UTILIZATION OF FATLIQUORS BY FUNGI

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Twenty five fungi isolated from deteriorated finished leathers have been tested to know their relative capacity to utilize the fatliquors viz., raw fish oil, castor oil, fish oil (sulphated), spindle oil turkey red oil and coconut oil. All these fatty substances supported the growth of all the fungi except a few species of *Aspergillus, Trichoderma* and *Drechslera* which showed moderate growth. The studies support the contention that fatliquors initially provide a substrate for the growth of fungi on finished leather and its products.

Fatliquoring is the post tanning operation in which leathers are treated in an emulsion of oil-in-water with a view to distribute a comparatively small quantity of oil throughout the thickness of the leather to impart it flexibility, and make it more attractive and appealing to users. It is a common experience to find the shoes or some other leather objects (including defence articles) completely mildewed when left in a dark and humid area. Various mycoorganisms which attack leather usually spoil it by increasing stiffness, loss in durability and formation of coloured inbleachable spots rendering unfit for use[1]. These fungi primarily thrive best on the fatliquoring substances and other materials incorporated during processing of leather.

In the present study 25 most dominant fungi isolated from variously tanned deteriorated finished leathers were selected to know their relative capacity to utilize various fatliquors introduced into leather during manufacture.

MATERIALS AND METHODS

The oils usually employed in fatliquors viz., raw fish oil, castor oil, fish oil (sulphated), spindle oil (mineral oil), turkey red oil and coconut oil were selected. These were obtained from Government Leather Institute, Nunihai, Agra.

The growth of various fungi was studied on Rahn's medium[2] (K_2HPO_4—5.0 g, $(NH_4)_3\ PO_4$—5.0 g, $MgSO_4.7\ H_2O$—1.0 g, $CaCl_2$—1.0 g, $FeCl_3$ 6 H_2O—trace, $NaCl$—trace, distilled water—1.0 litre, fat/oil 20-40 ml/lit) prepared with 5% V/V of each oil separately. The dispersion of oils was made by emulsification (oil-in-water) and medium sterilized at 12 lb pressure for 15 minutes for 3 successive days. Twenty ml of medium was poured into sterilized petridishes and three replicates of each oil were taken. The plates were aseptically inoculated by spore suspensions (2-5 spores/drop) of each fungus at four places on the surface of the medium and incubated at 28°C±1°C. The double control sets of Rahn's medium, one with olive oil and second with 2.0% sucrose as carbon source were maintained for each fungus. The fungal growth was measured after 7 days by radial expansion of the colony on medium surface which is fairly a reliable method for the same.

RESULTS AND DISCUSSION

The results embodied in this paper reveal that all fungi utilized the fatliquors and showed good growth on the surface of the medium (Table 1). All the species of *Penicillium* and *Aspergillus* except *A. terreus, A. japonicus, A. luchuensis, A. amstelodami, A. chevalieri, Trichoderma viride* and *Drechslera papendorfii* were very much active and showed profuse growth on medium with each type of fatliquor. Though various oils differ considerably in their chemical properties i.e., free fatty acid content, saponification, peroxide and iodine values, yet their utilization by fungi appears to be similar which is evident by the radial growth ranging between 12.0 to 15.0 mm in different cases. The relative capacity of individual fungal species for utilization of a particular fat can be compared on the individual fat or oil.

Since, the olive oil is regarded as the well recommended fatty substrate to test the lipase secretion in microorganisms, therefore, it was selected as control. Fungi grow well on this oil and produce extracellular lipase[4]. In the present investigation also fungi showed their growth comparable to the control sets. This indicates that these substances may also be utilized by fungi during growth. However, the free fatty acids present in oils as free acids can be utilized without lipase production. Since most of the oils used in fatliquoring are natural (vegetable or animal fat) belonging to unsaturated or semi saturated triglycerides, therefore, these are always hydrolysed by lipases. It was interesting to note in the present investigations that mineral oil (spindle oil) also supported the growth of fungi.

TABLE—1

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Fungi	Average radial growth in mm							
	Fish oil (Raw)	Castor oil	Fish oil (Sul)	Spindle oil	Turkey red oil	Coconut oil	Control sets I	Control sets II
Aspergillus niger	13.8	14.2	12.7	14.5	14.5	15.0	15.0	17.9
A. flavus	13.0	14.0	13.0	12.0	13.0	13.5	15.0	17·8
A. fumigatus	14.0	14.5	12.5	10.0	13.0	13.0	14.0	15.5
A. terreus	8.0	9.0	9.0	10.5	8.0	7.0	12.0	14.7
A. sulphureus	8.5	8.0	8.5	9.5	8.0	7.0	12.0	14.7
A. tamarii	13.5	12·0	11.5	12.5	12.0	12.5	13.0	15.6
A. nidulans	12.0	13.5	13.0	13.5	13.5	13.0	11.0	11.2
A. sydowii	12.0	13.0	13.0	12.5	13.0	12.5	13.0	16.0
A. awamorii	13.0	14.5	14.0	13.5	14.0	13.0	13.5	16.2
A. japonicus	9.5	7.5	8.0	7.0	8.0	8.0	13.0	14.7
A. luchuensis	9.0	7.0	7.5	8.0	7.0	8.5	12.5	13.6
A. ameselodami	7.5	8.0	8.5	8.0	6.5	7.0	12.0	12.5
A. chevalieri	6.0	7.0	6.5	7.0	7.0	8.0	10.5	12.2
Penicillium purpurogenum	12.0	11.0	11.5	11.0	12.0	12.5	13.5	16.1
P. citrinum	11.5	12.0	13.0	12.5	12.5	12.0	14.0	16.3
P. oxalicum	11.0	12.5	13.0	12.5	12.5	12·0	14·0	16.5
P. simplicissimum	11.5	13.0	11.5	12.0	13.0	11.5	13.0	16.2
P. expansum	12.0	13.5	11.5	12.5	13.5	13.0	14.5	16.2
P. variabile	12.5	13.0	12.5	13.0	12.0	13.5	15.5	16.3
P. funiculosum	11.0	11.5	12.0	12.5	12.5	13.0	14.5	16.2
P. fellutanum	12.5	13.0	11.0	14.0	13.5	13.5	15.0	16.2
P. cyaneum	13.0	14.5	13.0	13.5	14.0	12.5	15.0	16.0
Paecilomyces variotii	13.5	14.0	13.5	13.5	13.0	13.0	15.0	16.4
Trichoderma viride	8.5	4.0	8.5	9.5	8.5	9.5	13.0	16.2
Drechslera papendorfii	7.0	8.0	8.0	7.5	7.0	8.5	11.0	15.3

I—with olive oil,
II—Rahn's medium with 2.0% Sucrose.

In control sets (Rahn's medium with sucrose as carbon source) higher growth of all fungi was recorded in comparison to fat/oil incorporated medium. This may be due to the presence of complex substrate (fat/oil) which delays the growth of organisms.

Screening of the literature also suggested that the fungi grow on leather surface and utilize fats, greases and organic oils incorporated during tanning and conditioning. The removal of incorporated fatty substances by fungal growth results into the loss of durability, formation of cracks and discolouration. Kanagy *et.al.* also stated that the destruction of these conditioning agents by fungi affects the leather products by increasing stiffness, tendency to crack and loss of tensile strength. Lazar and Bratulescu[6] conducted the investigations on different leather sorts kept in high moisture and temperature and reported the similar observations. Sharma[7] also studied-the deterioration of vegetable oils and observed considerable utilization of the same by fungi.

It can be concluded from these studies that the development and survival of fungi on leathers is at the expense of substances incorporated during tanning and subsequent stages. Therefore, incorporation of fat soluble antifungal substances may be a beneficial process in providing resistance against fungal attack during biodeterioration of leather and its products.

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REFERENCES

1. SHARMA, O. P. & SHARMA, K. D., *Agra Univ. Jour. Res. Sci.*, **26** (1976), 81-82.
2. RAHN, O., *Bacteriol. Abst.*, **II**, (1905), 15-54.
3. SHARMA, K. D. & CHAUHAN, R. K. S., *Indian Phytopath.*, **29** (1976), 425.
4. SHARMA, K. D., *Lab dev J. Sci & Tech.*, **13-B** (1975), 182.
5. KANAGY, J. R., SEEBOLD R. E., CHARLES, A. & CASSEL, J. M., *Jour. Amer. Leath. Chem. Assn.*, **44** (1949), 27.
6. LAZAR, VIORICA & BRATULESCU, VICTORIA, *Rev. Roum. Biol. Ser. Bot.*, **16** (1971), 207.
7. SHARMA, K. D., Ph.D. Thesis, Agra Univ., Agra (1974).