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## Role of ohmic heating in stabilization of pearl millet: An overview

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### Abstract

Pearl millet (*Pennisetum glaucum* (L.) R. Br., also categorized as *P. Typhoides*, *P. Americanum* or *P. Spicatum*) and domestically known as mahangu (Namibia), bajra (India) and dukhon (Senegal), is a cereal grass cultivated almost exclusively on a subsistence foundation with the aid of farmers in semi-arid parts of Africa and Asia. While bulrush millet is reduced into flour, that is often attributed to the deterioration of its triglycerides through lipolysis and next oxidation of de-esterified unsaturated fatty acids. Ohmic heating may be a thermal procedure all through which heat is internally generated through the passage of alternating electric modern-day (AC) through a body like a food system that serves as an electrical resistance. Ohmic heating remedy of pearl millet grains at seventy two °C (forty% moisture) for a hundred and twenty mins led to significantly decreased lipase interest in flour. Pasting residences decreased minorly but notably for peak viscosity with an increase inside the duration of ohmic heating temperature. As ohmic heating is an powerful and economically effective technique, it can be used for lipase inactivation in pearl millet. Those studies would be beneficial to the researcher, miller, retail seller, additionally as customer, because it might assist to save flour usable for a extended time without good sized changes in general quality. It might additionally encourage utilization of bulrush millet grains, which remains untapped regardless of its severa nutritious and therapeutic benefits.

**Keywords:** Role, ohmic, heating, stabilization, pearl, millet

### Introduction

#### Pearl Millet-General

Pearl millet's gain over other cereals is that it can and is grown in marginal agricultural areas wherein annual rainfall is variable, unpredictable and very low (two hundred-500 mm) and wherein daily temperatures reach in extra of 30 °C (ICRISAT and FAO, 1996) <sup>[9]</sup>. Moreover, its nutrient content material and properties are equal or maybe superior to the ones of other cereals.

The pearl millet grain is small however has a proportionally larger germ than all other cereal grains, except possibly maize (Taylor, 2004) <sup>[15]</sup>. Consequently, bulrush millet tends to include a higher content material of triglycerides. Those are wealthy in unsaturated fatty acids (Lai and Varriano-Marston, 1980a; Kapoor and Kapoor, 1990) <sup>[5]</sup>.

Whilst pearl millet is decreased into flour, the ensuing flour is mentioned as having terrible maintaining first-rate particularly below conditions of moderately high moisture and oxygen publicity (Abdelrahman, Hoseney and Varriano-Marston, 1983; Chaudhary and Kapoor, 1984) <sup>[2]</sup>. This is attributed to the deterioration of its triglycerides thru lipolysis and next oxidation of de-esterified unsaturated fatty acids (Lai and Varriano-Marston, 1980) <sup>[1]</sup>. These chemical modifications show up themselves as off-odours and/or off-flavor of the flour or in merchandise made of the flour. There is also a demand for processing value-delivered, traditional, handy meals products made up of domestically grown raw materials like bulrush millet in particular in urban regions. These factors consequently require a prolonged storage life for pearl millet flour. There's, but, scant records on the way to improve the shelf lifestyles of pearl millet flour. Accordingly it becomes unpleasant to devour.

#### Anti-nutrients of pearl millet

One of the anti-nutrients of bulrush millet grain is phytate. Phytate content of pearl millet is in the approximate range of 172 and 327 mg per 100 g (Taylor, 2004) <sup>[15]</sup>. This range falls within the range typical of cereal grains. Phytate binds multivalent metal ions like calcium and iron thereby interfering with their absorption within the gut. In contrast, the fact that phytate binds pro-oxidant cations such as iron and copper ions may be desirable.

Unique to pearl millet, is the presence of the phenolic compounds, C-glycosyl flavones (Akingbala, 1991). These are concentrated within the outer layers of the grains and contribute to the grey colour of the grain (Taylor, 2004) [15]. In areas of Sudan where pearl millet is also a staple these compounds have been implicated in goitre (Elnour, Leiden, Bourdoux, Elton and Khalid, 1997). Furthermore, C-glycosyl flavones are believed to be the explanation for the previously mentioned disagreeable mousy odour of damp bulrush millet grain flour. Bangar, Bhite, Kachare and Chavan (1999) [10] attributed this to peroxidase action on the Cglycosyl flavones. Unlike sorghum, tannins are apparently absent in pearl millet grain (Taylor, 2004) [15].

### Ohmic Heating

Ohmic heating may be a thermal system throughout which heat is internally generated by way of the passage of alternating electrical modern-day (AC) through a body like a meals system that serves as an electrical resistance (Shirsat, 2004) [16]. The primary advantages of Ohmic processing are the rapid and relatively uniform heating performed (Zareifard, 2003), ease of method manipulate, high energy performance (Ghnimi *et al.*, 2008), decrease degradation of nutrition (Vikram, 2005), collectively with the lower capital fee as compared to different electro heating methods which include microwave and radio frequency heating (Marra, 2009; Kim, 1998). Many reports have indicated that a superior product high-quality are regularly obtained with a properly-designed ohmic heating plant results of thanks toattributable to"> because of decrease in time interval because of no thermal lags (Lima, 2007). The quantity of warmth generated is at once associated with the existing precipitated by means of voltage gradient implemented and electrical conductivity (EC) of the meals.

### Pearl Millet Flour Quality

As noted, whilst bulrush millet flour is processed at elevated moisture tiers (30% w/v), the merchandise also can increase and impart a mousy odour, which could be disagreeable especially to those unexpected with the meals (Reddy *et al.*, 1986; Hanna *et al.*, 1990) [4]. Bangar *et al.* (1999) [10] observed that peroxidase motion on C-glycosylflavones is responsible for this feature odour. consistent with Seitz, Wright, Waniska and Rooney (1993) [6], 2acetyl-1-pyrroline prompted the mousy odour in wetted bulrush millet flour. it is exciting that 2-acetyl-1-pyrroline in millet brought on a disagreeable mousy odour, whereas within the aroma profile of wheat bread crust it become discovered to be the important thing odorant evoking the popcorn-like and toasty flavour notes (Grosch and Schieberle, 1997). But, at everyday garage moisture stage (~10%), the utmost satisfactory illness of pearl millet flour that has been stored is that the development of ugly odours and rancid-taste (Kaced *et al.*, 1984). These flavours make its merchandise unsightly to devour. As discussed, bulrush millet grain includes a surprisingly high percentage of oil. Hydrolysis of pearl millet flour triglycerides and next oxidation of the released de-esterified unsaturated fatty acids arise throughout storage at ambient conditions (Lai and Varriano-Marston, 1980b; Chaudhary and Kapoor, 1984, Kapoor and Kapoor, 1990) [1, 2, 5]. it's those chemical modifications that are manifested as undesirable tastes and odours in pearl millet flour that has been saved.

### Triglyceride Hydrolysis

Hydrolysis of triglycerides entails the cleavage, in presence of water, of ester bonds that connect acid residue to glycerol (Galliard, 1999) [11]. Fatty acids are consequently set free from glycerol. bulrush millet lipase enzymes, which by the way show a far better hobby than in maximum different cereal grains, catalyze this hydrolysis (Galliard, 1999) [11]. Studied the effect of milling bulrush millet grain into flour on lipid hydrolysis. The fats acidity degrees increased greater unexpectedly in bulrush millet flour, whilst intact grains showed no considerable trade at some stage within the same storage length and conditions.

### Effect of Storage Environment on Whole bulrush millet Flour Stability

Garage conditions mainly temperature and ratio beneath which flour is kept affect its moisture content (Kumar and Anandswamy, 1979; Lai and Varriano-Marston, 1980b) [1]. Lai and Varriano-Marston (1980b) [1] saved pearl millet flour in cotton bags for 100 eighty h at 19°C and 58% rh and 42 °C and seventy five% rh. The moisture content material of bulrush millet flour saved at forty two °C and seventy five% rh increased through 30% greater than that saved at 19 °C and 58% rh. Therefore, triglyceride hydrolysis and peroxidation multiplied extra unexpectedly at 42°C and 75% rh relative to 19°C and fifty eight% rh. This, in turn, induced greater speedy (40 hours in advance) improvement of off-flavours in whole bulrush millet flour stored at 42°C and 75% rh than that saved at 19°C and 58% rh (Lai and Varriano-Marston, 1980) [1].

### Applications of Ohmic heating

Yongsawatdigul (1995) [8] discovered that Ohmic heating with rapid heating rate became an efficient technique for maximizing gel capability (gel energy in phrases of shear strain and stress) with out the addition of enzyme inhibitors. An test conducted with the help of studies scholars on Ohmic treatment with a spread of low- acid, high – acid self-stable products and refrigerated extended shelf existence products located that the previous product had a texture, color, taste and nutritional value same or better than that with traditional processing strategies like freezing, retorting and aseptic processing (Zoltai, 1996).

Ohmic heating become used to stabilize rice bran and to embellish rice bran oil extraction yield as compared to microwave heating and manage (no heating). Results confirmed that Ohmic heating is an efficient technique for rice bran stabilization with moisture addition. Unfastened carboxylic acid concentration improved more slowly than the manage for raw bran samples subjected to Ohmic heating and not employing a corresponding temperature rise, indicating that strength has non-thermal effect on lipase pastime Ohmic heating elevated the whole percent of lipid extracted from rice bran to a most of ninety three%, whilst 53% of overall lipids had been extracted from control samples. Decreasing the frequency of AC significantly elevated the number of oil extracted, probable thanks to electroporation. Ohmic heating became efficiently applied to rice bran despite its excessive oil content material (N.R. Lakkakula, 2004) [14].

### Conclusion

Pearl millet grains are produced sort of a liquid drop. They thresh free of the hull. The grains are often up to 2. Five mm

in period and their weight levels between three.5 mg and sixteen mg. Ohmic heating is taken into account very plenty appropriate for thermal processing of particulates in liquid ingredients thanks to the very fact the particulates heated on an equivalent time at comparable or quicker costs than the liquid. Many reports have indicated that a better-best product are often received with a nicely-designed electro resistance heating machine thanks to lower in time interval due to no thermal lags. the number of heat generated is directly associated with the modern-day triggered by using voltage gradient implemented and electric conductivity (EC) of the food. From exclusive studies overview it became concluded that this heating technique might be very effective for lipase stabilization.

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