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EFFECT OF DIFFERENT TEMPERATURES AND STORAGE PERIODS ON THE FUNGAL FLORA OF WHEAT FLOUR*

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Maximum fungal count was obtained at 30°C when isolations were made from different mill and house type wheat flour samples stored for 8 and 10 weeks respectively. However, the count was significantly less when the samples were incubated at temperatures lower and higher than 30°C. Among different isolates, species of *Aspergillus* were most common but *A. flavus* and *A. parasiticus* were low in number. Fungal population in the flour also produced an effect on the pH of the flour and showed a negative correlation.

INTRODUCTION

Wheat flour is prone to contamination by different moulds and the mould development varies with the changes in temperature, humidity, and period of storage. Moulds adversely affect the quality of flour through biochemical changes including the increase in fat-acidity (Mehrotra and Basu, 1975). The kind of moulds that affect the grains and grain products are influenced by initial moisture, temperature and oxygen concentrations (Semenuik, 1954). Moulds not only cause spoilage but sometimes produce toxins if environmental conditions are conducive to their growth. Out of these, *Aspergillus flavus* and *A. parasiticus* in particular have been of concern because these produce aflatoxins which even in small quantities in any food or feed may cause health hazards (Hisocks, 1965).

Some information regarding changes in wheat flour by mould during storage is available for other parts of the world (Semenuik, 1954; Milner and Geddes, 1954; Daftary and Pomeranz, 1965; Daftary *et al*, 1970; and Pomeranz, 1971) however, information on this aspect is lacking for Pakistan.

Studies were therefore, undertaken to investigate the influence of some spoilage factors like temperature, humidity and period of storage on fungal

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count and pH of wheat flour. The present paper deals with the effect of temperature and period of storage on the occurrence and development of fungal population in mill and house type wheat flour.

MATERIALS AND METHODS

Fresh samples of Mexipak wheat flour from commercial flour mill and freshly milled flour of Mexipak wheat variety representing house type flour (about 1 Kg) were stored in coarse cloth bags at 5, 10, 25, 30, 35, 40 and 45°C in the laboratory for a period of 12 weeks. The samples were examined initially and then periodically after every 2 weeks for fungal count and pH at various temperatures.

Isolations of fungi from these flour samples were made on two culture media i. e. malt extract agar and malt salt agar by the standard dilution plate method (Christensen and Cohen, 1950). The petri plates were incubated at 29 ± 1°C for 3-4 days. The isolates were later identified upto species.

RESULTS AND DISCUSSION

Data presented in Tables 1-2 indicated that the fungal count was considerably low in both flour mill and house type samples when stored at 5, 10 and 25°C. In flour mill samples stored at 30°C, there was a slight rise in total colony count after 4 weeks storage followed by a sudden increase in the colony count after 6 weeks and it was maximum at 8 weeks storage. However, in house type samples, maximum colony count was noticed at 10 weeks storage. Except 30°C, the colony count both in house type and flour mill samples was considerably low indicating that the majority of the fungal population belong to the mesophilic group having their optimum temperature for development near 30°C. Out of the two culture media used, the number of fungal colonies was, however, comparatively more on malt salt agar as compared to malt extract agar and the maximum colony count on both these media was obtained at 30°C. Out of various isolates, species of *Aspergillus* such as *A. ochraceus*, *A. versicolor*, *A. restrictus*, *A. candidus* and *A. fumigatus* were commonly isolated from flour samples on malt salt agar at all the temperatures (5, 10, 25, 30, 35, 40 and 45°C). These species, however, occurred in abundance in both types of flour samples stored at 30°C. Among aspergilli, *A. flavus* and *A. parasiticus* were low initially, but increased in samples stored for longer periods of 8-12 weeks at 30-35°C. One of the isolates, Aspergilli were common on malt salt agar and the field fungi such as species of *Alternaria*, *Helminthosporium* and *Cladosporium* were common

in house type flour cultured on malt extract agar. The common occurrence of field fungi in house type flour is most probably due to more infection of these fungi in grain samples. The pH of wheat flour stored at various temperatures was determined. It was found that the flour samples both mill and house type stored at 30°C for 8 weeks had lowest pH values i. e. 5.35 & 5.7 respectively. The increase in the fungal count was inversely proportional to pH as shown in Table 3.

It was concluded that isolations from samples of flour mill stored at different temperatures mostly yielded storage fungi (especially Aspergilli) rather than field fungi and the pH values of flour depended mostly on the temperature and the colony count.

Table 1. *Effect of different storage periods and temperatures on mold count of Wheat Flour (house type).*

Period of storage (weeks)	Culture media	Colony Count of fungi associated with flour stored at temperatures (°C)						
		5	10	25	30	35	40	45
2	MEA	7	11	13	11	20	16	23
	MSA	15	20	15	13	20	28	24
4	MEA	15	24	20	63	25	22	21
	MSA	19	37	21	119	22	23	20
6	MEA	56	37	54	500	19	40	40
	MSA	38	35	48	450	32	33	34
8	MEA	84	47	44	937	87	19	15
	MSA	46	37	31	731	131	19	15
10	MEA	42	41	52	1484	95	93	14
	MSA	47	100	51	2634	184	88	102
12	MEA	105	132	198	850	90	20	31
	MSA	112	221	214	2020	99	22	30

MEA = Malt extract agar
MSA = Malt salt agar

Table 2 : *Effect of different Storage periods and temperatures on mold count of Wheat Flour (Mill Flour)*

Period of storage (weeks)	Culture media	Colony Count of fungi associated flour stored at temperatures (°C)						
		5	10	25	30	35	40	45
2	MEA	77	104	76	59	75	53	49
	MSA	85	154	77	63	88	65	64
4	MEA	57	60	45	71	61	41	41
	MSA	58	63	58	167	66	51	51
6	MEA	55	67	28	589	23	26	32
	MSA	62	77	27	666	29	34	36
8	MEA	109	97	56	2256	94	31	48
	MSA	153	144	71	2362	123	58	73
10	MEA	75	90	66	924	59	80	74
	MSA	107	106	88	1016	98	80	80
12	MEA	64	56	105	790	379	138	135
	MSA	137	111	126	1726	311	159	128

MSA = Malt salt agar
MEA = Malt extract agar

Table 3. *Effect of different storage periods and temperatures on the pH of Wheat Flour.*

Period of storage (weeks)	Source of Sample	pH Values of flour samples stored at temperature (°C)						
		5	10	25	30	35	40	45
2	F.M.	6.20	6.20	6.20	5.95	6.05	6.05	6.15
	H. type	6.50	6.45	6.45	6.20	6.35	6.35	6.39
4	F.M.	6.20	6.20	6.20	5.75	6.00	6.00	6.10
	H type	6.50	6.45	6.45	6.00	6.30	6.30	6.35
6	F.M.	6.20	6.20	6.20	5.60	5.95	5.95	6.00
	H. type	6.50	6.45	6.45	5.85	6.15	6.25	6.30
8	F.M.	6.21	6.20	6.15	5.55	5.80	5.80	5.95
	H. type	6.48	6.40	6.20	5.70	6.00	6.20	6.25
10	F.M.	6.10	6.00	5.80	6.55	5.55	5.50	5.60
	H. type	6.45	6.40	6.10	5.80	5.90	6.10	6.00
12	F.M.	5.90	5.80	5.85	6.70	5.70	5.55	5.60
	H. type	6.35	6.35	6.05	6.30	5.70	6.00	6.05

F.M. = Flour of Mill
H. type = House type.

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