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TECHNICAL REPORT

“DESIGN AND CONSTRUCTION OF A HUMIDIFIER OBLEAS "CORAZÓN DE JESÚS" MONASTERY FROM BELLA VISTA - SAN ANTONIO DE IBARRA”

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SUMMARY

This work focuses on the design and construction of a humidifying machine oblea monastery "Heart of Jesus" beautiful view area - san Antonio de Ibarra, in order to improve and renew the system of production obleas, the machine stores 50 obleas inside and allows you to change the moisture having the obleas, by controlling time, becoming an important point for cutting oblea processing.

KEYWORDS: mechanical design, humidifier, oblea.

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I. INTRODUCTION

The sisters of “CORAZON DE JESUS" monastery are characterized by hosts and produces other products, their development is part of their livelihood from subsistence religious faith and, by failing to perform it lost one of its most important revenue.

It should be mentioned that the obleas are produced in the cooking process and leaving this exhibit characteristics of fragility, dryness and also a moisture low, hence its wetting is one of the necessary parameters to control before postprocessing cutting.

Without humidity control, the obleas have high or low humidity depending on the time of exposure to the environment. Sometimes passing directly from the process of ironing court without humidification, with raw material producing too dry breaks, trisados not uniform and the hosts cut.

Inefficient and inaccurate methods of humidification such as bath, wet cloths or fog in the early hours of the morning have served as a replacement for humidifying machine. Acceptable methods but that also run the risk of contaminating the obleas when exposed outdoors.

Humidification manual techniques involve long work, which to build a humidifier is improved uptime and all aspects related to the moisture of the obleas improving quality and increasing production obleas.

II. DESARROLLO DE CONTENIDOS

DESCRIPTION OF OBLEAS

It is very easy to confuse a hostia with a oblea his body and preparation is the same but its consumption differs from each, it is noteworthy that in the end is the host, a small oblea diameters between 2 cm and 5 cm, a thickness approximately 1.5 to 2mm blessed by a priest during the celebration of Mass, and a oblea, a giant host a diameter of 25-30 cm and a thickness of 3-4 mm, which is not blessed. According to (obleas, 1990) "the host is the sacred food of the Eucharist and the oblea" is no more "than a typical dessert of certain areas."

DEFINITION OF OBLEAS

According (Dominguez, 2012) "The Host (Latin: 'Host'," oblation "is a piece of matzo (unleavened), wheat flour circular offered in the Eucharist or Christian Catholic Mass and offering or bloodless sacrifice. "

CHARACTERISTICS OF OBLEAS

Obleas behave different forms stating that are most sensitive to atmospheric humidity, defined as the hygroscopic this, after this we found that because of its fine structure is able to undulate and soften. They are considered as materials reversible

behavior because they may lose or gain water by assignment or absorption of ambient water.

Hygroscopic material

To any material having cells that readily absorb water or other liquid, causing a change in its texture and size is defined hygroscopic. By (Encyclopedia of parquet, 2013) "hygroscopic materials always tend to reach equilibrium with the surrounding environment." It is precisely the variation of the dimensions of materials due to a change in relative humidity, which can influence the handling of materials and processes, to a greater extent than the temperature. (SUPERCONTROLS, 2007)

Undulation

The undulation of the oblea is normally given when a dough expands at a high temperature by removing moisture, in this case the plate maintains its fragility.

Figure 1. Oblea corrugated high temperature

Very similar case occurs when there is too much moisture concentration on the exposed oblea, in this case the plate without its characteristic becomes fragile and soft to handle.

Softening

When obleas are made, they are passing through a plate at high temperature, resulting in a dry film with a much lower environmental relative humidity; exposing the oblea to a moist environment that tends to balance such that the humidity takes, that is, its water content increases, resulting in the softening. (Jay, 2013)

Figure 2. High humidity softened oblea

BACKGROUND OF HUMIDIFICATION

After the cooking process

The previously rolled dough between two plates heated to 170 ° C, so that water evaporates. (Aragon, 2013) Thus, sheets of dry and crusty bread that must have a low water retention capacity are obtained.

The main functions of the cooking machine is responsible for obtaining obleas with that feature crisp which is very clear to see, moreover, tends to break when it is handled, a brief description we can mention that the then obleas cooking process have :

• Reduced moisture

• High percentage of dry

• Reduced flexibility

• High fragility

Prior to the cutting process

Obleas for proper humidification must be immersed in a humid environment of 90% to 95% humidity within chamber for a suitable time thus achieving the following characteristics:

• High humidity

• Reduced dry

• High flexibility

• Reduced brittleness

Parameters that are necessary for proper cutting of the obleas that are necessary to meet the humidification chamber.

DESCRIPTION AND CAMERA SPECIFICATIONS

A humidity chamber is defined as a closed cabinet that allows you to change the internal moisture therefrom by the action of a humidifier or humidity generator.

The description and specifications of the humidification chamber are important points to consider and meet the machine as detailed below.

- Achieve greater amount of obleas to moisten in less time.
- Get easy and quick humidification to avoid physical discomfort that is commonly had to do it manually.
- Achieve a uniform wetting minimizing the risk of faulty cuts made by the cutting machine.

Other important criteria to consider for the design of the machine are:

- Number of obleas to moisten: 50
- Humidity = 95% to reach 100% RH
- Humidification time: maximum 15 minutes

SIZE OF THE HOUSE

In designing the size of the camera have several points to consider such as:

- Space required for internal operations.
- Handling equipment.
- Displaying the process.
- Height for maneuver by the operator.

It was decided to design a camera with adequate characteristics to perform the process, taking reference to space handling and storage devices. For proper display and the front wall insulation glass door allow adequate visualization of the process is placed.

The points necessary to identify the height and width of the prototype fund are directly with the operator and equipment used, the height of the equipment must not exceed the average height of a person who is between 1.5m and 1.7m width and depth Team obtained oblea size which varies between 30 x 20 cm considering space required for the movement of moisture separation and last but not least the depth of the chamber must be appropriate to the size of obleas also should be taken into account when humidification vessel that goes inside the camera.

With the above mentioned design is chosen in the first instance the inner chamber consisting of the following dimensions:

- Width: 54 cm
- Height: 73 cm
- Depth: 47 cm

SELECTING THE TYPE OF ISOLATION

- Thermal conductivity
- Water vapor permeability
- Resistant characteristics and installation.
- It must not generate or absorb odors.
- Security features.

FEATURES FOR SELECTION

Table 1. Characteristics of expanded polystyrene

Insulation	R value (in inches)	Advantages	Disadvantages
Expanded polystyrene, known as styrofoam, Polypor, etc.	3,75 a 4,0	Reasonable R values, lower cost than smooth surfaced sheets	Can not be used with fiberglass resins unless it is protected, easily damaged

	Polystyrene
Convective heat losses	NO
Heat losses together	YES
Heat loss through air infiltration	NO
Fireproof	YES
Humidity controls	NO
Any thickness is achieved	NO
It merges with the flame	YES
Installation in closed cavities	NO
R decreases with humidity	NO
It keeps different densities R	NO
It maintains its properties in winter and summer	YES
Lose properties over time	NO
Host insects and rodents	NO

The humidifier will be subject to a humid environment therefore it is necessary to select an insulator where its R is not affected by moisture, do not be lost by infiltration of heat, do not lose their properties with time and its safety from burning it only with a flame exists.

By the above points and the characteristics of different types of insulation, the most appropriate and available in the market is expanded polystyrene, which is used in humidity control chambers of small size.

Wall width calculation

In practice, the calculation of the thickness of the insulation is performed as follows

$$x = \frac{\Delta t * k}{Q}$$

Equation 1. Equation wall width

Source: (Refer to complement the ASHRAE 90.1 CODE)

where:

Δt = temperature difference between the outside air and the air temperature inside the refrigerated space.

k = given in the table of thermal conductivity of insulation of cold storage.

Q = a total of 8 to 10 where 8 is more efficient and 10 less efficient.

The outside air temperature is 18 ° C corresponding to the city of Ibarra temperature and the internal temperature reaches 15 ° C.

$$\Delta t = 18°C - 12°C$$

$$\Delta t = 6°C$$

Is the value of k (k = 0.037).

$$x = \frac{6 * 0{,}037}{8}$$

$$x = \ 0{,}02775\ m$$

The thickness selected is 3cm found in the market.

STORAGE CAPACITY

Selecting storage rack

The number of obleas placed vertically is analyzed by the following equation:

Equation 2. Vertical grid spacing

$$erv = \frac{yi}{\text{rv}}$$

Where:

erv = spacing between grid placed vertically

yi = height internal chamber (73 cm)

rv = number of vertical racks (15)

$$erv = \frac{73\ cm}{15\ \text{grid}} = 4{,}86\ \frac{\text{cm}}{\text{grid}}$$

This us our we leave a space of 4.8 cm between support grid 4 sheets of oblea placing each, obtaining a total of 60 wet obleas, this would succeed if the vertically distributed manner in which moistureIt is not the same at all levels of the grid you.

Knowing that the obleas have the following dimensions 30 cm long and 20 wide with a thickness no greater than 3 mm. As the available space humidification is 73 cm high, 54 cm wide and 47 deep considered the following:

Equation 3. Horizontal grid spacing

$$erh = \frac{xi}{\text{rh}}$$

Where:

- erh = space between grids placed horizontally
- xi = width of the inner chamber
- rh = number of grid

$$erh = \frac{54\ cm}{24\ grid} = 2{,}25\ \frac{cm}{grid}$$

Which shows that the space between sheet is 2.25 cm placed vertically on the grid.

Equation 4. Number of grids

$$\#r = \frac{yi}{\text{lo}}$$

Where:

- $\#r$ = number of grid
- yi = height of the internal chamber
- lo = length of the oblea

$$\#r = \frac{73\ cm}{30\ cm} = 2{,}43$$

It shows us we can put 2 racks one located at the top and another at the bottom, finally if we analyze that:

$$PC - AL = 43\ cm - 20\ cm = 23\ cm$$

Where:

PC = space between grids placed horizontally

AL = width of the inner chamber

This indicates that we still have adequate space for the location of the humidification system, with the foregoing takes a design as that shown in Figure 3

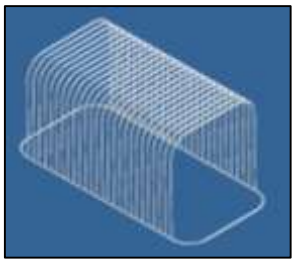


Figure 3. Grid Storage

The humidity does not vary at different levels, in addition to be located vertically allowing the passage of moisture needed only advantage. With this design gets wet of 48 to 50 or more obleas at its best, it is able to reduce wetting time because the oblea is left alone and not together with other obleas as in the case of the horizontal grids.

With the above exposed choose to select a grid design placing the sheets vertically knowing that serve as support and also as storage.

DISTRIBUTION SYSTEM

The structure and components that are part of the distribution system moisture choose to perform a drive system of evaporation by forced ventilation.

He chooses to place the distribution systems within the internal chamber that avoids the use of pipes and also the moist air is sent directly to the camera without loss or stagnation.

Table 2. Comparison Chart fans

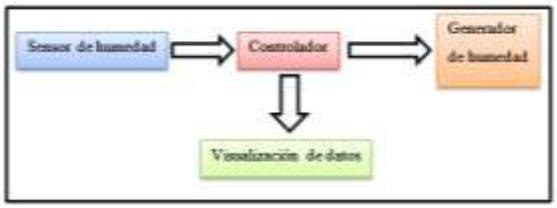
	HA80251V4	DC7530
category	Axial fan	centrifugal fan
Wind direction	Follow the direction of the axis	Changes direction at an angle of 90 ° between the input and output.
rated voltage	12 V / DC	12 / 24V
power	0,8 W	2.4 ~7.2W
consumption	150 mA	180 ~ 300 mA
Rpm	2000 rev / min	2000-3500 rev / min
Airflow	35, 26 m³ / h	37,68 m³ / h

With the above points you choose to use a centrifugal fan for their construction characteristics; the direction of airflow can drive greater air flow in addition to the fan blades allow the moist air does not stagnate in the fan, its consumption is small when used with a supply of 12 V.

III. CONTROL SYSTEM DESIGN

It is responsible for carrying the control humidification chamber, obtaining information from the various sensors, process and execute the relevant actions through actuators. Thus it is achieved effectuate the desired production process and in optimal conditions.

Diagram 1. Block diagram of the process



The control system is designed according to the needs of the application means. For data acquisition and process control moisture generation is needed:

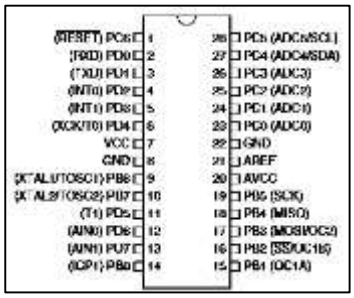
- Enter data from the humidity sensor.
- Check for timings.
- Interface with LCD display 16x4.
- Output to drive the humidifier.
- Output status indicators.

According to the needs outlined above, a total of 7 pin for controlling the LCD, 2 analog input pins, 2 pin status indicators and one output pin is controlled by time.

ATMEGA8A

The Atmel AVR ATmega8A is a CMOS 8-bit microcontroller low power. By executing powerful instructions in a single clock cycle, the yields achieved ATmega8A approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. (Atmel Corporation, S.F.)

Diagram 2. Diagram microcontroller Atmega8A



Fuente: Datasheet, Microchip Atmega8A

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Setting timer 0

The internal interrupt TIMER 0 is who controls the activation time of the humidifier. The calculation and the required time is displayed.

- Time required for 0-30 minutes.
- We work with timer0 with an overflow of 10 ms

Equation 5. Equation Timer 0

$$T = \left(\frac{1}{Fosc}\right)[(2^{Rt}) - (X)] * E$$

Donde:

- T: timer time.
- Fosc: oscillation frequency of the micro-controller.
- Rt: resolution timer (8.16).
- X: work record.
- E: working scale

$$T = \left(\frac{1}{8\ Mhz}\right)[(2^8) - (178)] * 1024$$
$$T = 9{,}984\ mseg$$

For one minutes then need 60000 ms counter limit is:

Equeation 6. Time count

$$Vc = \left(\frac{Tr}{Td}\right)$$

Where:

• Vc = counter value

• Tr = time required

• Td = overflow time

$$Vc = \left(\frac{60000\ ms}{9{,}984\ ms}\right)$$

$$Vc = 6009{,}615$$

$$Vc = 6009$$

S MOISTURE ENSOR HIH4000

Almost linear output voltage of this sensor allows direct input to a controller or other device. With a typical current consumption of 200 uA, the HIH-4000 Series is often ideal for low power consumption.

The multilayer construction of the sensing element provides excellent resistance to most of the risks of application, such as condensation, dust, dirt, oils and common environmental chemicals.

Figure 3. Humidity sensor

Fuente: Autor

Equation 1. Equation of Relative humidity

$$RH = \frac{Vout - zerooffset}{slope}$$

Where:

- Zero offset =0,958
- slope = 0.0307

$$vout = (RH\ x\ slope) + zerooffset$$
$$= (RH\ x\ 0{,}0307) + 0{,}958$$

Si RH=0% => Vout = 0,958V

RH= 100% => Vout = 3,75V

Humidity generator

Exo Terra Fogger

The Fogger generates ideal for increasing humidity levels and creating a natural misty and damp environment cold dew. It emits high frequency vibration to 2 "(5 cm) above the membrane when operated.

If the water level falls below the minimum level of 45 mm, the water level sensor automatically turns the fogger.

Figure 5. Fogger (Fogger)

Fuente: Datasheet Fogger

For any ultrasonic frequency v, λ longitudinal length of the surface wave can be can be calculated from Equation 8. Wavelength, where σ is the liquid surface tension and ρ is the liquid density

Equation 2. Wavelength

$$\lambda = \left(\frac{8\pi\sigma}{\rho v^2}\right)^{\frac{1}{3}}$$

Fuente: (Herbert, 2002)

Where:

λ = wavelength

σ = surface tension of the liquid

ρ = density of the liquid

$$\lambda = \left(\frac{8 * \pi * 72.75 \frac{dina}{cm}}{\left(\frac{1g}{cm^3}\right) (1.7\ Mhz)^2} \right)^{\frac{1}{3}}$$

$$\lambda = 8.585\ \mu m$$

Equation 3. Average diameter of drops

$$D = 0.34\ \lambda$$

$$D = 0.34\ (8.585 \mu m) = 2.9189\ \mu m$$

For a longitudinal microns disturbance wave length, the droplets have an average diameter of about 3 microns.

It is responsible for generating moisture as its easy accessibility and use you choose to use ultrasound generators.

Table 3. Characteristics of moisture generator

Exo terra (fogger)

Fogger voltage: DC 24 V

Power 20 W

Max fog volume 20 ml / h

1.7 Mhz frequency

Operating hours More than 10 hours

Radio size 2.5 cm, height 2 cm

Place Setting Stainless steel protections

Extras level sensor for activating work

Once and equipment, components and devices suitable timing is determined, the design and verify the operation of the electronic circuit in Proteus Isis, as shown below is selected.

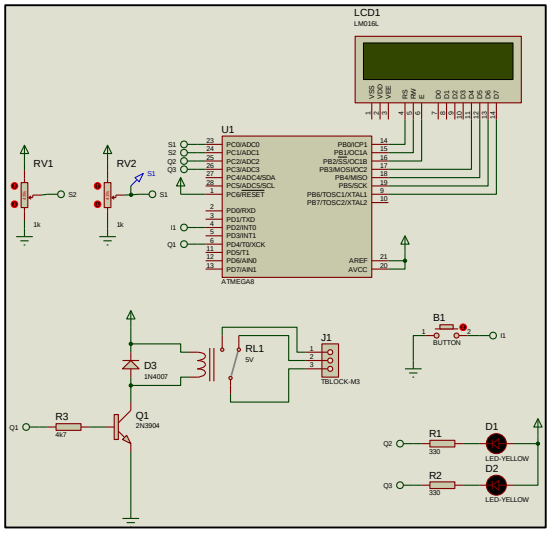


Figura 4. Designed

IV. DESIGN AND SELECTION OF MECHANICAL PARTS

The humidity and the elements in contact with obleas should have a reduced impairment proper humidification of the obleas also should be of a material that can not cause harm to people who consume the product, since they will being in direct contact with food comply with ISO 22000 for the Management System Food Safety.

SELECTION OF MATERIAL

Stainless steels

Stainless steel is an alloy of iron and carbon containing by definition a minimum of 10.5% chromium. Some types of stainless steel also contain other alloying elements. The main ones are nickel and molybdenum (Goodfellow, 2013). To increase corrosion resistance can be increased chromium and other elements such as nickel or molybdenum may be added.

The degree of imperviousness of the oxide layer in certain environments depends not only on the alloy composition but also on the specific medium, in its temperature, and concentration of the corrosive agent (E. Ibarra, 2012).

Galvanized steel

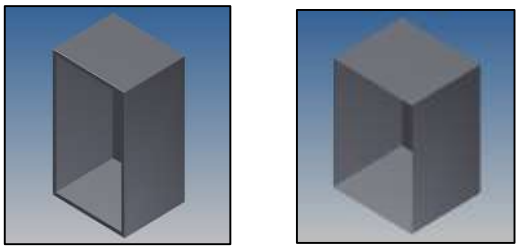
Galvanized steel is a special type of steel that is galvanized. Galvanizing takes place mainly on the surface of a steel that is more corrosion resistance. All galvanized steel has a distinctive gray metallic

appearance. The surface is also a hundred times milder than uncoated steel.

Due to its high durability, galvanized steel has a wide range of applications, from the creation of frameworks for construction steel for the manufacture of auto parts. For example, truck and bus bodies are made of galvanized steel.

CONSTRUCTION OF THE HOUSE

Both external and internal chamber are those in direct contact with the environment and with the moisture generated respectively. Then the appearance of each of these is shown.



a) Extern camera b) Intern camera

Figure 5. Aspect cameras

The support grids are who allow oblea support this addition the appropriate number of obleas to be placed humidificarlas, has a uniform space between foil, ease of management is optimal, as it is extremely light for handling.

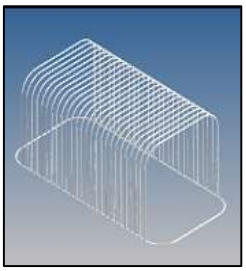


Figura 6. Aspect of grid

The buffer allows to place the fan, the humidity generator and it is where the water for work humidifier is placed.

Figure 9. Appearance water buffer

The access door is designed so as to permit viewing of camera work humidifying the same as shown below.

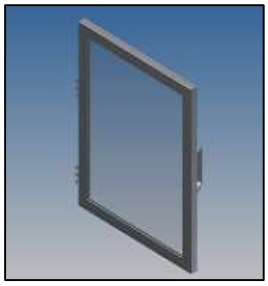


Figura 7. Aspect of door

V. CONCLUSIONS

It is very clear that you can moisten the obleas in the environment, but it is also clear that these do not have adequate humidification in all areas, and not all obleas are moistened, it is also clear mention that it is only applicable in non-rainy days and including applicable only in the morning (calm);

The humidification system is part of a complete system of processing obleas being vital to the cutting machine and cooking the existence and work of this chamber.

The thickness of the sheet is obtained by baking machine is one of the most important for properly wetted obleas factors. If exceeding obleas of 0.08 mm thickness humidification time is also increased.

Humification proper climate will depend not only but also the size of obleas produced, if these are very thick humidification will be higher, in the same way the humidification time will increase.

It is determined that the generation system most suitable and correct for the operation of the humidification chamber humidity is the humidity generator generates silent ultrasound is ideal for increasing humidity levels and dew cold damp environment.

As the range of moisture needed for humidification is 100%, this humidity range may vary on rainy days, therefore the humidity sensor serves to verify whether the work being done inside the camera wet.

The grids used as separation of the two levels and also between oblea help the good distribution of the environment within the chamber so that it is homogeneous and is utilized mostly.

When working with moist air is essential to avoid the constant recirculation of water to avoid microorganisms and effects, in order to avoid possible problems of recirculating water is suitable to avoid the automatic feeding of the storage this health issues.

The camera needs a very clear display and easy to understand what is sought by placing the LCD screen, this point is achieved being the best.

VI. RECOMMENDATIONS

It is very important to consider the material that the structure of the camera is manufactured, it is essential to maintain proper hygienic conditions; the ideal material is stainless steel as this meets the requirements for handling food.

The prototype camera also can be used not only humidify square obleas, louvers enable support for round obleas and even other food that humidification is necessary because we can change the parameters for user convenience.

Humidification make hot water is adequate it can be done once every 15 days, but should take into account the time that this is moistened.

It is recommended that the water within the buffer is removed once a day, thus avoiding the water recirculation and hence the appearance of possible effects.

With this machine not only supporting the community that promotes the Technical University of North but rather working in a joint manner with the needs it promotes certain groups that are not known but mostly doing hard work. It is recommended to clean the equipment once finished with the work done to prevent any bacteria is generated, it must be done by turning off the power whenever the machine to avoid any possible accident.

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VIII. BIOGRAFÍAS

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