International Journal of Future Generation Communication and Networking
Vol. 13, No. 2, 2020 pp.1251-1255

Design of De-oiling Dryer for Domestic Purpose by using Centrifugal Force

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Abstract

The machine with an internal spinner which rotates to extract the extra oil from the fried food. This process is known as de-oiling. The process is mainly used in the industries, but this design is for the domestic purpose as for household use. The domestic de-oiling machine is built with components such as Internal Spinner, Oil Collector, and Electric Motor. With the use of internal spinner when fried food is rotated at high RPM, Due to centrifugal force, the oil from the fried food will move outward from the netted spinner and hence, the extra oil is dried from this fried food. By the Centrifugal force and Coriolis force, the de-oiling is done, which is generated by the electric motor at spinning.

Keywords:*ACMotor, Spinner, Oil collector.*

1. INTRODUCTION

For domestic use, the de-oiling dryer will help to extract the excess oil from the surface of the fried food. The crust of the fried food contains as much oil as the inner part of the fried food, so the extraction of the surface oil is very important. This de-oiling dryer will work on the centrifugal principle to assure the maximum de-oiling. The dryer, with an internal spinner, rotates to extract the extra oil from the fried food. The domestic de-oiling machine is built with components such as Internal Spinner, Oil Collector, and Electric Motor, etc.

2. LITERATURE

(i)**Ranasalva and Sudheer (2018)**, "The product centrifuged at high speed can be considered as best sample in pertaining to sensory evaluation"In their paper they explains the oil removing process by centrifugation process, they took the example of fried banana chips where they specified the the amount of oil extracted from a specific quantity at respective RPM, they detailed the relative RPM Time graph to confirm the amount of oil extraction.

(ii) **Kim, and Moreira (2012),** "De-Oiling and Pretreatment for High-Quality Potato Chips "In their paper they explains the use of centrifuge for reduction of oil content and maintain the quality of fried snacks. They tool the example of potato slices, and used a commercial deep fat fryer to fry the potato slices and performed the de-oiling for a specific time, they done all the processes including frying, de-oiling and Cooling at different temperatures, increasing centrifuging speed and observed the change in colour and weight of the potato chips.

(iii)**Moreira et al. (2009),** "The effect of a de-oiling mechanism on the production of high quality vacuum fried potato chips"In their paper they explains the process with the example of potato chips with specific size of the slice of the chips and the weight for the accurate observation in the final product. The conclusion of the paper is, The vacuum frying with the de-oiling process result in less oil content superior quality fried products.

(iv)**XiaojianQuan et al.(2016),** "Low oil French fries produced by combined pre-frying and pulsed-spouted microwave vacuum drying method"In their paper they explained the process of de-oiling through the use of microwave vacuum drying they named Pulsed-Spouted Microwave Vacuum Drying (PSMVD). They took the sample of French fries and observed the impact on the quality and the oil content was low. They concluded this method is an alternative to produce low oil content fried product.

ISSN: 2233-7857 IJFGCN

(v)**Yagua and Moreira(2011)**, "Physical and thermal properties of potato chips during vacuum frying"In their paper they explained to produce low fat fried food, they took the example potato chips where the process of de-oiling is used and they studied the oil distribution and absorption to get the success rate of de-oiling. They measure the moisture content, density in bulk and true, and the prosperity of potato chips. They determined the change in oil content at different temperature range and found shrinkage, thickness and expansion were not affected by change in temperature.

(vi)**Basuny et al. 2012),** "Vacuum frying: an alternative to obtain high quality potato chips and fried oil"In their paper they explained the effect of different frying process which is atmospheric and vacuum with the example of potato chips, they determined the quality measures by using different types of oil and observed the quality limits as acid value, polar content, polymer content, oxidized fatty acids and peroxide values. They concluded the acceptable and improve quality also depends on the frying oil.

(vii)**Ravli et al. (2013),** "Two-stage frying process for high-quality sweet-potato chips" In their paper they explained about The energy of oil ingestion and oil dispersion in the chips (all out, inside, and surface oil content) was contemplated so viability of the de-oiling framework could be built up. Item quality properties (for example, dampness content, oil content, measurement shrinkage, and thickness development, just as, shading, surface, mass thickness, genuine thickness, and porosity of chips singed at various temperatures (120, 130, and 140 °C) was performed to assess the impact of procedure temperature on the item. The last oil substance of the vacuum seared chips was 60% lower than those found in generally singed sweet potato chip, which shows that the de-oiling component is pivotal in vacuum fricasseeing handling. The pace of progress in PQAs is enormously influenced by temperature; be that as it may, the last estimations of mass thickness, genuine thickness, porosity, distance across shrinkage, and thickness extension were not influenced by temperature. The organized of the chips settled quicker when singed at 130–140 °C. Shading values was not influenced by temperature by the scope of temperature utilized. As the conclusion denotes the last oil substance of the TS singed chips was 15% lower than those seared by the SS procedure demonstrating that the structure of the chips shaped during the procedure influenced the oil ingestion during browning.

3. Materials

In the de-oiling dryer, the electric motor is used to spin the spinner; the spinner is made of perforated stainless steel, which will be mounted on the motor. The perforated spinner will be covered by the oil collecting barrel made of stainless steel where an excess oil outlet pipe will be given to removing the collected oil, this whole enclosure will be mounted on the iron chassis. The rubber shock absorber will damp the vibrations produced by the motor, the spinning time will be controlled by the timing controller.

4. Design and Working

The design of the de-oiling dryer will be compact which contains the components:-

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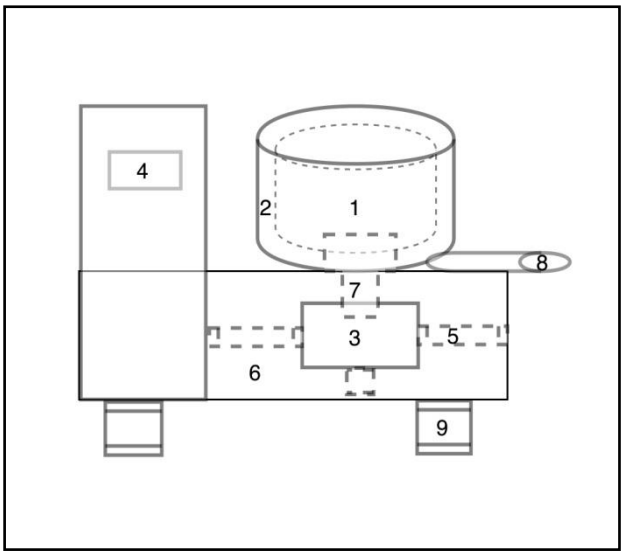

Figure 1 Block Design of De-oiling Dryer

(1) **Perforated Spinner**- The cylindrical perforated bucket-shaped spinner made of high-quality stainless steel to maintain after continuous use the hygiene of the component which will spin on the high RPM to generate the centrifugal force, this spinner will be mounted on the electric motor.

(2) **Oil Collecting Barrel**- The oil collecting barrel is the closed and compact cylindrical bucket-shaped covering for the perforated spinner where the oil extracted from the fried food is collected and drained out through outlet pipe. The oil containing barrel is mounted on the chassis.

(3) **Electric Motor**- The Electric Motor with specification- 4Poles, 3phase, 24volts with the rated speed of 7000RPM producing torque 32oz-in and 96oz-in at the peak, consuming the current of 10A at 154 watts and 30A at the peak, the length of the motor is 75mm with the weight of0.75 Kg. This motor is mounted with the chassis frame with the shock absorbers holding it; the rotating side is connected with the perforated spinner.

(4) **Time Controlling Digital Panel**- Time controlling digital panel is used to set the time of spinner which will work digitally to control the rotation. The connection of the motor will pass through this panel where it will auto cut the power and the spinner will stop. This panel can control the speed with the help of rheostat.

(5) **Mounting Components**- These are the basic mountings components like screws, holding brackets, closed Couplings, etc. These mounting components are used for connections between the motor and perforated spinner, motor to chassis via shock absorbers, oil collecting barrel to chassis and digital panel on chassis and all the other connections.

(6) **Iron Chassis**- The chassis made of iron is the main base frame of the de-oiling dryer which will be holding all of the components. The motor will be mounted vertically on this frame and the oil collecting barrel is directly placed on this frame.

(7) **Coupling Joint**- This coupling joints are used to couple the electric motor to the perforated spinner.

(8) **Outlet Pipe**- This outlet pipe is connected to the bottom side of the oil collecting barrel, this oil collecting barrel collects the extracted oil from the fried food and the outlet pipe will drain out the extracted oil. This pipe will be welded on the bottom side of the oil collecting barrel.

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(9) **Shock Absorbers**- Rubber shock absorbers are used to damp the vibrations produced by motors to maintain the stability of the de-oiling dryer. These shock absorbers will be placed between the connection of the motor and the chassis frame.

The working and construction design origin with the base frame called chassis of the de-oiling dryer, where all the major components are mounted directly, the weight of the frame ensures the stability of the dryer while the dryer is spinning, during this process various shocks and vibrations are produced by the electric motor which is damped by the shock absorbers. The motor will be vertically mounted to the chassis with connecting rods and holding brackets, shock absorbers are placed between the holding bracket and motors. Then the perforated spinner will directly couple to the electric motor with the couplings. Then the perforated spinner will be covered by the oil collecting barrel and this oil collecting barrel will be mounted on the chassis frame, this barrel will be mounted in such a way that the weight of the oil collecting barrel does not come on the motor to ensure less load on the motor to get high torque. The electric wirings are of the motor is connected to the rheostat and the digital timer which auto-cut the current after the use and rheostat will help to control the speed of the motor. All these components connections make the closed pack compact de-oiling dryer. The fried food is transferred to the perforated spinner just after frying and the timer will set for 2 minutes, then the spinner will start rotating and the centrifugal force will be developed and the oil is extracted then the timer will auto-cut the power, the excess oil is extracted into the oil collecting barrel and drained out through the outlet pipe.

5. CALCULATIONS

To determine the oil content in the fried food we have

$$Oilcontent = \frac{Initialweight - Finalweight}{Finalweight} \times 100$$

We have taken 1kg of friednamkeenand spin it in de-oiling machine for 5min at 3500rpm then,

$$Percentageinweightreductionis = \frac{1000 - 950}{950} \times 100 = 5\%$$

This process is repeated three times then the result we get is shown in figure 2

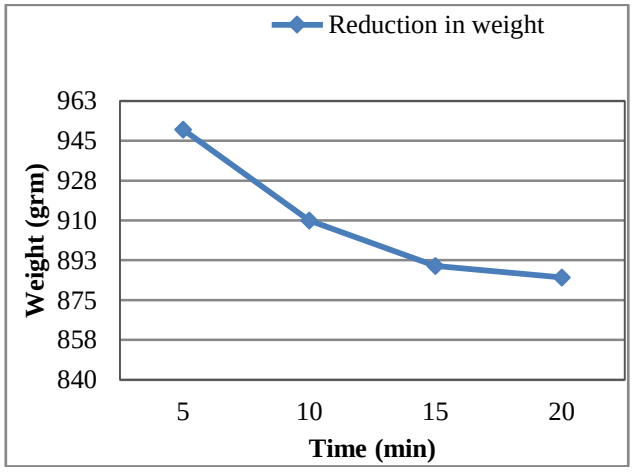

Figure 2 Reduction in oil content

6. CONCLUSION

The determined value denotes the oil content from the fried food is reduced up to 12% by the de-oiling dryer, This process successfully reduced the oil content of the fried food. The food with less oil

ISSN: 2233-7857 IJFGCN

content is very essential for health. This compact design of de-oiling dryer for domestic use is successfully achieved.

ACKNOWLEDGMENT

I would like to express my deepest gratitude to **Dr. Neelesh K. Sahu,** Asso. Prof. Mechanical Engineering Department Medi-Caps University, whose unfailing support and continuous encouragement for betterment of the project.

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ISSN: 2233-7857 IJFGCN