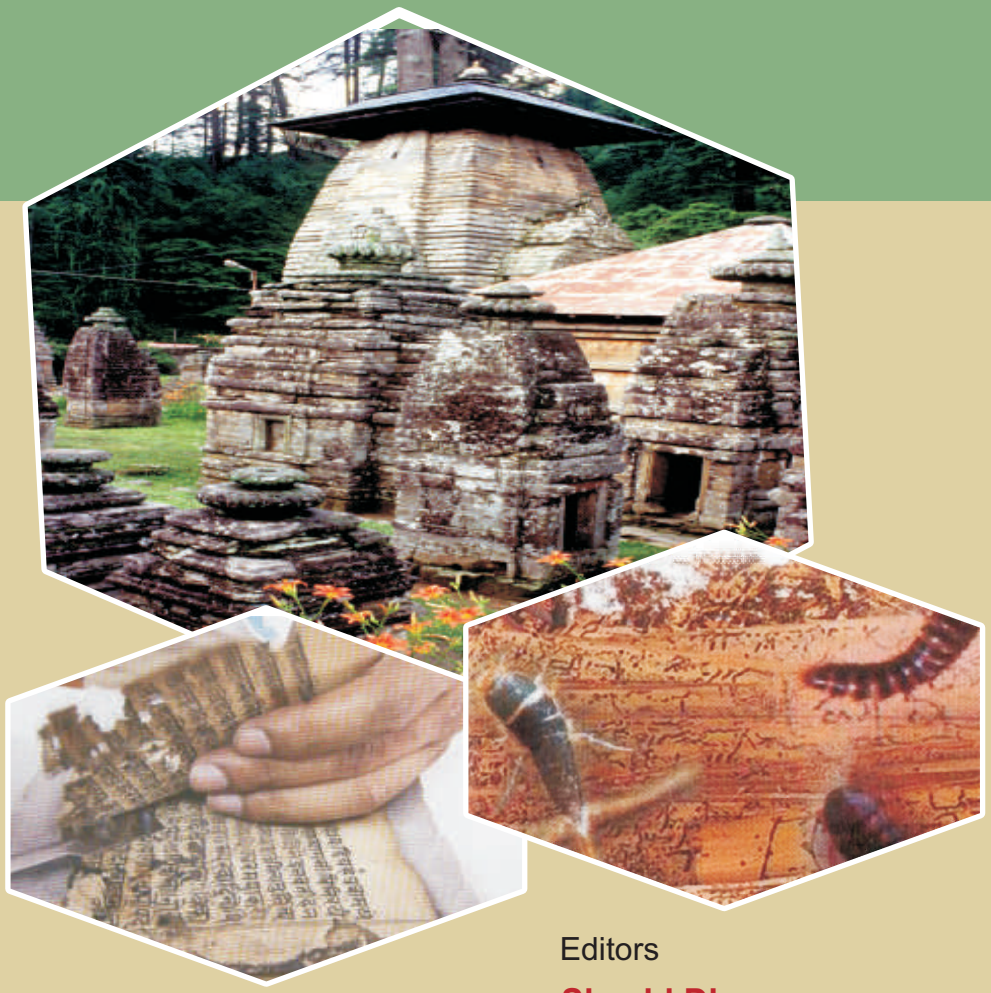
ICBCP

Biodeterioration of Cultural Property-7



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He has been the Fellow of the Indian Social Science Congress, Co-ordinator of Innovative Teaching and Research under the UGC SAP programme. His Innovative Research on colour preservation of flowers obtained patent, awards and International reputation. He is recipient of ARE Egyption Scholarship and posses 20 years research

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BIODETERIORATION OF CULTURAL PROPERTY-7

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Contents

Scientific Analysis in Traditional Preventive Measure using Garlic and Vinegar as a Wood Fungicide in Malaysia

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Abstract

Information received from woodwork masters (Carpenters) indicate that garlic (Allium Sativum) and vinegar are being traditionally applied on timbers as fungicide against wood staining and mould fungi in Malaysia. This technique can reduce the usage of synthetic fungicides such as Boric acid, Arsenic compound, Zinc chloride and Tributyltin oxide, which may cause harm to human health, artefacts and environment also. During the present study the experiment was conducted to observe antifungal activities of vinegar and garlic extraction. The extraction was used against the culture of Aspergillus niger on agar media and kept at a temperature of 35°C-37°C for inoculation in the laboratory. The results indicate that the extracts of garlic and vinegar completely inhibited the fungi after a certain period of time.

Key Words: Wooden objects, *Aspergillus niger*, Garlic, Vinegar.

1. Introduction

Wood is one of the materials that hold an important role in human life from ancient times to the present. Wood has been used for

making tools, utensil, transportation, furniture, and building structure since people start to live within a community. Even though wood may seem to be a solid material, it is subject to deterioration from a number of biological agents including insects, marine borer, bacteria and fungi. Fungi need nutrition to grow and usually found on organic material such as paper, textile and wood. The common types of fungi that affect the quality of the wood are "decay fungi and stain fungi". In this paper, *Aspergillus niger* is used as a subject of experiment which is very commonly found on deteriorated wooden surfaces and on artefacts displayed where temperature and humidity are difficult to control especially for a country like Malaysia, where rain is all over the year.

The existence of humid temperature can cause colour changes and damages wood during storage or in service. It also has a mouldy characteristic odour and its exposure can cause detrimental effect towards human health (Unger, 2001; Michael and Waldemer, 2002; Florian, 2004; Caneva *et al.*, 2004).

The durability of wood can be improved by applying certain chemicals called preservatives. Fungicide is one of it as it is used to make wood resistant to attack by fungi. There are three main groups of wood preservatives; oil based, water based and solvent based. The increasing concern for the integrity of the objects and to minimize the application of chemicals in conservation, the use of Eco friendly-based products in conservation treatment are introducing especially in the case of use of fungicide. Woodwork masters had reported garlic (*Allium sativum*) and vinegar are a two materials that traditionally applied in timber buildings as fungicide for wood staining and mould fungi. Keeping this in mind

Table 1: The pH value after different days interval

Substance	**pH Value (Duration For 15 Days)**							
Day	**1**	**3**	**5**	**7**	**9**	**11**	**13**	**15**
Garlic extract	6.3	6.28	6.28	6.2	6.2	6.2	6.2	6.18
Vinegar (commercial)	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05

experiments were conducted in the field of conservation by observing the antifungal activity of garlic extracts and industrial vinegar against *Aspergillus niger.*

2. Materials and Methods

Commercial vinegar and garlic extract two main materials used as fungicide, Potato dextrose agar (PDA) as nutrition for growth of fungi and specimen of *Aspergillus niger* as test organism. Following steps of experimentation were conducted.

2.1. Preparation of garlic extract

100 gms of garlic bulbs after peeling were immersed in distilled water to remove any impurities. Then blended with distilled water in 1:1 ratio (100gms garlic + 100 ml distilled water), to make a smooth solution and kept it for couple of hrs, strain the ingredients before pouring it in to a bottle and seal it for further experiments.

2.2. Preparation of vinegar

Same dilution like garlic were made with distilled water ie. 1:1 (100ml vinegar : 100ml distilled water).

2.3.Acidity Test

This test was conducted to identify a range of pH reading of each substance using pH strip and pH meter. Observations were made for two weeks.

2.4. Testing of antifungal property of garlic and vinegar

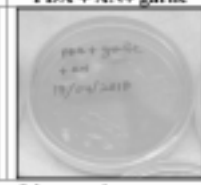
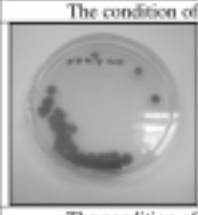
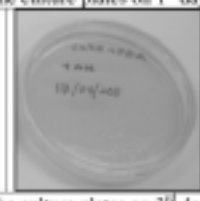
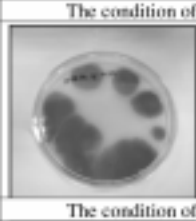
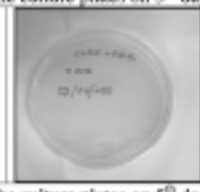
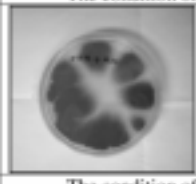
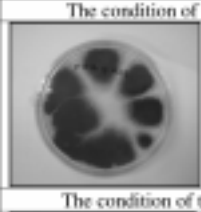
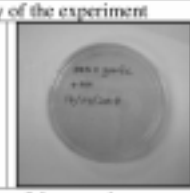
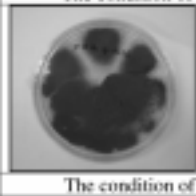
This testing was done in vitro on Potato Dextrose Agar Media (PDA). Media was prepared by simple microbiological technique i.e. by dissolving 20 gm of PDA in 500 ml of water prepared on magnetic stirrer with hot plate until it completely dissolves the PDA. Then autoclaved it, at 15 PSI (121^{o}C) for 20 minutes. Luke warm 20 ml of autoclaved media was poured in petridish and 5ml. of test solution i.e., garlic/vinegar, after solidification the media was inoculated with the test fungus *Aspergillus niger* which was obtained from the library stock of Department of Biotechnology, Kulliyah of Engineering at the International Islamic University, Malaysia). Plates were sealed with tape and kept in an incubator at 35-37^{o}C for four weeks, colony diameter was measured after

Table 2: Screening of antifungal activity on selected medium against *A. niger*

Sl.No.	Substance	Inhibition zone (cm)							Appea-rance
		Day 1	Day 3	Day 5	Day 7	Day 9	Day 11	Day 14	
1	PDA + AN	0	5 cm	10cm	12cm	17cm	19cm	21cm	+++
2	PDA + AN+ vinegar	0	0	0	0	0	0	0	-
3	PDA + AN+ garlic	0	0	0	0	0	0	0	-

Notes: Incubated at range 35-37^{o}C
PDA = Potato dextrose agar, AN = Aspergillus niger, - = no growth, +++ = very good growth

Table 3: Inhibitory zone by the activity of vinegar and garlic against *A. niger*

Day	Photograph record		
	PDA + AN	PDA + AN + vinegar	PDA + AN+ garlic
1			
	The condition of the culture plates on 1st day of the experiment		
3			
	The condition of the culture plates on 3rd day of the experiment		
5			
	The condition of the culture plates on 5th day of the experiment		
7			
	The condition of the culture plates on 7th day of the experiment		
11			
	The condition of the culture plates on 11th day of the experiment		
14			
	The condition of the culture plates on 14th day of the experiment		

Notes: Incubated at range 35-37°C experiment for 14 days
PDA = Potato dextrose agar, AN = *Aspergillus Niger*

different days interval (1, 3, 5, 7, 11 and 14 days). Control set was run without treating culture plates with viniger/garlic.

3. Results and Discussion

The results were analysed on the basis of appearance, pH reading on each substance and the rate of fungus growth on the treated (incorporated with garlic and vinegar) and untreated culture media.

3.1. Physical Observations

Traditional method for making garlic extract shows that after 14 days the colour of the garlic extract changed from whitish yellow to light brown, imparted very bad odour. However, vinegar did not show any change in colour or smell.

3.2 pH test

From the results obtained for pH studies it shows that pH of vinegar at the initial stage is 3.05 and remains unchanged during the present observation period. However, the pH of garlic extract was 6.3 on the day one and after that it slightly decreased to 6.18 (Table 1, Fig. 1) On the basis of these observations vinegar is categorized as acidic and garlic as towards neutral at initial stage and slightly towards acidic after 15 day of observations. It shows that it can't be kept for longer period.

3.3 Antifungal testing of garlic extract and vinegar

The data were analyzed by the inhibition zone of the selected medium against *Aspergillus niger* as shown in Table 2 and photographic records in Table 3. Based on the photographic record, it shows that the *Aspergillus niger* (AN) within 2 weeks rapidly grew on PDA (control set) while there is no sign of growth on the medium of PDA + vinegar and PDA +garlic extract (Treated set). This *A. niger* also can grow even though it was exposed to a higher temperature as 35-37^{o}C.

Based on all the above studies, vinegar and garlic extract have a very good antimicrobial activity. It also supports the traditional method used in Malaysia where it is practically applied in timber buildings as fungicide for wood staining and mould fungi.

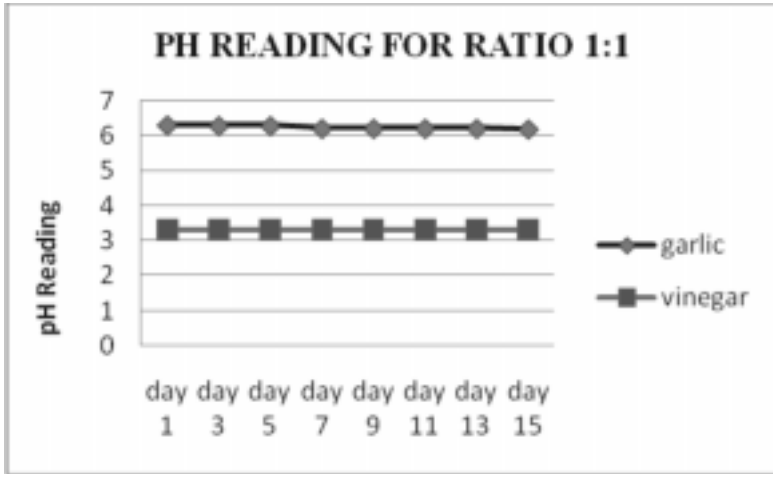


Fig. 1: Result of the pH reading for ratio 1:1 (Garlic/Vinegar)

4. Conclusion and Recommendations

Garlic extract and commercial vinegar shows antimicrobial activity against *A. niger.* It is proved that traditional method used in Malaysia may be used for other types of wood also. These features indicate that fungicide based on vinegar and garlic extract could be used in a variety of ways to control a large number of biological deterioration.

The problem with these materials especially for garlic extract is that it cannot be stored for a long time, because it changes the properties of the material (whitish yellow to brown). The other problem is, it easily leached with water. There is a need to explore and to improve the quality of these natural fungicides in order to minimize the usage of the inorganic and synthetic organic fungicides used in conservation treatment especially for wooden cultural heritage.

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kulliyah of engineering for their support throughout the project and providing material for the experiment. Mr. Zamarul b. Zakaria Head Department of Conservation and Mr. Suparman b. Miskamassistant curator at Department of Museum, Malaysia for their cooperation and advice.

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experience, 15 years of teaching and administration experience in the University and held many positions like Incharge University Museum of Science and Culture, OSD AMU Malapuram Centre, Kerala, Member of University Court, Member of Academic Council, Member Board of Studies of various Departments etc. He has guided many Ph.D. Students, supervised many project works and published more than 30 papers and presented more than 40 research papers in various National and International Journals and Conferences respectively.

Various Universities invited him as visiting professor and examiner and as a resource person of Academic Staff College etc. He also organized several National and International Conferences as an active member of various organization such as a excecutive member of ICBCP, Life Member of IASC etc.

Dr. Virendra Nath, M.Sc., Ph.D., F.B.S., F.E.S., F.Pb.S., F.A.P.T., F.S.P.R.B., M.N.A.Sc. is presently CSIR-Emeritus Scientist and Former Head of Bryology Group at National Botanical Research Institute, Lucknow, is a student of late Professor Ram Udar, F.N.A. working for last 43 years in the field of Bryology. He supervised research work on diversity assessment, morpho-taxonomy, bioprospection, conservation of bryophytes and on biodeterioration studies of cultural heritage.

He has discovered 14 species new to Science and 15 new records to India and published 130 research papers in peer reviewed Journals, three books, several review articles, popular papers and chapters in book.

In the year 1986 he was deputed to visit Poland under CSIR - PAS exchange Programme, and in the year 1988 to Royal Botanic Gardens, Kew, London and visited the herbaria of the Reading University, Oxford Forestry Institute and British Natural History Museum, London under Common Wealth Programme. He also attended World Conference of Bryology at Malaysia in 2007. He is member of several National and International Academic Societies and the International Association of Bryologists (IAB), U.S.A. has nominated him Regional Secretary for South Asian Region.

He has been awarded Late Prof. Ram Udar Medal in the year 2012 by Associations of Plant Taxonomists of India for his outstanding research contributions.

About the Book

The book is a result of the proceedings of International Conference on Biodeterioration of Cultural Property held at Aligarh Muslim University, Aligarh Feb. 16th - 18th 2013. Conservation is necessary when deterioration occurs or is likely to occur. Among agencies of deterioration, the effects of biological-monuments, paintings, manuscripts etc, are vulnerable to damage by biological factors. Thus taking care of cultural property becomes an important subject of research and teaching. At present, very little literature dealing with biodeterioration and preservation is available. This publication will fill the gap prevailing in the area and help researcher to undertake future research programs on various aspects of biodeterioration of heritage and prove to be of interest to art conservationists, conservation scientists and curators of museums all over the world. The book deals with biodiversity and cultural heritage, biodeterioration of books, manuscripts etc., biodeterioration of monuments, biodeterioration of mummies, preventive and control measures, impact of temperature and humidity on biodeterioration and conservation measures etc.

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