

Matt wall paint	Amount in g
Water	42,76
TEGO® Dispers 711W	0,25
TEGO® Foamex 18	0,25
CALGON® N	0,05
NATROSOL™ 250BR	0,60
KRONOS® 2190	6,70
SOCAL® P3	12,56
LUZENAC® OOC	5,02
OMYACARB® 5 GU	23,44
ACRONAL® S790	8,37
TOTAL	100,00

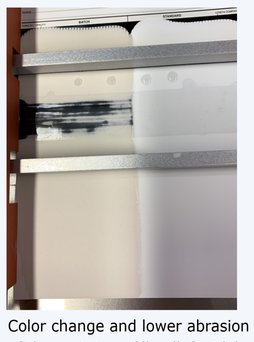
High filler content of 41%

Test equipment

Wet scrub tester



Test result



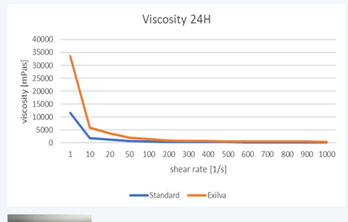
Color change and lower abrasion resistance of the prototype filler (left side) compared to the standard (right side)

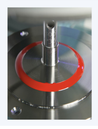
Micro fibrillated cellulose (MFC) for Architectural Coatings
Evaluation of the effect of bio-based fibers (EXILVA®) on rheology and cracking resistance in architectural coatings

Test formulation:

Component	Standard	Exilva
Water	27.6	24,4
CALGON® N	0.1	0.1
Defoamer	0.3	0.3
TEGO® Dispers 715 W	0.3	0.3
TYLOSE® MH 30.000 YP 4	0.4	0
Ammonium hydroxide sol.(25 %)	0.1	0
Exilva F01 V, 10% a.m.		3.6
TIOXIDE® R-TC 90	9.0	9.0
OMYACARB® 10 GU	8.0	8.0
OMYACARB® 2 GU	8.0	8.0
OMYACARB® Extra CL	5.0	5.0
LUZENAC® OOC	2.0	2.0
SOCAL® P3	5.0	5.0
Dissolver 30 min.		
ACRONAL® S 790	32.0	32.0
Texanol	2.0	2.0
ACTICIDE® MBS	0.2	0.2
Acrysol RM2020		1.7
Total	100.00	100.00

Test equipment & result rheology: use of MFC allows to adjust the rheological profile in the desired way





Test result: favourable cracking resistance of thick films

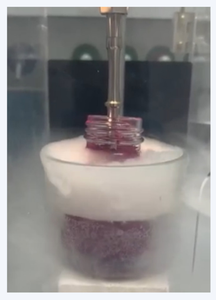
Biobased pigments in water-based architectural coatings – architectural paints are often white but end consumers also want to be able to obtain various colors

Test formulation for a water based pigment preparation

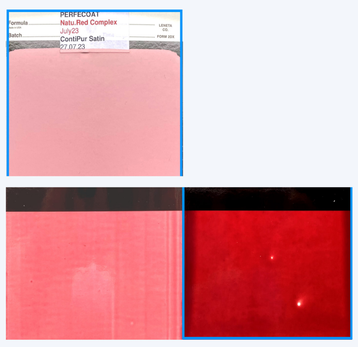
Component	Amount [g]
Demin. Water	44.4
ZETASPERSE® 3800	22.5
TEGO® Foamex 810	1.0
AMP-90	2.0
Pigment	30.0
Parmetol K6	0.1
Total	100.0
AsoP [%]	30

Test equipment

Ultrasonic dispersion method established for small quantity biobased pigment samples



Test result: biobased pigments provide quite intensive colors



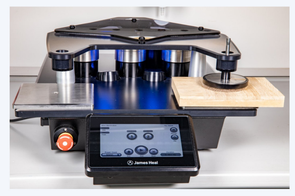
Challenge: stability of color after long-term storage

Biobased filler / functional additive for UV-curable wood coatings

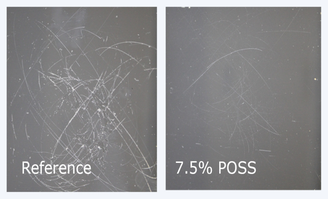
Test formulation

Component	Amount (g)
Ebecryl 5129 (resin)	30
TPGDA (reactive diluent)	33
TMPEOTA (ethoxylated trimethylolpropane, triacrylate - resin)	30
TEGO Rad 2100 (surface control)	0.6
Genocure MBF (initiator)	2.2
Darocure 1173 (Initiator)	2.2
i-Propanol (Diluent)	2.0

Test equipment: Mini Martindale abrasion tester



Test result

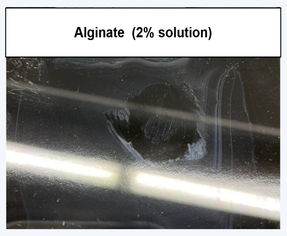


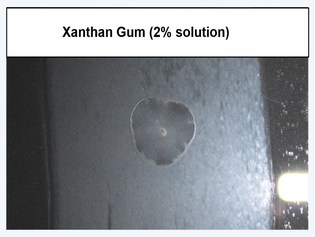
The addition of POSS to the UV wood coating enhances the mechanical resistance - less scratches are seen at the surface compared to a reference without POSS

Binders for water based respectively UV-curable formulations
Oligosaccharides & their film forming properties – modification needed to meet requirements of coating application

Draw-down of aqueous alginate solution shows good film formation

Water resistance test (a water droplet is placed onto dried film and removed after short waiting time)





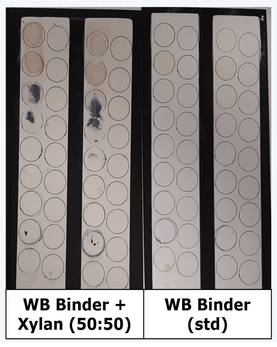
Challenge: water resistance of non-modified oligosaccharides
The film is degraded due to water redissolution

Demonstration of performance & readiness level

Architectural Coatings

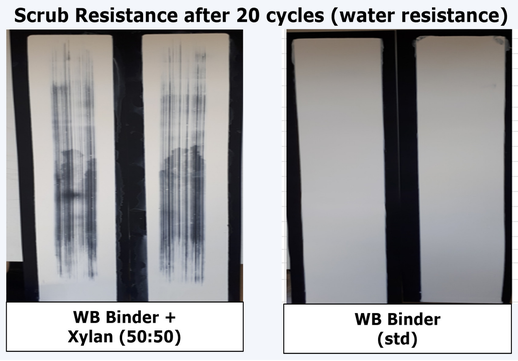
Tests for chemical stain resistance and scrub resistance were conducted twice for each product.
In both tests, WB BINDER demonstrated superior performance. The use of XYLAN in the paint formulation showed decreasing performance in both tests.

Chemical and Stain Resistance



WB Binder + Xylan (50:50) | WB Binder (std)

Scrub Resistance after 20 cycles (water resistance)



WB Binder + Xylan (50:50) | WB Binder (std)

Summary:

- samples of multiple components for coating formulations were assessed regarding key properties
- pigments could be processed & provide good color development but long term stability of color not sufficient yet
- incorporation of fillers could be easily achieved but mechanical needs improvement
- micro fibrillated cellulose shows expected rheology modification as well as benefits in mud cracking performance
- addition of modified POSS leads to benefits in resistance
- binder development is a more complex task

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