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Hydrophobic coating using natural preservatives

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Abstract: *Over the past few years, the scientific community as well as the world's coatings industry has seen the introduction of oxide/polymer-based superhydrophobic surfaces and coatings with exceptional water repellency. This research attempts to discuss and explain the latest superhydrophobic technological breakthroughs. This project will represent the trial attempt in the making of water resistant coating which will be free from silica nanoparticles and will study over the field applications. To conduct the tests, three different coating were prepared by making the use of Beeswax, Silica fume and Octeo silane respectively for having a comparison of the characteristics, which will have the water repellency, antibacterial properties and will possess high durability along with good chemical resistance. Since the beeswax is highly inert and is widely used as an waterproofing agent so by conducting this study we have studied the ability of the beeswax made coating by using processed Linseed oil for strengthening the characteristics.*

Keywords *–Anti-bacterial, Solvent, Drying oil, Organic wax, Salt template, Superhydrophobicity.*

1. INTRODUCTION

Surface with anti-wetting and anti-staining particles have generated a number of hobby amongst experimenters from each primary development side and software side of the problems and also amongst multitudinous stakeholders with inside the enterprise and the academia. There has been a increase with inside the amount of the scientific studies conducted in this area since the early 2000, and multitudinous reviews that have been published in this area are mentioning the multitudinous rudiments of those shells. Superhydrophobic shells have extremely inordinate water repellency, and any similar means is dependent on a fixed of parameters, specifically the bottom shape and the bottom power.[1] The bottom power may be reduced either through the use of a chemical film which is carpeted or stuck to the bottom or through modifying the being bottom chemistry or through producing micro-and nanotextures which can emulate the CassieBaxter or Wenzel goods as detailed latterly. Further, due to the ultimate cause of converting superhydrophobic parcels, a look at of producing procedures to supply bottom textures becomes critical to the know- style of the area.[6]

Coatings are a cost effective result and the request offers numerous products, which are generally grounded on tempera, polyurethane or alkyd. Lately, scientific groups have started to probe the possibility to produce superhydrophobic coatings on timber with a static water contact angle (WCA) above 150° [3]. Nature gives numerous exemplifications of similar shells, including the notorious lotus splint, the leaves of nasturtium or the petals of roses. This has inspired experimenters to come up with artificial superhydrophobic coatings. To achieve this, the bottom has to correspond of a low bottom free power material that has veritably inordinate roughness. The exact armature of this roughness determines the superhydrophobic state. The lotus effect describes a bottom with WCA above 150 ° and a sliding angle (SA) below 10 °. In discrepancy, in a bottom flaunting the rose petal effect, a WCA above 150 ° and inordinate adhesions occur. The part of the roughness is to increase the geometrical bottom area, making water-soaking lower stoutly favorable. However, the bottom can trap air, so that a water drop sits primarily on these air pockets, If the roughness is indeed more increased. This is especially true in the case of hierarchically structured shells. Also, the environmental and toxicological long- term goods of nanoparticles are an ongoing content of exploration with numerous open questions. Choi etal. introduced a salt templating system as a straightforward way to produce superhydrophobic polydimethylsiloxane (PDMS) [2]. This elegant fashion causes a direct structuration of the hydrophobic bottom material, so that the final coating doesn't contain any potentially dangerous patches. In their work, the authors simply settled micronized sodium chloride patches onto uncured precursor polymer and after curing, washed them out with water. The imprints of the patches in the bottom handed the necessary roughness to achieve a WCA of 151 ° as well as a low SA. [10]

Drying canvases and natural waxes are some of the longest known hydrophobic protectants and are effective water-repellents for the treatment of timber. Because of environmental enterprises, bio-based coffers in defensive coatings witness a golden age. An increase in request share of drying canvases and waxes in the recent times reflects this trend. Drying canvases are another class of bio-based water-repellents enforced in timber safety. Reports that the Chinese Empire used Tung canvas in its boat coatings illustrate their literal use. The most important drying canvases are the factory canvases linseed canvas and Tung canvas.[2] Chemically, they're glycerol esters of polyunsaturated adipose acids. Contrary to their deceiving name, drying canvases don't dry, but suffer a polymerization response involving their double bonds. After software, the liquid canvas penetrates the timber bottom and forms a polymeric network through replying with oxygen from the air. This process is called auto oxidation and issues in the conformation of a solid film. While drying canvases have had their place in timber safety since major times, their possible software in environmentally friendly superhydrophobic coatings has been greatly overlooked. Same as waxes, they're hydrophobic, but due to the fact of their capability to crosslink, they could offer the advantage of advanced mechanical stability, temperature stability as well as solvent stability. Generally, drying canvases bear drying agents grounded on cobalt mariners and mariners of different transition essence to beget the auto oxidation response [13].

We demonstrate a easy system for the fabrication of superhydrophobic shells on timber and also on different CEM (Civil engineering accoutrements) containing only linseed canvas and beeswax.

II. METHODOLOGY

2.1 Materials

Sodium Chloride (CAS No. 7647-14-5) was bought from local market,n-butyl acetate was bought from local chemical shop (CAS No. 123-86-4) and Natural Beeswax (CAS No. 8012-89-3) was obtained from Clia Naturals co. (Cochin),Double Boiled Linseed oil (CAS No.68649-95-6) was obtained from the local shop of building materialsShree Shanti Jain Stores (Borivali, Mumbai), Isopropyl alcohol (CAS No. 67-63-0), Dilute Acetic acid (CAS No. 64-19-77), Fumed Silica (CASNo. 112945-52-3), n-OctylSilane(CAS No. 871-92-1) were all used from the paint industry and Deionized water was used in all experiments with beeswax. A piece of plywood was cut in 3 piece in the dimensions of 60 mm × 60 mm × 15 mm in longitudinal, radial and tangential direction.

2.2 Coating Procedure

When coating of beeswax was made two different coatings was also made from Silica fume and Octeosilane using them as a basic material for the hydrophobic coating. This was done for having a comparative study between all the three coatings respectively.

2.2.1 Coating Procedure for Beeswax coating.

Beeswax and/or Linseed oil were stirred in n-butyl acetate in a weight ratio of 1:10 at 65 °C to ensure proper mixing of the components and the solvent. The coating procedure was as follows:

1. The wood sample was vertically dipped into the coating solution for 5s.
2. Excess coating solution was removed with a paper towel from the bottom edge of the sample.
3. After 4 days of forming the coating solution the specimen was then horizontally placed underneath a 35 μm steel mesh carrying 1 g of ground salt for conducting the salt templating. With the help of a pestle, it was sieved onto the sample for a duration of 40 s, so that the surface was completely covered with the micronized salt.
4. Samples were dried and cured at 20 °C and 65 % RH for at least one week.
5. They were subsequently washed for 10 min in a beaker containing deionized water, which was exchanged once after 2 min. The samples were then dried and stored at 20 °C and 65 % RH. The coating solution designations W1L0, W1L1, W1L5, and W0T1 signify the weight ratio of beeswax (W) to linseed oil (L) being 1:0, 1:1, 1:5, and 0:1, respectively. Samples, that received the treatment described above, were named W1L0S, W1L1S, W1L5S, or W0L1S, the S meaning salt templating. In a second group of samples, point 4 of the procedure above was omitted, so that no salt templating took place. These samples were accordingly named W1L0N, W1L1N, W1L5N, or W0L1N. [2, 10]

2.2.2 Coating Procedure for octyl silane hydrophobic coating.

100 ml of an Isopropyl alcohol was taken by measuring cylinder; 5ml of water was added into the solution. The pH level of the solution was adjusted to 4.5 by adding up the dilute Acetic acid. Now, under a constant stirring

5gms of octyl silane was added slowly and after the completion of the process the formed solution was kept for 24 hours at a uniform temperature to gain the maturity.[12]

2.2.3 Coating Procedure for fumed silica hydrophobic coating.

Thermoplastic resin was taken in the ratio of 97 grams with 30% solution of xylene. 3 grams of hydrophobic fumed silica was dispersed in the above formed solution and to ensure well mixing of the solution it was stirred by the mechanical means. The solution that was formed was filtered later and the obtained filtered solution was in transparent form that could be used as a lacquer.[13]

III. RESULTS

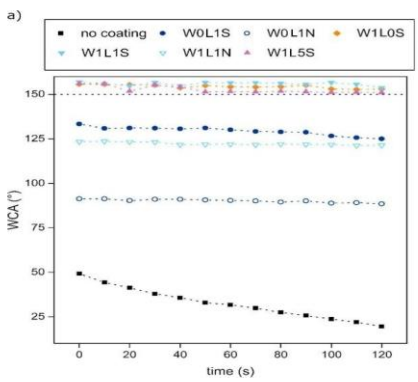
3.1. Stability of the coating solutions

At 65 °C all variants were in the liquid state. In W1L0 and W1L1, which had the highest amount of beeswax, precipitation became apparent at a temperature below ∼49°C. At 40°C, both variants had already formed a well visible white precipitate of beeswax on the bottom. At this temperature, in W1L5 all components were still liquid, but precipitation became apparent below a temperature of ∼34°C. The smaller amount of wax contained in this variation could stay in solution down to a lower temperature. At 26°C, all variations had formed well visible precipitates except for W0L1, which is owed to Linseed oil being liquid at room temperature.

3.2. Results of contact angle and sliding angle measurements

The stationary water contact angles of wood samples subordinated to different coating procedures using fusions of linseed canvas and beeswax. Measures were taken 30 s after the water drop was placed onto the face. For uncoated wood an average water contact angle of 45 ° ± 9 ° was calculated, which is typical of lately prepared shells for this wood species (34). By comparison, carpeted samples of all variants showed clear increases in contact angle. The DBLO canvas (W0L1N) coating only handed a slight hydrophobisation with an average contact angle of 86 ° ± 3 °. By comparison, pure beeswax (W1L0N) was more effective, with average contact angles of 115 ° ± 2 °. The difference between the wetting parcels of DBLO canvas samples and samples containing wax can be seen as a less convex shape of its water drop. Slight but significant fresh advancements in hydrophobisation were achieved when using fusions of both factors, i.e. canvas and wax. Supposedly, the combination of canvas piercing the wood face to a certain degree with wax furnishing face hydrophobisation is most effective. The content of DBLO canvas in the phrasings W1L1N and W1L5N didn't affect in strong differences of contact angle, demonstrated by average values of 125 ° ± 5 ° and 120 ° ± 10 °, independently.

IV. FIGURES



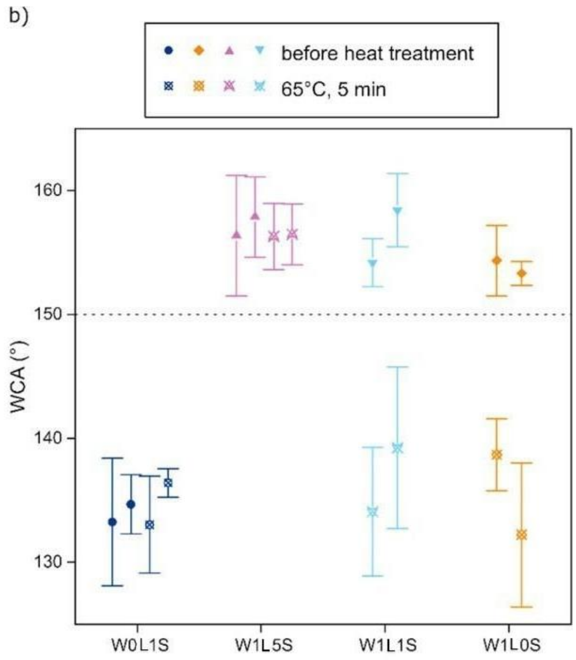


Fig.b) Difference in the WCA before and after heat treatment for all coatings produced by salt templating.

V. CONCLUSION

On the idea ongoing paintings and the studies research performed via way of means of us, right here we are able to finish that this paintings can serve as a starting point for future studies on the preparation of improved coatings based on drying oils and natural wax. Toxicologically safe superhydrophobic surfaces could play an essential role whenever the surface is potentially in contact with food or the skin. It is also the first coating based primarily on plant oil to exhibit superhydrophobic properties. The simple concept used herein could be easily transferred to different film-forming materials, e.g. alkyd paints which have higher business importance than drying oils. Notably, the proposed surface remedy could be used in a variety of applications and is via way of means of no means limited to wood as a substrate.

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