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Effect of Storage Material and Aging on Quality Parameters of Shellac

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ABSTRACT

Study was carried out to assess the changes in quality parameters of shellac stored in different storage materials under ambient environment. The qualitative parameters *i.e.* flow (fluidity), life (heat polymerization time), impurity, moisture content and acid value of shellac were evaluated initially before storage experiment and continue till 18 month from the date of storage on quarterly basis. Flow was found to decrease rapidly after 6 months of storage period. Life of shellac decreases gradually up to 1 year and then remains stable up to 1½ year of storage. The decreasing trend of life of shellac was similar in all the samples stored in different storage materials after storage duration. Maximum increase in impurity was noticed in samples stored in poly propylene (PP) and jute bag (JB) and minimum increase was observed in samples stored in the low density poly ethylene (LDPE). There was no appreciable change in acid value. Study indicated that aging deteriorated quality of shellac during storage. As there was no appreciable effect of different storage materials on quality parameters of shellac on storage, LDPE (50.8 μ) the cheapest storage materials can be used for storage of shellac.

Keywords : Storage, Aging, Shellac, Quality, Lac

INTRODUCTION

Shellac is a nontoxic and biodegradable natural resin of insect origin. It is made from seedlac by hot filtration and sheeting in form of thin sheet. The seedlac is obtained from sticklac which is renewable in nature. Shellac is the name of finished product and is commonly used throughout the world. It is an amorphous and brittle resin containing small amount of wax and a substance responsible for its characteristic pleasant odour. Its natural colour varies from dark red to light yellow. Shellac is a natural polymer and is chemically similar to synthetic polymers, and thus can be considered a natural form of plastic. Shellac exhibits a number of unique properties such as film-forming, insulating and sealing.

Shellac undergoes various chemical changes during storage, as a result of which deterioration in the physical and chemical properties takes place. As it ages, shellac slowly loses its solubility in alcohol, becomes less fluid and possesses poorer life under heat. The extent of such deterioration depends upon various factors such as method of storage (packaging materials), storage environment (temperature and humidity), type of shellac etc. Thus when stored in improper conditions for a long time, shellac becomes useless for all practical purposes that becomes a major concern of shellac industries. Polymerization of shellac, which is responsible for the degradation of the product, occurs either on heating or aging.

Some studies have been conducted to reduce the heat degradation of shellac in its commercial forms. It has been reported that storage in air-conditioned godown at 25°C temperature and 60% relative humidity effectively checked the degradation in qualities of lac (Rangaswami & De, 1944). The mechanism of degradation of lac on aging has also been studied (Saha, 1992). In another study, it was found that storage of dry stick lac (at about 4% m.c.) in hessian bags was the best (Saha, 1993). It was also concluded that at an ambient temperature, lac should be stored away from light preferably at a relative humidity of around 45%. Use of chemical retarders and

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antioxidants has also been attempted to control the degradation of lac when stored at room conditions (Goswami *et al.,* 2009). Storage under controlled conditions of temperature and humidity is costly. A study was conducted to identify the suitable lining material for packing of shellac used for transportation and storage. Further, use of chemical retarders and antioxidants are also not preferred, as shellac is used in many applications which are used for human consumption.

MATERIALS AND METHODS

Fresh handmade shellac made from *Kusmi* (*aghani*) seedlac was purchased from a manufacturer for the experiment. Initial quality parameters (flow, life, impurity, moisture content and acid value) of hand made shellac were determined according to standard methods (Rangaswami and Sen, 1952; Anonymous, 1973) before storage in different storage materials *i.e.* Low Density Poly Ethylene (LDPE – 50.8 µ), High Density Poly Ethylene (HDPE – 50.8 µ), High Density Poly Ethylene (HDPE – 64.3 µ), Poly Propylene (PP – 38.1 µ), Aluminum Coated Polythene (ACP – 152.4 µ), Five layer craft Paper Bag (PG) and Jute Bag (JB). Samples stored in storage materials were kept in a well ventilated room. Quality parameters of hand made shellac thus stored in different storage materials were determined after every three months up to 18 months.

RESULTS AND DISCUSSION

The data obtained from experiments were analyzed and results (Table 1) are presented and discussed in following sections.

Effect of Storage Duration and Storage Materials on Quality Parameters of Shellac

The handmade shellac stored in different storage materials and kept under ambient condition was evaluated quarterly from the date of storage up to 18 months to determine change in quality parameters like flow, life, impurity, moisture content and acid value with the use of different storage materials as per IS : 6921 – 1973 (Anonymous, 1973).

Effect of Storage Materials on Flow

The change in flow of handmade shellac with the period of storage under different storage materials indicates that initially flow of handmade shellac was 88 mm which was maintained in all the samples stored in different storage materials after 3 month of storage period except aluminium coated polythene (ACP), paper bag (PB) and jute bag (JB) and showed a decrease up to 84 mm. After 6 month storage period the above value decreased to 82 mm in all the cases which rapidly decreased after 9 month of storage period for all the samples ranging from 58 -65 mm. After 12 and 15 month of storage period the flow of all the samples stabilized and remained about 55 mm. After 18 month of storage the same decreased up to 53 mm in all the samples. The findings are in conformity with the finding of Goswami *et al.,* 2009 and Khanna *et al.,* 1986. No effect of storage material was observed on flow of shellac.

Effect of Storage Materials on Life

Polymerization time provides a measure of time during which shellac retains its plasticity and flow properties at the specified temperature before gelling or polymerizing to a tough rubbery insoluble form. This test is important in determining the quality of different lots, shelf-life, batch uniformity and processing characteristics of shellac. Change in life of handmade shellac with the period of storage under different storage materials indicated that initially life of handmade shellac was 52 min, which decreased in all the samples with time as 48, 48, 44, 42, 42 and 42 min after 3, 6, 9, 12, 15 and 18 month of storage period, respectively. The findings are in conformity with the finding of Goswami *et al.,* 2009 and Khanna *et al.,* 1986. Thus results indicate that there was no effect of storage material on life of shellac.

Effect of Storage Materials on Impurity

The change in impurity level in hand made shellac with the period of storage under different storage materials are determined and the initial impurity of handmade shellac was 1.0% which was slightly increased in all the samples packed in different storage materials with minimum and maximum as 1.0 - 1.04, 1.02 - 1.06, 1.06 - 1.1, 1.08 - 1.13, 1.09 - 1.13 and 1.10 – 1.15%, respectively after 3, 6, 9, 12, 15 and 18 month of storage period. The maximum increase in impurity was observed in case of samples stored in poly propylene jute bag, however, minimum increase in impurity was found in samples stored in LDPE.

Effect of Storage Materials on Moisture Content

The change in moisture content of handmade shellac with the period of storage under different storage materials showed that initially moisture content of handmade shellac was 2.5% which increased slightly in all the samples after 3 month

of storage period due to rainy season. After 3 month storage period it continued to decrease till 9 and 12 month of storage period for all the samples to warmer and dry months. It was observed that there was gain in moisture content after 12 month of storage period during rainy season. After 15 month of storage again decrease in moisture content was observed. The findings are in conformity with the finding of Giri *et al.,* 2010. In case of shellac stored in poly propylene and aluminium coated polythene moisture loss was less during warm and dry months as compared with other storage material used for shellac storage.

Effect of Storage Materials on Acid Value

A measure of free acid is the number of milligrams of caustic potash required to neutralize

Table 1 : Quality parameters of handmade shellac after storage periods.

Parameters	Packaging materials	Storage period, months						
		0	03	06	09	12	15	18
Flow, mm	LDPE	88	86	82	65	55	55	53
	HDPE (300)	88	86	82	65	55	55	53
	HDPE (400)	88	86	82	65	55	55	53
	PP	88	86	82	67	55	55	53
	ACP	88	84	82	60	55	55	53
	PB	88	84	82	63	55	55	53
	JB	88	84	82	58	55	55	53
Life, minutes	LDPE	52	48	48	44	42	42	42
	HDPE (300)	52	48	48	44	42	42	42
	HDPE (400)	52	48	48	44	42	42	42
	PP	52	48	48	44	42	42	42
	ACP	52	48	48	44	42	42	42
	PB	52	48	48	44	42	42	42
	JB	52	48	48	44	42	42	42
Impurity, %	LDPE	1.00	1.00	1.02	1.06	1.08	1.09	1.11
	HDPE (300)	1.00	1.02	1.03	1.08	1.10	1.10	1.10
	HDPE (400)	1.00	1.00	1.04	1.08	1.10	1.11	1.12
	PP	1.00	1.04	1.06	1.09	1.12	1.13	1.15
	ACP	1.00	1.04	1.05	1.09	1.12	1.12	1.14
	PB	1.00	1.03	1.04	1.08	1.10	1.11	1.14
	JB	1.00	1.03	1.05	1.10	1.13	1.13	1.15
Moisture, %	LDPE	2.50	2.55	1.61	0.95	0.96	1.65	1.09
	HDPE (300)	2.50	2.56	1.67	0.97	0.99	1.65	1.12
	HDPE (400)	2.50	2.55	1.40	0.95	0.97	1.64	1.08
	PP	2.50	2.55	1.76	1.10	1.16	1.65	1.08
	ACP	2.50	2.56	1.30	0.93	0.95	1.64	1.43
	PB	2.50	2.58	1.51	0.95	0.96	1.65	1.07
	JB	2.50	2.80	1.21	0.84	0.94	1.65	1.02
Acid Value	LDPE	73.00	72.96	72.50	70.86	70.68	70.51	70.49
	HDPE (300)	73.00	72.96	72.40	70.86	70.66	70.50	70.46
	HDPE (400)	73.00	72.97	72.50	70.86	70.67	70.50	70.46
	PP	73.00	72.90	72.30	70.86	70.67	70.50	70.48
	ACP	73.00	72.93	72.40	70.51	70.50	70.40	70.38
	PB	73.00	72.94	72.50	70.57	70.56	70.45	70.42
	JB	73.00	72.97	72.40	69.90	69.98	69.75	69.63

one gram of the material. The changes in acid value of handmade shellac with the period of storage under different storage materials revealed that initially acid value of handmade shellac was 73 which was nearly maintained in all the samples packed in different storage materials after 3 month of storage period later decrease in acid value was observed for all the samples. After 6 month of storage the acid value of all the samples were slightly decreased which was almost remain same after 12, 15 and 18 month of storage period. The findings are in conformity with the finding of Goswami *et al.,* 2009 and Khanna *et al.,* 1986.

CONCLUSION

The quality parameters in all different types of storage materials flow and life was found to decrease with time. Hot alcohol insoluble increased gradually with time in all samples. The maximum increase in impurity was found in case of sample stored in poly propylene and jute bag while minimum in sample stored in low density poly ethylene during storage duration. The acid value of the experimental samples stored in different storage materials was observed to be almost constant. Aging shows deterioration in quality of shellac during storage however, there was no appreciable effect of different storage materials on quality parameters of shellac on storage. As quality of shellac during storage is unaffected by the type of storage material LDPE (50.8 μ) the cheapest storage material can be used for packaging of shellac.

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