Combating bacteria via silver-dammar coating

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Natural resins obtained from plants to be used as a coating element to enhance durability and anti-rust properties.

Coating systems are formulated using a mixture of dammar, silver and nanoclay in varied compositions. Generally the problems in the coating area are poor coat quality, poor adhesion, long curing time period, corrosion attack, attachment or bacteria attack which could also cause corrosion attack which is called as Microbiologically Influenced corrosion (MIC). These disadvantages of coating system and coating surface could lead to coating failure thus leading to substrate damage especially metal substrate.

Dammar or triterpenoids resin are natural resins which can be isolated or obtained from plants that belong to the family Dipterocaupecea sp. Dammar is well known for its glossy properties and the plant can be found abundantly in Sarawak, Malaysia. Thus, it can be used in the coating industry. The role of the dammar is to improve the adhesion property, self cleansing property and shorten the coating curing time. Silver nitrate has quite a long history of usage as an antibacterial agent. Silver possesses good antibacterial activity. The addition of silver onto the coating system, introduces the antimicrobial property for the coating system. It is used in a variety of applications for example as protective coating for concrete, brick, wood, metal and others. It is considered as a good anti-microbial coating due to its low toxicity to where the toxicity is lower than of bacteria. However, the antibacterial activity depends on the Ag+ ions released by the silver. If it is too high, it will result in

cytotoxicity. Thus to overcome this problem nanoclay was added into the coating system. Clay is a good absorbent which belongs to the phyllosilicate group. In this case Montmorillonite clay was used as the absorbent. Montmorillonite clay form could absorb compound and store it in the pore without leaching out the compound to the surrounding environment.

In this research work, the polyol is modified by using a solvent and mixed with dammar in varied compositions. Silver nitrate is incorporated into the optimum composition of polyol-dammar, followed by a small amount of Nano clay is dispersed into the modified Silver-polyol-dammar mixture. Then the paint mixture is spin coated onto polished Aluminium Q-panel as a substrate and is left to dry at room temperature. This research describes the characteristics of the dammar based paint system. Adhesion property is evaluated by using crosshatch test and pull-off test. The crosshatch test method is based on ASTM D3359 standards. The wettability property of a coating is characterized by using contact angle measurement. The resistances of paint systems are also described against microbial activity by using disc diffusion and agar well diffusion method.

The result of crosshatch and pull-off test shows that the coating system containing 50 wt. % of dammar (50 PD) exhibits an excellent adhesion property. The addition of dammar to polyol helps to increase the contact angle measurement up to approximately 50 degrees. The antimicrobial activity of silver nanoclay coating was demonstrated by using disc diffusion and agar well diffusion method. The antimicrobial activity was evaluated against a few negative gram bacteria and positive gram bacteria. K. pneumoniae, E. coli, S. aureus, P. aeruginosa and B. subtilis. Moreover it is also tested against fungi, C. albicans (fungi). The largest inhibition diameter zone against E. coli and S. aureus is obtained for the silver nanoclay polyol dammar, namely PDS3 coating system.