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Isolation and Characterization of Fungi Associated with in-Can Degradation of Paint

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Absract
This study was carried out to determine the isolates of fungi types associated with in-can degradation of paint. Thirty-six paint made up of water based and emulsion in equal numbers obtained from various location in the southwest Nigeria were investigated by conventional biochemical cultivation on selective medium. Growth of different fungi isolates were obtained in varied proportions in both water based paint and emulsion paint. Rhizopus and Aspergillus spp were predominant in this study while other fungi; Absidia, Monilia, Alternaria, Fusarium and Penicillium spp were also recorded in varied density.

INTRODUCTION

Fungi are unicellular or filamentous organism that are devoid of chlorophyll. They otherwise known as mildew/moulds and require minimal amount of water to grow. In the can, both water and solvent borne paint are prone to attack.. A can of waterborne paint is an ideal environment for microorganism (bacteria/fungi) to grow due to the available nutrients sources such as surfactants, thickeners and defoamers, available water supply, adequate oxygen supply and suitable pH and overall manufacturing cleaningness. Consequently, the absence of insufficient fungicide and long storage beyond the stipulated time can aid the development of resistant fungi and their spore in manufactured house paint before use.

Aqueous raw materials such as wetting agents, polymer emulsions, pigment dispersion and clay slurry are susceptible to microbial degradation unless these materials are manufactured with biocidal protection and under aseptic condition. Water-borne coating paints are potentially prone to in-can attacks by both nutritionally non exacting fungi and bacteria, because the in –use injection of recycled water can be a source of contamination. . Fungi organisms reproduce by spores and can be a significant deterrence to paint adhesion. The sole intention of paint manufacturer in adding fungicidal agent to paint is to prevent the in-can degradation. The temperature in the tropic could be an in-can spoilage factor for the paints on storage rack. Microorganisms are ubiquitous and they can support each other symbiotically because the metabolite release by one can be enzyme chain that can be usurped for growth of others The typical plant environment coupled with air in-let system into the mixing and storage tanks can occasionally be contaminated by fungi.

Increasingly, it has become evident that many water based house paints can be degraded by the presence and or activities of microorganisms Fungi laden paint can reduce the shelf-life and degrade the quality of paints. The use of a fungi laden paint in a location such as food preparation areas, hospital areas and biological laboratories where it is important to limit the growth of microbes in the interior surfaces can aid the epidemiology of resistant microbes occasioned a act of washing a wall surface. Hygienic paints heavily laden with biocide is therefore needed to combat the episode of resistance. The effects of class of organisms that can grows in paint irrespective of the additive added depends on many facto of which storage is of prime important. Anaerobic microorganisms in the finished paint, raw water can oxidize organic matter using electron acceptors (an oxidation-reduction types of reaction) that leaves large acidic fragments in the paint than oxygen for nutrients, during their metabolic process plays its spoilage role differently from their aerophilics counterparts.

The associated spoilage indicators of an in-can paints ranges from loss of viscosity, bulging as a results of gassing, pH changes as a results of fungi metabolites liberated to the paints, frothing, sedimentation and separation into phases, discoloration, aesthetic degradation and potential health hazard. Once a water-borne paint has been contaminated, its chemical and physical appearance change.

The objective of this \study is to isolate and characterized fungi as an index of in-can microbial degradation of house paint.

MATERIALS AND METHODS

Sample Collection

The paints were purchased from selected paint selling location with adequate storage facilities in the southwestern Nigeria. They were transported aseptically to the microbiology laboratory of the Department of Biological Sciences and Industrial biotechnology of the Caleb University, Lagos Nigeria for investigation.

Medium for Isolation.

Dehydrated Ovoid and Remel made Sabouraud Dextrose Agar (pH 5.6) was aseptically weighed and sterilized at 121^0C for 15 minutes in an autoclaved as specified by the manufacturer.. All the Pyrex used glassware's for this cultured works were aseptically sterilized.

Cultivation Techniques

Ten fold serial dilution of the paint with sterile distilled water was prepared, homogenized by vortexing to ensure effective distribution of the paint in the diluents and selected dilution factors was pipetted pour- plated aseptically to Sabouraud Dextrose Agar medium. Some set of the inoculated plates were incubated at room temperature 25^oC for 5 to 7 days and the duplicate set were inoculated at 37^0C 24 to 72 Hrs**.**

Isolation Techniques.

Observable apparent morphological growth colonies from the plates that elicited growth after incubation was aseptically teased with a flamed inoculating needles to mycelium squashing and prevent on-spot overcrowding were transferred to a sterile slide containing a drop of Lactophenol cotton blue stain.

Identification Techniques

The selected slide-stained colonies was observed with microscope objective resolution and the image observed was interpreted by using Alexopoulosin mycology (fungal) interpretation manuals.

RESULTS

A total sum of thirty six (36) paints comprised of eighteen(18) water based paints and eighteen (18) emulsion paint were bacteriologically examined for fungal isolation . The types and prevalence pattern of the fungi isolates elicited the biodegradative potential of some fungi specie that aided their survival in both water and oily phase. Rhizopus specie was predominant especially in water based paint than other specie, but Aspergillus cut across both water based and emulsion paint.

The emulsion paint in this study elicited a varying degree of antifungal and quality from the samples no growth was recorded with the exception of six(6) samples obtained from Abeokuta that reflected growth in varying density (Table 1.)

Table 1

Location of sample collection	Sample code	Fungi isolated	Culture density
Ibadan	WBP_1	*Fusarium spp.*	+++
	WBP_2	*Rhizopus spp.*	+++
	WBP_3	*Rhizopus spp.*	++
	EMP_1	*Aspergillus spp.*	++
	EMP_2	*No growth*	-
	EMP_3	*No growth*	-
Abeokuta	WBP_1	*Aspergillus spp*	++
	WBP_2	*Rhizopus*	+++
	WBP_3	*Mucour spp*	+++
	EMP_1	*Aspergillus spp*	+
	EMP_2	*Alternaria spp*	++
	EMP_3	*Aspergillus spp*	+
Akure	WBP_1	*Aspergillus spp*	++
	WBP_2	*Mucour spp*	+++
	WBP_3	*Rhizopus spp*	+++
	EMP_1	*Penicilum spp*	++
	EMP_2	*No growth*	-
	EMP_3	*No growth*	-
Oshogbo	WBP_1	*Cladosporium spp*	++
	WBP_2	*Alternaria spp*	++
	WBP_3	*Monilia spp*	++
	EMP_1	*Aspergillus spp*	+
	EMP_2	*Absidia spp*	+
	EMP_3	*No growth*	-
Ado-Ekiti	WBP_1	*Mucour spp*	+++
	WBP_2	*Rhizopus spp*	+++
	WBP_3	*Rhizopus spp*	+++
	EMP_1	*Aspergillus spp*	++
	EMP_2	*No growth*	-
	EMP_3	*No growth*	-
Obalende	WBP_1	*Fusarium spp*	++
	WBP_2	*Alternaria spp*	++
	WBP_3	*Penicillium spp*	+++
	EMP_1	*Aspergillus spp*	+
	EMP_2	*Cladosporium spp*	+
	EMP_3	*No growth*	-

Key: WBP : Water Based Paint EMP: Emulsion Paint
+ = Scanty ++ = Moderately present +++ = Heavily present

DISCUSSION

This study elicited a varying degree in the quality and potency of the paint examined. All the samples collected location support the growth of fungi irrespective of their good storage system or geographic location of the site of sample collection. Of the eighteen water based samples examined from the six different location in the southwest Nigeria, Rhizopus specie were recorded to be predominant followed by aspergillus specie, this establish the ability of these specie of fungi ubiquity, acid tolerant and there air-borne potential

Fusarium and Alternaria specie were isolated twice in a less predominant density from both water based and emulsion paint, an indication of the potency and resistant property of these isolates in both water and oily phase. Their ability of the in-depth growth of these fungi could be facilitated by hyphae formation. It is observed in this study, that some fungi growth can be inhibited by paint additives, which was recorded in emulsion paint that supported no growth, an evidence of sterility and quality of the samples.Penicillium was recorded twice while absidia occurred once, both in emulsion paint, an inherent ability to these specie of fungi to survive an acidic and anaerobic medium.

Perusal of the list of taxa isolated, showed that the most common soil inhabitant are present in many samples examined in quantitative variation which agreed with the findings of some authors. Some factors associated with storage facilities coupled with the nature of the tropical climate may induce a pH changes to a lesser extent and initiate an in-can degradation. The few reports in which the mechanism of fungal colonization of paint were traceable to their ability to metabolize paint additives.

There is a dearth of scientific information on the in-can degradation of paint in spite of much coherent and aesthetic values loss as a results of fungal metabolites. In spite of these negative effects, in-can degradation of paint is yet to attract the much needed attention by microbiologists, thereby necessitating a study of this nature to serve as a bedrock for the extended work. Evidence of biodeterioration of paint samples in this study can serves as an information for the stakeholders in paint manufacturing to improve the method of paint, and paint products preservation.

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