

Study on improving dust-proofing performance of Teflon – based paint film

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ABSTRACT : *Dirt-pick up for water based coatings, as a well-known optimal solution the paint industry, has been the center of attention amongst scientists and producer. The choice of using decorative paints with everlasting colors, antimicrobial, water-resistant, weather-resistant and dirt-pick up is a matter of concern and necessity. Decorative paint used for concrete-cement surfaces, beautifying your house. Besides, cost as one of the most important issues. Hence, PTFE with a combination of several materials, such as acrylic emulsion resin, Nano silver, can have competent capacity or even the potential of double dirt-pick up properties. Current review gives a promising aspect to the knowledge of various combinations of PTFE with specific materials as a polymer to improve and optimize the potential dirt-pick up properties.*

KEYWORDS: *self-cleaning, dirt-pick up, beading effect, Teflon.*

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I. INTRODUCTION

Today, the challenges for dirt-pick up researchers are mostly about air pollution and environmental contamination in buildings specially on indoor and outdoor building surfaces. Due to this wide range of dirt-pick up applications for decorative paints. The dirt-pick up materials and derives involving chemicals such as ZnO/TiO₂/ Ag-SiO₂-TiO₂/PTFE/ Polysilazane, etc. With specific physicochemical characteristics have to be considered for all combinations. Moreover, the products of this technology have successfully been commercialized in the area of environmental application construction and building and so on. In case of decorative paint, Nano silver and super hydrophobicity - induced dirt-pick up are two strategies which can defined. Acrylic emulsion resin combined with PTFE and Nano silver, which have high potential dirt-pick up properties.

Environment and buildings contamination and infestation by insects adhered to various surfaces and solar panel can be cleaned simply via flowing water. The other way, in order for the building to be maintained by surface painting, one effective and strongly applicable solution is the use of PTFE combined with acrylic emulsion resin. The most efficient material with PTFE, extreme stability, and low cost which is commonly used PTFE. The second section of this paper shows three methods for monitoring systems of solar plants. The third section discusses communication and monitoring system for wind turbines, and finally the conclusion is discussed in the fourth section.

PTFE is a synthetic polymer based on the tetrafluoroethylene polymerization reaction. PTFE is a fluorinated organic compound, so it is heat resistant, hydrophobic and non-toxic to users. Because the molecular circuit contains a fluorine-carbon bond, which is a single bond with chemical stability, PTFE has many excellent properties such as high strength, small coefficient of friction, the best resistant to abrasion, heat resistance, chemical resistance, dirt-pick up, etc. PTFE does not brittle in the air, does not soften in boiling water, does not change state from -190 degrees to 300 degrees, extremely resistant to chemical agents.

PTFE is one of the popular surface protection applications in many fields of different industries in the world in general and in Vietnam in particular. Therefore, the use of PTFE as a compound in the paint will provide an anti-dust coating.

II. APPLICATIONS AND FEATURES

Self-cleaning of a surface can be defined by two different mechanisms. First, it has the ability to connect to the surface wettability, and second, exhibit water resistance characteristics into surfaces. There are many articles that present research works with the purpose of understanding this matter that how contaminants

affect the environmental conditions and buildings. Moreover, they mention the impacts of the construction procedure, the self-cleaning reaction at Nano-size scale, and through contexts. Among other parameters, these recorded factors are based on visual observations and also have measurements of contaminated self-cleaning sample. This review has tried to focus on of available self-cleaning material that are currently used in industries is PTFE combined acrylic emulsion resin.

These composites have the potential to be applied for use in buildings and environment surfaces. For clear examples in this area, it can be focused on wall and roof surfaces, etc., for use in industry. The demonstration of self-cleaning materials includes a lot of information about properties, and manufacturers which are provided by manufacturers due to evaluate the application of self-cleaning materials in their products.

III. BEADING EFFECT

Lotus leaves have long been considered the gold standard for their ability to maintain dryness in nature. On the lotus leaf, the water droplets will land in the shape of a thin cake, then quickly bounce back into a symmetrical drop. The lotus leaf effect has been applied to the production of a wide variety of industrial fibers, paints and waterproof roofs. Their secret is the high "angle of contact".

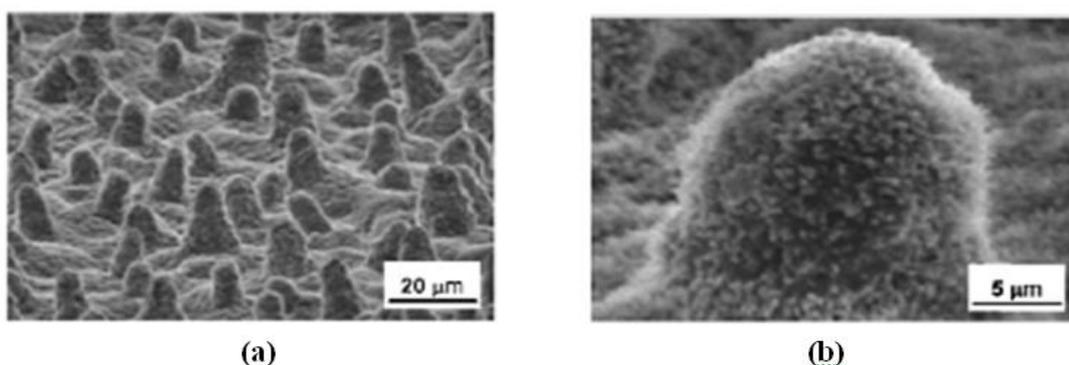


Fig.1. Two hierarchical structure of the lotus leaf

A large tumor on the leaf surface (a) and a large tumor (b) enlargement shows that a small tumor is nanometer on the surface of a large tumor. Also because of the nanometer tumors, the water drop has only 3% of the area in contact with the lotus leaf surface. This results in an obvious result that the water droplets can move freely when the surface is tilted and entrapped with dust giving the lotus leaf self-cleaning properties. Water falling on the surface of the lotus leaf will roll like spherical droplets, sweeping away dirt and germs. Research on super hydrophobic and anti-dust surface based on lotus leaf effect phenomenon in reality is of interest to scientists.

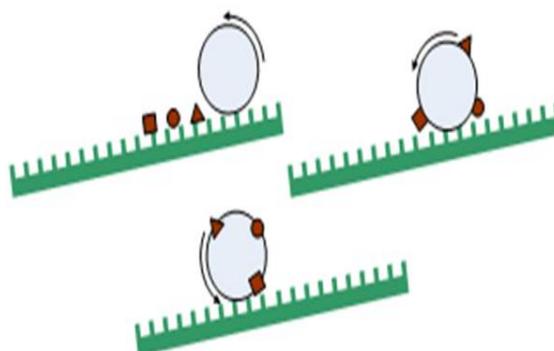


Fig.2. Mechanism of "self-cleaning" on lotus leaves: round water drops wash away dirt.

IV. METHOD

Self-cleaning test procedure

Laboratory equipment includes: Dimmer (UV / Vis / NIR accessory 3D NB Detetor Module), UV light. The dirt solution used for testing is prepared with a mixture of organic acids including stearic acid, ethanol, adipic acid, propane-2, pure water, $(Al_2Si_2O_7)$, $CaNO_3$, $CuNO_3$, $ZnNO_3$, K_2SO_4 , Na_2SO_4 , $CaSO_4$, $NaCl$.

Self-Cleaning test procedure showed as Fig.3. Based on the experimental simulation model, determine the results of self-cleaning efficiency of the paint film, value%.

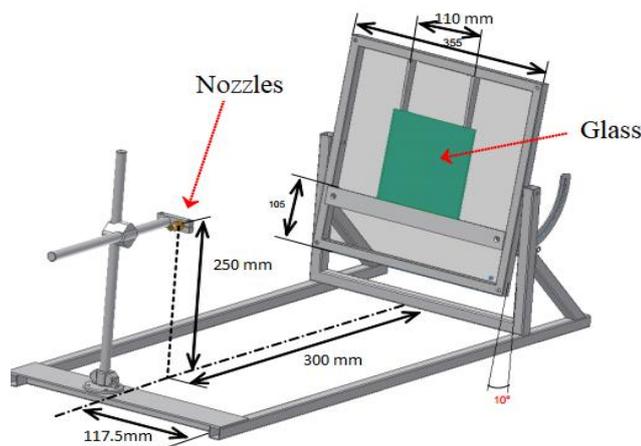


Fig.3. Test equipment

Antibiotic activity value of the paint mixture

Antibiotic activity values were checked according to the agar perforated method. The agar punching method is one of the methods to evaluate the effect of reagents on the development of in vitro cultures of microorganisms. The principle of this method is to determine the ability of the drug to diffuse into the agar layer, which inhibits the growth of bacteria around the agar hole. The larger the inhibitory area, the stronger the effect of the drug.

V. RESULTS

Self-cleaning performance of paint samples based on PTFE is from 75% - 85% ability to self-clean the surface, anti-dust on the surface. From a dirt solution made in a laboratory to a test procedure, it shows that the use of Capstone FS-61 provides a highly efficient dust cleaning effect for the paint film. Control with samples not using Capstone FS-61, surface cleaning efficiency was 60%. In addition, 06 experimental samples using Capstone FS-61 together with 06 samples without using Capstone FS-61 on Acrylics base are compared with current paint products that are proven to be superior and dominant. Vietnam's paint market includes premium outdoor gloss Weathershield and Jotashield for optimal color fastness. For Weathershield products with gloss finish and Jotashield, the optimal color fastness results in self-cleaning performance of 80% and 70%, respectively.

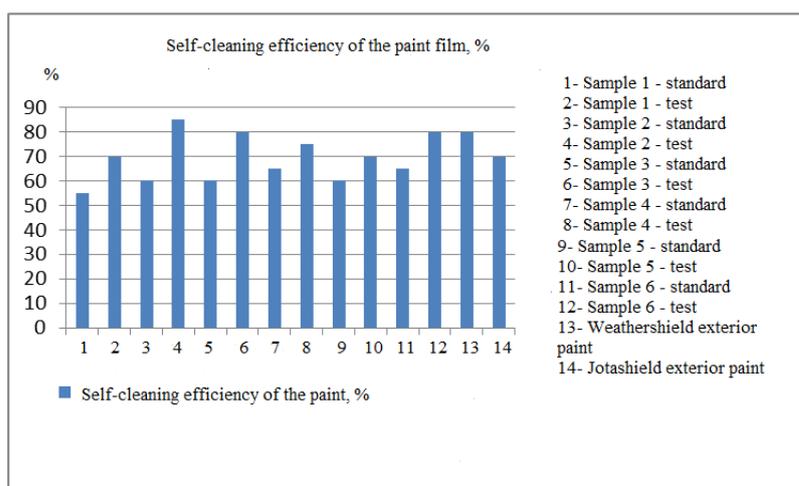


Fig.4. Self - cleaning performance of paint film under test and comparison with competitors

Antibiotic activity values of the test sample using Nano Silver and PTFE

Results 3 out of 6 test samples were active against strains of Staphylococcus, Escherichia coli and Candida albican fungi at a test concentration of 5 mg / cloudy well with a sterile ring diameter as described below.

Table 1. Test results of antibiotic activity of samples tested using Nano Silver and PTFE

STT	Form name	Volume	Diameter of sterile ring (mm)		
			Gram (+)	Gram (-)	Mushroom
			Staphylococcus	Escherichia coli	Candida albican
1	GA-4	50 µl (5 mg test sample / well)	6	8	21
2	GA-5		6	8	21
3	GA-6		6	8	21

VI. RECOMMENDATIONS

From the results of the study, it is recognized that further research is needed to improve the properties of the anti-fouling paint film based on the PTFE to help prevent water from entering the paint film surface, prevent dirt from sticking to the surface, prevent UV rays, protect the surface of buildings with cement - concrete and some other materials such as wood, natural stone or metal. And also need to study more about the durability of anti-dust effect on the surface of works under the direct impact of natural weather as well as durability over time.

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