

Extraction of oil from medicinal plant *Butea monosperma* (Palash) seeds by electric muffle furnace using locally available materials: Design and fabrication

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Abstract

In the present work, the main focus is to design and fabricated Electric Muffle Furnace using locally available materials for oil extraction from *Butea monosperma* seeds. *Butea Monosperma* widely distributed throughout India, Burma and Ceylon, popularly known as 'kakracha', 'mooduga', 'palasamu', 'parasa', 'muttuga', 'dhak' or 'palas'. This plant is commonly known as 'flame of forest'. The estimated production of oil from its seeds found various significant medicinal applications. Oil extracted from seeds contain chemical composition (yellow, tasteless), proteolytic and lypolytic enzymes, plant proteinase and polypeptidase. (Similar to yeast tripsin). A nitrogenous acidic compound, along with palasonin is present in seeds. It also contains monospermoside (butein 3-e-D-glucoside) and somonospermoside. The effect of heat treatment on *Butea Monosperma* (BM) seeds for oil extraction. (BM) seeds (100g) were placed in interior container i.e. small cylindrical box diameter (7.2 cm) inside the muffle furnace. Stepwise a.c. voltage 25V, 30V, 35V, 40V, 45V etc. respectively, is applied through dimmer stat to the furnace and measure the temperature with time. In present work, from Palash seeds near about 16-17 ml oil is extracted at temperature 316-324 °C.

Key Words: Electric Muffle Furnace, *Butea Monosperma*, Thermocouple, Thermometer

1. Introduction

Butea monosperma is typically known as 'flame of forest', belongs to the family Fabaceae [1]. It is locally called as palas, palash, mutthuga, bijasneha, dhak, khakara, chichra, Bastard Teak, Bengal Kino, Nourouc and is common throughout India, Burma, Ceylon and in many countries except in very acrid parts. Normally it grows gregariously on open grasslands and scattered in mixed forest. In India, palas ranks next to kusum (*schleichera trijuga*) as a host tree for lac insect [2, 3]. It has confirmed to be a source of constitutive osteogenic agents belonging to isoflavonoid and pterocarpan groups. The genus *Butea* includes *Butea monosperma*, *Butea parviflora*, *Butea minor* and *Butea superba* widely distributed throughout India [4]. It holds an important place because of its medicinal and other miscellaneous uses of economic value. It is one of the most beautiful tree has been put to some useful purpose. *Butea monosperma* is used in Ayurveda, Unani and Homeopathic medicine and has become a cynosure of modern medicine. The plants of this genus are well known for their colouring matters. Commonly *Butea monosperma* is used as tonic, astringent, aphrodisiac and diuretics [5]. Natural

antioxidants such as flavonoids, tannins, coumarins, curcuminoids, xanthon, phenolics and terpenoids are found in various plant products such as fruits, leaves, seeds, and oils [6]. Different methods such as heat behavior, far-infrared (FIR) radiation, fermentation, and protease treatment have been studied to liberate and activate low molecular weight natural antioxidants [7]. The objective of this research was to explicate the relationship between temperature & voltage.

2. Details about Design & Fabrication Details with Dimensions

The Electric Muffle Furnace consist of following components

Aluminum Metallic Box: Generally metallic box of proper dimension is used. It is easily available in different shapes and size. It has low cost, portable easy to handle and no need of special prevention from breaking. The whole assembly is kept within the circular Aluminum box. Dimensions: Height of Aluminium metallic box- 24.7 cm, Diameter of metallic box - 15.7cm as shown in figure-1

Muffle: Muffle is made up of a good insulating material Alumina (Al_2O_3) and can be stand up to very high temperature up to 1150°C – 1400°C. In this research paper, Electric Muffle Furnace is surrounded by heating coil, which is wrapped by kanthal wire in such a way that there should be maximum heat in the middle zone of the muffle furnace as shown in figure-2

Dimension of muffle:-Height of Muffle - 24 cm, External Diameter- 12.5 cm, internal diameter -11.5 cm, Thickness of Muffle - 0.5cm

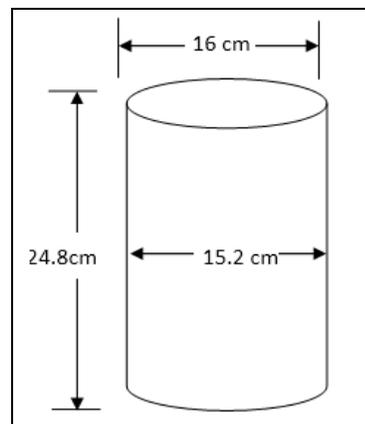


Fig 1: Aluminum Box



Fig 2: Muffle Wrap with Kanthal Wire

Kanthal Wire: Kanthal wire is used for heating purpose and have high melting point at about 1200 °C. Length of kanthal wire and Resistance is 432 cm and 6.8 Ω respectively.

Glass Wools: Glass wool is nothing but the fine filaments of glass or silica (SiO₂). The collection of large numbers of glass filament looks like wool so term as wool. In the furnace glass wool is used as a dielectric material. Hence it is electrically and thermally insulator and provide the thermodynamics stability to the furnace. It is kept in between metallic box and muffle, so as high quality glass wools are used to minimize the heat losses and to avoid unnecessary electrical contact.

Insulating Beads: Beads are the small piece of ceramic with hole inside it, through this hole electric wire is passed to prevent unnecessary external contact of metallic box such type of designing provides the thermal stability to the furnace.

Asbestos Plates: These plates plays an important role in minimizing the heat losses from the furnace in up or down side of furnace, asbestos is also a good insulating material.

Metallic Small Steel Cylindrical Box: The small steel cylindrical metallic box is placed inside the muffle, copper tube joining with welding at the bottom. In this box the *Butea monosperma* seed is placed for heating purpose for extraction of oil.

Thermometer: It is used to measure the lower temperature of furnace measure up to 360 °C.

Thermocouple: It is used for measuring the temperature of very hot body. The furnace temperature is very high up to 1600 °C. It is impossible to measure such high temperature through thermometer, so thermocouple is used. Thermocouple is made up of metallic wires which fused through a point at one end. The end which has been fused must consist either of the metal.

Dimmer stat: Stepwise A.C. voltage is applied through dimmer stat to the furnace and measure the temperature with time till the max constant temperature reading is obtained. The temperature of the furnace can be measured with the help of thermocouple using Digital Multi-meter (DMM)

Beaker: For the extraction of oil collection beaker is used.

Stand: The whole arrangement of Electric muffle furnace is placed on the stand.

The experimental set up of the & details description of the electric muffle furnace is as follows in

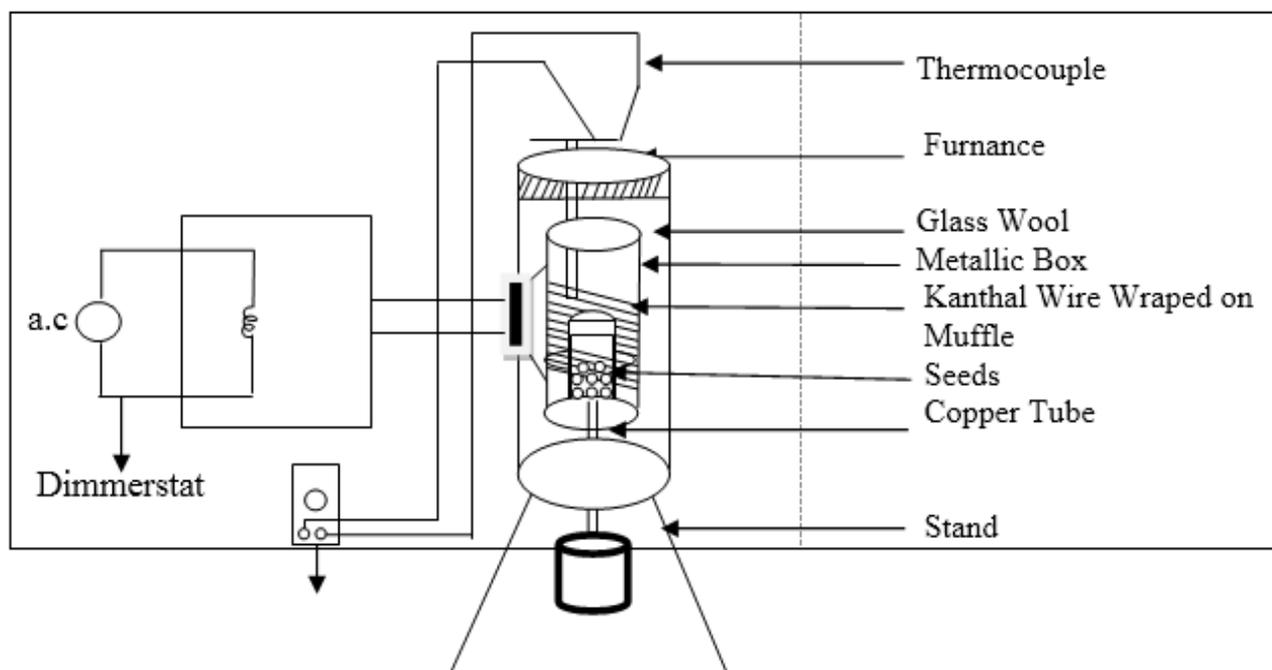


Fig 3: Experimental Set up of design and fabrication of Electric Muffle Furnace for oil extraction of *Butea Monsperma* seeds.

Table 1: It shows the study of Electric Muffle Furnace with respect to temperature versus applied voltage.

| Sr. No. | Voltage | Time In Hours With Temperature | | | | |
|---------|---------|--------------------------------|--------|--------|--------|--------|
| | | 10 Min | 15 Min | 20 Min | 25 Min | 30 Min |
| 1. | 25 V | 30 °C | 55 °C | 70 °C | 80 °C | 90 °C |
| 2. | 30 V | 110 °C | 122 °C | 131 °C | 143 °C | 151 °C |
| 3. | 35 V | 154 °C. | 165 °C | 174 °C | 185 °C | 195 °C |
| 4. | 40 V | 220 °C. | 231 °C | 240 °C | 252 °C | 261 °C |
| 5. | 45 V | 270 °C. | 280 °C | 291 °C | 316 °C | 324 °C |

3. Result and Discussion

The results obtained during the testing of Electric Muffle Furnace are shown in Tables 1. Stepwise A.C. voltage 25 V, 30 V, 35 V, 40 V, 45V etc. respectively, is applied through

dimmer stat to the furnace and measure the temperature with time. In present work, near about 16-17 ml oil is extracted from Palash seeds at temperature 316-324 °C as shown in Table-2

Table 2: Shows the extraction of oil from *Butea Monosperma* seeds with respect to applied voltage.

| Voltage | Time | Seeds Name | Quantity | Temperature | Oil Extracted |
|---------|-----------|-------------------------|----------|-------------|---------------|
| 45 V | 30 Minute | <i>Butea Monosperma</i> | 100 gm | 324 °C | 16-17 ml |

4. Conclusion

The Furnace was specifically designed for controlled heating of element/material of temperature range of 1100 °C by increasing the applied voltage it can also equally be adapted for use in other heating operations of same temperature range. The result obtained makes it possible to heat treat both ferrous, non-ferrous metals, alloys and different types of medicinal seeds oil is extracted by using electric muffle furnace in other to alter their microstructure and to enhance their properties for needed application in service with highest safety and precaution in place.

5. References

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