



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 3, March 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com



Design and Development of Grain Storage Moisture Regulator

Vanitha Subramani¹, Dhanabal K², Kuppusamy C³, Ruban K⁴, Surendar A⁵

Associate Professor, Department of Agriculture Engineering, Nandha Engineering College, Erode, Tamil Nadu, India¹

U.G. Students, Department of Agriculture Engineering, Nandha Engineering College, Erode, Tamil Nadu, India^{2,3,4,5}

ABSTRACT: Mostly in agriculture, post harvesting losses are more than pre-harvesting losses. In India, about 30% of food grain production is lost during post harvesting period like storage, transport etc. The change in moisture level will affect the quality of grains and increase in moisture level causes fungi growth in grains. Grain storage moisture regulator is a device used to control or regulate the moisture level in the grain storing silos. If the moisture level increases, the hot air will be circulated across the grains and decrease it to optimum level. If the moisture level decreases, the cool air will be circulated across the grains and increase it to the optimum level. Thus, the way, this device is used to regulate the moisture level of stored grains.

KEYWORDS: Moisture level of stored grains, post harvesting loss, fungi growth, quality of grains.

I. INTRODUCTION

In India, agriculture is the major occupation. It is also called as 'Backbone of Indian Economy'. India is one of the major food grains producing countries in the world. But the storage techniques practiced in storing the food grains are under the below average. About 30% of post harvesting losses are occurred while storing the grains before selling them. Mostly in India, the grains are stored in gunny bags which can be easily attacked by mice, insects and other harmful animals. To avoid this, silos are used to store food grains. But the moisture level of the grains inside the silo can easily deviated by atmospheric changes. To control the moisture of grains, we have designed a device called 'Grain Storage Moisture Regulator'. By using this device, we can control the moisture level of the grains stored in silos. Grain storage moisture regulator is a device which is used for detecting and controlling the moisture level of the food grains stored in silos. It is operated by using various units such as sensor unit, relay unit, control unit etc.

II. RELATED WORK

BANKS H. J and ANNIS P. C (1) said that it is based on the uneconomic to provide a complete system of new sealed structure. In this structure, the pressure decay in a storage of 300-10,000 times capacity of five for an excess drop of 2500-1500Pa or 1500-750Pa indicates that the structure is sealed. All the bins in Australia are bolted metal sheet or bin. Mechanical modification is required here for proper application. This work is for optimum commercial sealing process for concrete cells and bolted metal structures.

JAYAS S.K and JEYAKANDAN(2) said that it is based on the modified atmosphere for storing grains. Grain farmers are seeing advantage by using this method. The air tightness chamber of the air tightness chamber of the bins and research is needed for improving the seality of the existing grain bins. It is commercial for preserving certain fruits and vegetables. This technique can be consolidated with active or interactive packaging to improve the control over the package atmosphere to achieve better product quality.

PRASHANNA PANDHARINATH and RAMACHANDRA PRADHAN (3) said that it is based on a review of food grains storage. Nowadays, grains are stored in improved structures like bags, silos, warehouses, containers etc. Introducing of phenomenon for monitoring of insects and pests. This is due to over attack of pests in warehouses. This paper is done for the minimizing post-harvest losses. An IPM might integrate insect monitoring aeration, refrigerated storage, modified or controlled atmospheres.

HANNEY MBWAMBA, BEKELE KOTU and ZENA MPENDE(4) said that post-harvest loss is high in Sub-Saharan Africa (20-40% of losses). So, PICS (Purdue Improved Crop Storage) bags are used to store grains for longer time. It gives low oxygen and high CO₂ to the grains and other aerobic organisms. The modified atmosphere kills the pest and insects through suffocation and desiccation.



SHLOMO NAVARRO, EZRA DONAHAYE and HOVAU TALPAZ (5) said that it is a numerical mode to stimulate the influence of different factors. It is compared with experimental results obtained from two concentration changes (52 tons and 28 tons of wheat). The readings and changes in the silos were recorded. The model is mainly done to show most important factors which influences gas loss and assess the need for improvements in the gas tightness.

MOHAMMED MANNA and KI DEOK KIM (6) said that it is based on the deleterious fungi attack during the post-harvest loss. This produce mycotoxins harmful to animals and humans. It is also telling about how the environment and biological factors influences grain fungi and mycotoxins. The environment influence on aflatoxin production hypothesized mechanisms of its molecule's suppression in response to environmental changes are also discussed.

MICHAEL C SWEDMAN ET AL (7) said that starch modified with octenyl succinic anhydride (OSA) have been used in wide range. This review is about synthesis procedure, structural characteristic methods and physiochemical properties and influence of botanical origins and structural parameter of OSA. Application of this include nutritional products and stabilizers.

CORNET ADLER and HANS GERD CORINTH (8) said that this review is about the modified atmospheres. The advent of organophosphates, carbonates etc. protecting plants and harvested plants product against insect infestation. The alternatives for this are conventional insecticides. These alternatives include some old and new insect growth regulators, inert dusts, botanicals, repellents attract extreme temperature like parasitoids, predators and pathogens. These alternatives are discussed here.

SHLOMO NAVARRO (9) said that it involves in increasing CO₂ and decreasing O₂ because the aerobic organisms need oxygen for survival. The lower the grain moisture content (m.c) and the corresponding intergranular humidity, the higher the mortality-due to the desiccation effect on insects caused by low O₂ or elevated CO₂ concentrations. Insect control should be achieved by increasing the temperature above 21 degree Celsius. Hermetic storage is used by giving sufficiently low O₂ and elevated CO₂.

GEORGE NMBATA AND THOMOS W. PHILIPS (10) said that egg larvae and pupae of *tribolium costaneum* (herbst), *plodia interpunctella* (hubner), *anrhizophtheradomica* over exposed to 32.5mmHg on glass chambers at 25,33,37,40 degree Celsius for time ranging from 30min to 144hr. Eggs and pupae of this and pressure and temperature at various stages are discussed. Low pressure represents a simple, non-chemical alternative to fumigants such as methyl bromide and phosphine for controlling pests of stored products or other commodities.

T. OFUYA and C. REICHMUTH (11) said that Modified Atmosphere (MA) created in a storage environment involving high CO₂ levels or low O₂ levels. This review is about probability of chances of enhancing MA action by controlling the relative humidity conditions in storage at 25±2°C investigated against *callosobruchus maculatus*. These results show the mortality of eggs and adults of bruchid in 70% of CO₂ in air and 1.0% of O₂ in N₂ was higher.

DIGIR S. JAYAS (12) said that post-harvest loss of grain is a major problem. So, vigilant post-harvest grain management is the most effective method. This paper shows information and analysis about the potential of sensors for grain quality monitoring. In this literature, the electrostatic sensors monitoring gas sensors for particle size measurement for grain dust are used. This results in the monitoring the quality of grain and increasing the shelf life of stored grain.

CHANDRA B SINGH and JOHN M FIEKIE (13) said that up to two-third of the total annual global production of grain loss due to post harvesting methods. This is due to lack of control over grain moisture content, temperature and insect infestation. High grain moisture and temperature provide favourable conditions for hotspot development, mould growth and insect infestation. Recent technologies (sensor software and hardware) are used in monitoring the grain storage.

III. METHODOLOGY

The grain storage moisture regulator is used to control the moisture level of the food grains stored in silos. This device consists of silo model, sensor unit, relay unit, control unit etc. The grains are stored in the silo which is connected to a fan and a water pump on both sides. If the humidity of the stored grains is deviated from the optimum level of the stored grain, the sensor unit will detect the deviation and transfer the signal to control unit. The control unit transfers the signal to relay unit and it displays the humidity level of the grain using display unit. The relay unit is connected to the water pumps present on the sides of the silo. If the humidity level is decreased, then the relay unit automatically operates the water pump and the cold water is flown through the copper tubes placed in front of the fan on one side. The cold air is generated from the fan and the copper tube. It is then passed through the grains. It will increase the humidity level of the grains. When the optimum humidity level is reached, the fan and the pump will be automatically turned OFF. If the humidity level is increased, then the relay unit automatically operates the water pump and the hot water is flown through the copper tubes placed in front of the fan on another side. The hot air is generated from the fan and the copper tube. It is then passed through the grains. It will decrease the humidity level of the grains. When the

optimum humidity level is reached, the fan and the pump will be automatically turned OFF. Thus, the way, grain storage moisture regulator controls the moisture level of the food grain stored in silos.

Fig.1 demonstrates the line diagram of the working units.

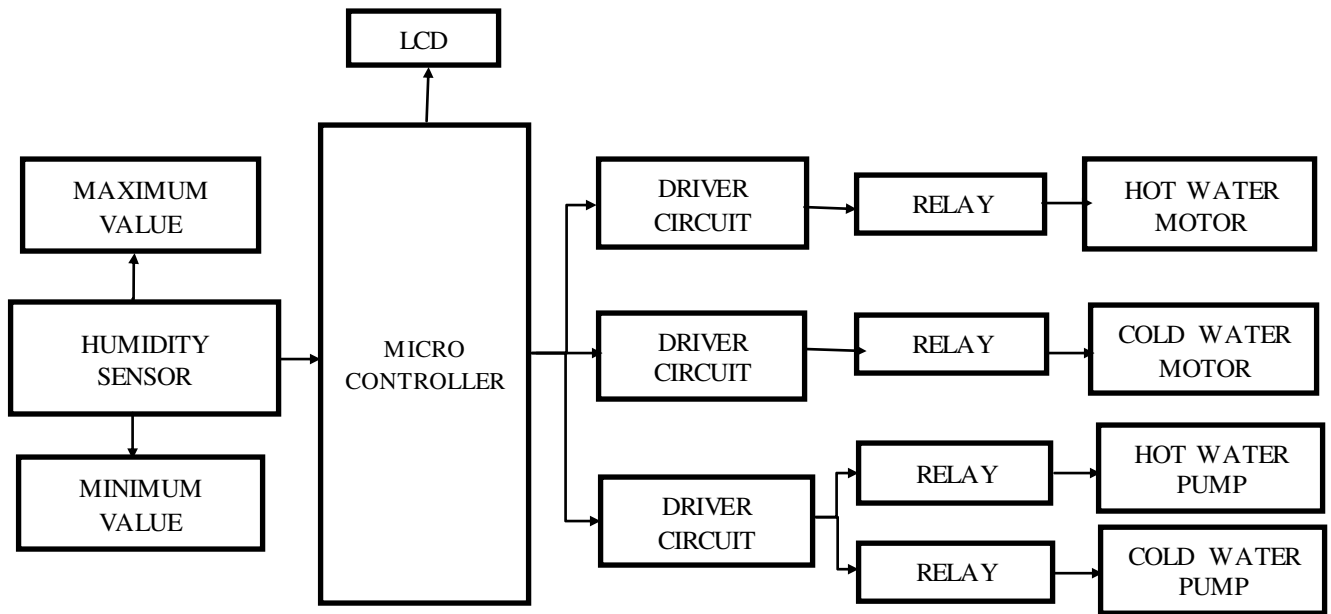


Fig.1 Line Diagram

IV. EXPERIMENTAL RESULTS

The overall setup consists of two major parts. They are silo and the circuit module.

Here, we constructed a miniature form of silo which is comparatively very smaller than the actual silo used for storing grains. The silo is covered by a metallic box. The center part of the box consists of fan, copper tube and a mini water pump. They are connected to the circuit module. The humidity sensor is placed at the center of the silo.

Fig.2(a) shows the top view of the silo model. Fig.2(b) shows the side view of the opened silo model.



Fig.2(a) Top View of Silo Setup

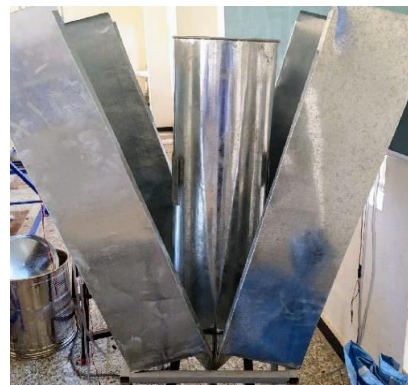


Fig.2(b) Silo Model

The circuit module is comprised of power supply unit, relay unit, control unit, display unit and sensor unit. The sensor gives the input to the relay unit. The pump and fan will give the output. The result can be witnessed inside the silo.

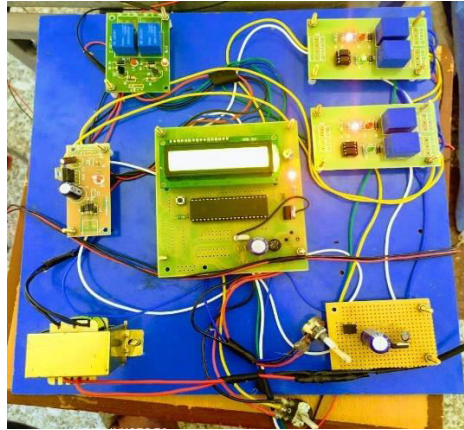


Fig.2 Circuit Module

By using this device, the problem in silos can be rectified and grain loss can be controlled. On the growing world, automation is a major part. So, this gives a major scope. This device has a huge future scope and it is very useful for farmers and retailers as they can decrease the cost in labor side and decrease the grain loss during their storage period. We can reduce the post-harvest loss of food grains occurred during their storage period automatically. The quality and quantity of food grains can be maintained throughout the storage period.

V. CONCLUSION

Grain storage moisture stimulator is a device used to control or regulate the moisture level in the grain storing silos. By using this device, we can reduce the post-harvest loss of food grains occurred during their storage period automatically. This device has a huge future scope and it is very useful for farmers and retailers as they can decrease the cost in labor side and decrease the grain loss during their storage period. The quality and quantity of food grains can be maintained throughout the storage period.

REFERENCES

- [1] Banks H.J, Annis P.C, "Conversion of existing grain storage structures for modified atmosphere use", CSIRO Division of Entomology, 1980.
- [2] Jayas S.K, Jeyakandan S, "Modified atmosphere storage of grains, meat, fruits and vegetables", Bio Systems Engineering, 2002.
- [3] PrashannaPandharinath, Ramachandra Pradhan, "Food Grain Storage- A Review", Journal of Grain Processing, 2014.
- [4] HanneyMbwanbo, Bekele Kotu, Zena Mpende, "Economic Evaluation of improved grain storage technology in Tanzania", 2017.
- [5] Shlomo Navarro, Ezra Donahaye, HovauTalpaz, "Application of modified atmospheres in grain storages retention of CO₂ within treated enclosure", Department of stored products, Agricultural Research Organisation, 2017.
- [6] Mohammed Manna, Ki Deok Kim, "Influence of temperature and water activity on deleterious fungi and mycotoxin production during grain storage", Korean Society of Mycology, 2017.
- [7] Michael C Swedman, Morgan J Tizotti, Christian Schafer, Robert G Gilbert, "Structure and physio chemical properties of octenyl succinic anhydride modified starches", Centre for Nutrition and Food Sciences, 2013.
- [8] Comet Adler, Hans Gerd Corinth, "Modified Atmospheres", 2000.
- [9] Shlomo Navarro, "Use of modified and controlled atmospheres for disinfestation of stored products", Journal of Pest Sciences, 2012.
- [10] George Nmbata, Thomos W Phillips, "Effect of temperature exposure time on mortality of stored product insects exposure to low pressure", Economic Entomology, 2001.
- [11] T. Ofuya, C. Reichmuth, "Effect of relative humidity on the susceptability", Journal of Stored Products Research, 2002.



- [12] Digir S Jayas, "Sensors for Grain Storage", American Society of Agricultural and Biological Engineers, 2017.
[13] Chandra B. Singh, John M. Fiekie, "Recent Developments in stored grain sensors monitoring and management technology", IEEE Instrumentation and Measurements, 2017.



**Impact Factor:
7.512**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details