

Comparison of antioxidative effects of methanol orange peel extract and butylatedhydroxytoluene on stability of crude peanut oil

J.O. Arawande*, B.F. Borokini

Department of Science Laboratory Technology, Rufus Giwa Polytechnic P.M.B. 1019 Owo, Ondo-State, Nigeria

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Abstract

The antioxidative effects of methanol orange peel extract (MOPE) and butylatedhydroxytoluene (BHT) on stability of crude peanut oil (CPO) stored for twelve months in white transparent plastic bottles at room temperature (27–33 °C) were investigated. Extract of orange peel was prepared by dissolving 20 g of dried, ground and sieved sweet orange peel into 200 ml of methanol for three days. The methanol orange peel extract (MOPE) was added at varying concentrations (200–1000 ppm) to CPO. Another set of CPO which contained 200 ppm BHT as well as CPO that contained no additive was also set up. The colour and refractive indices of oil samples were immediately determined while free fatty acid (FFA), acid value (AV) and peroxide value (PV) of CPO samples were determined monthly using standard methods. The colour of CPO containing additives (MOPE and BHT) and that which contained no additive (0 ppm) was 30.0 units in 1/2" cell. The refractive index of CPO containing varying concentrations of MOPE ranged between 1.464 and 1.465 while CPO containing no additive (0 ppm) and 200 ppm BHT was 1.463. There was no significant difference at $P < 0.05$ in FFA, AV and PV of CPO containing MOPE, BHT and CPO containing no additive. The FFA, AV and PV of CPO containing additive (MOPE and BHT) were lower than that of CPO containing no additive. BHT was better in stabilizing hydrolytic rancidity of CPO while MOPE was superior to BHT in stabilizing CPO against oxidative rancidity.

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Keywords: Stability; Methanol orange peel extract; BHT; Crude peanut oil and quality parameters

1. Introduction

Peanut oil is edible oil obtained from groundnut seeds (*Arachis hypogaea* Linn). It is also called groundnut oil or Arachis oil (Aluyor et al., 2009). The oil is commonly and majorly consumed in the northern part of Nigeria among the Hausa and Fulani tribes. Peanut seeds contain about 45–50% oil (Bernardini, 1973). The seeds are predominately cultivated among the Hausas in Kaduna, Kebbi, Kastina, Kano, Borno, Sokoto and Plaeue states in Nigeria and the seeds very cheap and affordable in these localities. The common and most effective processes involved in getting the crude oil from peanut seeds entails a mechanical method which includes nut

pretreatment, expelling (screw pressing) and oil clarification (Bernardini, 1973; Ihekoronye and Ngoddy, 1985). The residue after obtaining the oil is used to make local cake popularly known as “Kulikuli”. At times the seeds are industrially processed by solvent extraction method to obtain crude oil and meal (Nkafamiya et al., 2007). The crude oil is further processed industrially to obtain refined vegetable oil while the meal is used to feed pigs or use to formulate feeds for chicken, broilers etc. However, the low income Nigerians can easily afford to purchase the crude peanut oil rather than the refined peanut oil because it is cheaper. The crude peanut oil is commonly kept by the oil producers for several months or bought and stored in larger quantities by merchants when it is abundantly available due to its low price. The oil is later sold when the price increase approximately six months after peak harvest. During storage of peanut oil, several chemical changes occur resulting in deterioration in safety and organoleptic

*Corresponding author.

E-mail address: joawande1@yahoo.com (J.O. Arawande).

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properties (John, 1990). There is therefore need to find ways for prevent oil rancidity, possibly by addition of antioxidants (Amir et al., 2005; Ihekoronye and Ngoddy, 1985).

Therefore, in the edible oil processing industry, there is growing interest in finding suitable natural alternatives to synthetic antioxidants such as butylatedhydroxytoluene (BHT), butylatedhydroxyanisole (BHA), propylgallate (PG), tertiary butylatedhydroquinone (TBHQ) and citric acid currently in use to prevent lipid deterioration, but are reported not safe for human consumption (Ullah et al., 2003; Ruger et al., 2002; Gunstone and Norris, 1983). The effectiveness of antioxidants of phenolic compounds from some plant sources in retarding lipid deterioration have been reported (Arawande and Ogunyemi, 2012; Rehab, 2010; Arawande and Komolafe, 2010; Arawande and Abitogun, 2009; El-Anany, 2007; Farag et al., 2006; Shaker, 2006; Farag et al., 2003; Wanasundara and Shahidi, 1998; Tian and White, 1994). Owing to carcinogenicity of synthetic antioxidants, the exploration for safer natural sources of antioxidants continues to gather momentum. Sweet orange fruit peel has a lot of health importance and it is very rich in antioxidants (vitamin A & C, flavonoids) that helps to fight illness, and helps in reducing cholesterol, promotes healthy skin, aids digestion, good source of vitamin-packed flavouring (Anonymous, 2011). The focus of this work is to obtain methanol extract of sweet orange peel and to investigate its antioxidant potential on crude peanut oil stored for twelve months by determining some physical and chemical quality characteristics of the oil as well as to compare its antioxidant performance with that of butylatedhydroxytoluene (BHT).

2. Materials and methods

2.1. Sources of materials

Sweet Orange fruits that were matured and ripe were purchased from a local farmer at Utelu camp, Iyere, Owo, Ondo-State, Nigeria. The crude peanut oil was obtained from a local producer at Ore, Ondo-State, Nigeria.

2.2. Preparation and extraction of orange peel

Orange fruits were peeled with hands and knife, rinsed with water, chopped into smaller pieces for easy sun drying. The dried peel was ground using electric blending machine and it was sieved with 40 mm mesh size. The sample was packed into a black polythene bag prior to extraction.

Twenty gram of the sample was weighed into a cleaned and dried reagent bottle; and 200 ml of methanol was added and left for 72 h during which it was intermittently shaken on a shaking orbit machine. The mixture was filtered through a 0.45 µm Nylon membrane filter. The extract was evaporated to dryness under reduced pressure at 40 °C by a rotary evaporator (Amir et al., 2005; Arawande and Komolafe, 2010).

2.3. Addition of additives to crude peanut oil

Methanol extract of orange peel at concentrations of 200 ppm (0.02 g per 100 ml oil) to 1000 ppm (0.10 g per 100 ml oil) was added to Crude peanut oil (CPO) contained in white transparent plastic bottles of equal capacity and they were thoroughly shaken for proper mixing. CPO containing 200 ppm BHT (0.02 g per 100 ml oil) and that which contained no additive (0 ppm (control)) were also set-up. Each container was appropriately labelled and stored in an open place at room temperature ranging from 27 °C to 33 °C.

2.4. Physical and chemical analysis

The colour of the oil sample was determined as described by AOCS, 2004 using Lovibond Tintometer (Model 520). The refractive index was also determined using Abbe's Refractometer at 40 °C (AOCS, 2004). Thereafter, the free fatty acid (FFA), acid value (AV) and peroxide value (PV) of each oil sample were monitored monthly using standard method of analysis (AOCS, 2004) for a period of twelve months.

2.5. Statistical analysis

The results were compared by one-way analysis of variance (one-way ANOVA) to test for significant difference. Means of the group were compared using Duncan multiple range test (DMRT) (SAS, 2002).

3. Results and discussion

Table 1 shows changes in colour and refractive index of crude peanut oil stored with varying concentrations of methanol orange peel extract and 200 ppm BHT. Oil to which orange peel extract was added the colour with that of control. Colour of edible oils is an important physical quality factor that influences consumer decision of acceptance or otherwise (Ihekoronye and Ngoddy, 1985). The most acceptable colour of edible oils is golden yellow and the lower the colour unit, the more acceptable and attractive the oil becomes. The colour

Table 1
Changes in colour and refractive index of crude peanut oil stored with varying concentrations of methanol orange peel extract and 200 ppm BHT.

| Concentration of additive | Colour (units) in 1/2" cell | Refractive index at 40 °C |
|---------------------------|------------------------------|---------------------------|
| 0 ppm (no additive) | 2R + 20Y = 30.0 ^a | 1.463 ^a |
| 200 ppm MOPE | 2R + 20Y = 30.0 ^a | 1.464 ^b |
| 400 ppm MOPE | 2R + 20Y = 30.0 ^a | 1.464 ^b |
| 600 ppm MOPE | 2R + 20Y = 30.0 ^a | 1.465 ^b |
| 800 ppm MOPE | 2R + 20Y = 30.0 ^a | 1.465 ^b |
| 1000 ppm MOPE | 2R + 20Y = 30.0 ^a | 1.465 ^b |
| 200 ppm BHT | 2R + 20Y = 30.0 ^a | 1.463 ^a |

Within column, mean values followed by the same superscript are not significantly different at $P < 0.05$ level according to Duncan multiple range test (DMRT); MOPE= methanol orange peel extract; BHT= butylated hydroxytoluene, R=red slide; Y=yellow slide.

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