

Effect of synthetic antioxidant on shelf life of locally manufactured butter known as Makhan in Pakistan

Syed Ali RAZA*, Ayoub RASHID*, James WILLIAM, Sadia NAJAF and Muhammad ARSHAD

Department of Chemistry, Government College University, Lahore 54000, Pakistan.
Corresponding authors: S.A. Raza, E-mail: aliraza876gcu@yahoo.com, Tel: +923216231245
A. Rashid, E-mail: ayoubrashid@gcu.edu.pk

Abstract. Current investigations were carried out to evaluate the effect of synthetic antioxidant (BHA) on storage stability of freshly prepared makhan (butter). Free fatty acids (FFA), peroxide value (PV) and iodine values (IV) were analyzed to assess the growth of rancidity during 5 weeks of storage of makhan at 45°C. Butylated hydroxy anisole (BHA) was added to freshly prepared makhan to extend the storage life. After 5 weeks of storage at 45°C, freshly prepared makhan containing 200 ppm of BHA and BHT showed lower value of FFA ($0.586 \pm 0.001\%$) and PVs (7.33 ± 0.02 meq/kg) than the blank samples (FFA, $1.235 \pm 0.003\%$, PV, 46.40 ± 0.01 meq/kg). Iodine values of makhan sample containing 200 ppm of BHA was 39 ± 1.03 after 5 weeks storage at 45°C. However, iodine value of makhan sample without antioxidant (blank) after 5 weeks of storage at 45°C was 16 ± 1.25 . These results illustrate that synthetic antioxidant inhibited the development of rancidity during storage protocol of makhan. Therefore, storage life of makhan can easily be extended for 5 weeks by the addition of antioxidant like BHA.

Key words: synthetic antioxidant, shelf life, lipid oxidation, makhan, Pakistan.

Locally manufactured butter (Makhan) is an important component of the food of people of Pakistan living in villages. About 70% of the total population of Pakistan is in villages. They generate makhan by handmade and electric machines. Makhan is stored in pans where access of oxygen is very easy. This practice can lead to production of reactive oxygen species as a result of lipid peroxidation (Aruoma 1998) Lipid peroxidation is considered a principal mean of deterioration in the quality of food stuff. It not only imparts rancid and undesirable flavours to fat products, but also it generates reactive oxygen species which are linked to carcinogenesis, inflammation, aging and cardiovascular disorders (Pezzuto & Park 2002). It also decreases the organoleptic value of foods and imparts rancid and unpleasant flavors to the raw and end-use oil and fat products, thus making them unacceptable to consumers (Min & Lee 1998). Lipid oxidation can be minimized by adding appropriate amount of antioxidants. Traditionally, chemically synthesized compounds, such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT), are used as antioxidants in oil products (Whysner 1994). Current work is designed to investigate the effect of synthetic antioxidants like Butylated hydroxyanisole (BHA) in makhan to increase its shelf life.

200 ppm of BHA were added to freshly prepared makhan and stored at 45°C temperature in an oven for five weeks. A blank makhan sample was also stored under the same conditions as a control sample (Rehman

& Salariya 2006). Free fatty acids, peroxide value and iodine values were determined in order to monitor the lipid oxidation inhibition action of BHA.

Free fatty acid (FFA) values, Peroxide values (PV) and Iodine values (IV) were determined by following the recommended methods of AOCS (AOCS 1989). Analysis were carried out on weekly basis and in triplicated. Data was analyzed by GraphPad Prism 3.0 (Graph Pad Software, Inc.San Diego, USA).

Formation of free fatty acids (FFA) might be an important measure of rancidity of food. FFAs are formed due to hydrolysis of triglycerides and may get promoted by reaction of oil with moisture (Freja et al. 1999). Table 1 showed the changes in Free Fatty Acid values. Initial or original FFA value for fresh or original makhan was found to be 0.058 ± 0.001 . In the case in which the blank which sample FFA value increased to 1.235 ± 0.003 at the end of five weeks storage protocol. End value of FFA for BHA containing makhan sample was 0.586 ± 0.001 . An increase in FFA value for BHA containing the sample was statistically non-significant, indicating the strong inhibition of lipid oxidation by BHA.

Peroxide value (PV) is a widely used measure of the primary lipid oxidation indicating the amount of peroxides formed in fats and oils during oxidation. (Ozkan et al. 2007). Changes in Peroxide values are showed in Table 2.

PV for original makhan sample was calculated as 0.85 ± 0.01 .end value for blank sample was 46.40 ± 0.01 .

While end value for BHA containing makhan sample was 7.33 ± 0.02 .

Table 1. Free Fatty Acid Values in Terms of % ages of makhan samples.

No of weeks	Blank sample	BHA sample
1 st	0.076 ± 0.001	0.058 ± 0.001
2 nd	0.195 ± 0.001	0.061 ± 0.001
3 rd	0.529 ± 0.002	0.269 ± 0.003
4 th	0.996 ± 0.002	0.377 ± 0.001
5 th	1.235 ± 0.003	0.586 ± 0.001

Original value of blank = 0.058 ± 0.001
t-test significant in case of blank

Table 2. Peroxide values (meq kg⁻¹) of makhan samples.

No of weeks	Blank sample	BHA sample
1 st	8.10 ± 0.02	1.87 ± 0.01
2 nd	16.48 ± 0.01	2.99 ± 0.02
3 rd	27.46 ± 0.01	3.43 ± 0.01
4 th	38.25 ± 0.03	5.21 ± 0.01
5 th	46.40 ± 0.01	7.33 ± 0.02

Original value of blank = 0.85 ± 0.01
t-test significant in case of blank

There is a remarkable difference in both values indicating the inhibition of lipid oxidation due to presence of BHA.

Decrease in iodine value (IV) is an authentic tool to monitor lipid oxidation (Naz *et al.* 2004). Variations in IV were represented in Table 3. For original sample it was found to be 51 ± 1.20 for blank sample a sharp decrease was observed from 51 ± 1.20 to 16 ± 3.25 at the end of five weeks. While for BHA containing makhan sample a nominal decrease was noticed with end value 39 ± 1.03 . This minute change in IV was due to BHA present in sample.

In the light of the above mentioned results and discussions, it is clear-cut evidence that shelf life of makhan can be increased by adding antioxidants. Increase in lipid oxidation parameters for blank samples were statistically significant. While these variations for BHA containing makhan sample were statistically non-significant indicating the antioxidant potential of BHA. This measure can direct health benefits by decreasing the formation of Reactive oxygen species in makhan. The above-mentioned rancidity parameters are main indicators of deterioration of fats. The inhibition of these parameters by BHA indicated the significance of anti-

oxidants addition to makhan. Various coronary diseases and heart problems can be minimized by this practice in society.

Table 3. Iodine values.

No of weeks	Blank sample	BHA sample
1 st	45 ± 2.50	49 ± 2.25
2 nd	37 ± 1.50	47 ± 2.50
3 rd	30 ± 2.50	45 ± 2.50
4 th	23 ± 1.50	42 ± 1.05
5 th	16 ± 1.25	39 ± 1.03

Original value of blank = 51 ± 1.20
t-test significant in case of blank

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