

MEASUREMENT AND ANALYSIS OF VIBRATION AND SHOCK LEVELS FOR TRUCK TRANSPORT OF CRISPY BANANA PACKAGING PRODUCT.

Surapong Intarapak, Phitphisut Thitart, Phirayu Seanbudda

College of Logistics and Supply chain

Suansunandha Rajabhat University

1 U-thong Nok Road, Dusit, Bangkok 10300 Thailand

E-Mail : surapong.in@ssru.ac.th, phitphisut.th@ssru.ac.th, phirayu.se@ssru.ac.th

ABSTRACT

Measurement of vibration and shock levels of cargo vehicles that affect the banana peel products is the responsibility of Baan Nong Kong Housewife Group, Ban Phue District, Udon Thani Province. The purpose of the study (1) was to determine the amount of vibration and impact on the packing of the banana peeling product when traveling on a transportation vehicle from Udon Thani province to Bangkok Province on Mittraphap Road (2) measure the impact of vibration and shocks in the model experiment.

Shows the importance of vibration because during the transportation and distribution of packaging, the transport encountered conditions that caused damage to the product. Therefore has a random vibration test (Random vibration) by using conditions that cause the most damage. Assessment of the efficiency of internal containers including how to close the container by evaluating the intensity of random vibration and the protection of the products of the container according to standards (ASTM-D4728 and ISO-13355).

The results of the analysis in the packaging of the product, putty, weight 1000 grams / 1 bag, capture data, vibration sensor, or (G-sensor) data recorded can be saved in the file. By testing the speed between 10 km / h to 120 km / h will find that when tested at a low speed of 30 km / h measure vibration according to gravity ($X_{max} = 2.12$ G, $Y_{max} = 5.67$ G, $Z_{max} = 10.89$ G). The impact of 190 grams of putty banana product damage, representing 19 percent, speed 60 km / h, is the speed required by law to drive trucks in Thailand. Measures vibration according to gravity ($X_{max} = 3.27$ G, $Y_{max} = 3.67$ G, $Z_{max} = 15.27$ G). Effect of packing banana slices lost 284 grams percent. 28.4, speed 90 km / h, can measure vibration according to gravity ($X_{max} = 4.09$ G, $Y_{max} = 3.87$ G, $Z_{max} = 16.77$ G). Impacts contain 414 grams of damaged banana peel products, representing 41.4% of the result. Analysis of exploratory experiments, vibration and shocks when the vibrations according to gravity vary, the speed results in the impact of the damaged banana peel products as well.

Keywords : Measurement, Analysis of Vibration.

INTRODUCTION

Currently, Thailand can grow bananas in every region of the country. Especially Klui Namwa bananas that can be produced to the market throughout the year. Banana is a biennial plant. Is a folk species of Thailand and a mixed species. Between the wild bananas and the bananas, there is a straight trunk with a round shape, the leaves are parallel. Has a long, flat appearance, with a banana blossom at the top of the bunch. On the chain will have a comb. Will have the results arranged in a comb like a fan, and the fruits of the bananas will look round, slender, large, smooth skin, soft fruit and will be green. But when beginning to ripen

the fruit of the bananas will gradually change from green to yellow The inside of the banana is white, yellow, soft and has a sweet flavor. Is a fruit that both adults and children popularly eaten among many Is a fruit that is in every season and non-toxic And also able to bring all parts of this plant to be useful and eat a variety of leaves, flowers, stems, stems, fruits, etc.

Nowadays, many entrepreneurs are focusing on banana processing, including the development of preserving methods that can last a long time and not spoil. Most people will take the fruit of Kluai Namwa. To process into various products such as banana, banana, butter bananas and canned banana in syrup, etc. Namwa bananas are more popular than other types of bananas. Because it is full of properties and benefits as well as helping to cure illnesses Most of them are processed, especially for making plastered bananas that can be easily made and not long learned. The process is not complicated. And can also add value as well Villagers are therefore interested and sold in the village by producing or managing the resources that are local to become a quality product with distinctive features that are unique to the culture in each locality.

However, Ban Nong Kong Housewife Group, Ban Phue District, Udon Thani Province Which produces banana pulp as a career and is also an OTOP product that is exported in many provinces such as Bangkok Chonburi province And in Udon Thani In order to bring banana products for sale at convenience stores and souvenir shops But before the putty banana product reached the consumer Must go through the delivery process Which makes the putty bananas in the package broken, not flake and unappetizing The packaging is a clear plastic bag. For this reason Therefore, it is the source of the measurement of vibration levels and impact of trucks that affect the products. Is the responsibility of the Ban Nong Kong Housewife Group, Ban Phue District, Udon Thani Province The production team was able to collect data on vibration levels and as a way to improve packaging to be resistant to impact during transportation. And helps improve the image of the banana plaster packaging to be reliable for consumers. Product packaging greatly influences the purchasing decisions of consumers. Which may lead to the dissemination of various media news And meet the needs of consumers for the packaging of putty bananas as well.

RESEARCH OBJECTIVE

1. To find the amount of vibration and shock on the packing of banana plaster products.
2. Measure the impact of vibration and shock in model experiments.

LITERATURE REVIEW

Anuchnam Pinyo. (2019). The influence of distribution management and delivery service efficiency of large retail businesses that satisfy customers in the metropolitan region. *Journal of Logistics and Supply Chain College*, 5 (1), 82-98. In this thesis, the researcher investigates The influence of distribution management characteristics of distribution and performance of goods transport services of discount store to the customer satisfaction in metropolitan area.

Data were collected from 400 customers in metropolitan area overall the five adjacent provinces of Nakhon Pathom, Pathum Thani, Nonthaburi, Samut Prakan, and Samut Sakhon.

The data collected were analyzed using a computer software through statistical applications for multiple regression analysis.

The finding showed that The influence of characteristics of distribution and performance of goods transport services of discount store to the customer satisfaction in metropolitan area but the influence of The influence of distribution management didn't affected positively to the customers satisfaction at the statistically significant level of 0.05

EXPORTERS, T. O. F. (2019). This research aimed to study and compare the importance levels of factors influencing the selection of transportation firms for Thai ornamental fish exporters, as classified by company background. The survey research methodology was used. The research sample consisted of 66 Thai ornamental fish exporting companies in Bangkok and Nakhon Pathom, obtained by simple random sampling. The sample size was determined based on Krejcie and Morgan's Sample Size Table. The research instrument was a questionnaire and the data was analyzed using the frequency, percentage, mean, standard deviation, one-way ANOVA, Scheffé's LSD test and content analysis. The factors to be studied were 1) speed, 2) safety, 3) convenience, 4) reliability and punctuality, 5) finance, 6) personnel affecting the characteristics of ornamental fish exporters, i.e. registered capital, period of operation, and frequency per month of service usage.

The results showed that Thai ornamental fish exporters gave the highest importance level to the financial factor of transportation firms in terms of appropriate transportation cost, followed by the factors of speed, safety, convenience, reliability and punctuality, and personnel, all of which were rated at the high level. As for comparison of levels of importance as classified by company background, it was found that Thai ornamental fish exporters with different registered capitals, periods of operation, and frequency per month of service usage differed significantly at the .05 level of significance in their selection of factors of transportation firms.

Paternoster, A., Vanlanduit, S., Springael, J., & Braet, J. (2018). Temperature, vibrations and shocks during transport and storage are believed responsible for beer flavour instability. The aim of current study is twofold: (1) to quantify the vibrations and shocks on packaged bottled beer when travelling on the Belgian road network, (2) quantify the impact of the vibrations and shocks in a preliminary experiment.

The spectral density plots illustrate the importance of low-frequency vibrations and the similarities/discrepancies with international standards (ASTM-D4728 and ISO-13355). With increasing stack height, the amplitude of vibrations (5–25 Hz) intensifies in both corrugated boxes and plastic crates. Vibrations >25 Hz are amplified up to 9 times the original signal depending on the stack height of plastic crates. Corrugated boxes attenuate vibrations >25 Hz. Corrugated boxes absorb shocks and are preferred over plastic crates with respect to shocks and vibrations. In an exploratory experiment, vibrations and shocks induce the uptake of oxygen and the change of aldehydes (dependency initial oxygen content).

Paternoster, A., Vanlanduit, S., Springael, J., & Braet, J. (2018). In international test standards and literature averaged vibration spectra of truck and train transports are reported. However, cargo is exposed to extreme levels of vibrations and shocks for which the averaged vibration data are not representative. The objective of this study is to report evidence of the extreme vibrations and shocks during truck and train transport, and help food scientists design relevant vibration and shock simulation experiments. Results indicate that trains and trucks experience transient phenomena when traveling over train switches, accelerating and stopping the train, respectively road unevenness (e.g. potholes). The damping ratio (β) of shocks measured on the railcar is on average 0.05 ± 0.02 , while on the truck 0.08 ± 0.02 . Furthermore, the measured spectra of this study diverge from the spectra of international standards. A time-domain analysis indicates that traveling over cobblestones, and concrete pavement generates the most severe vibrations and shocks (dependency on truck velocity).

Paternoster, A., Van Camp, J., Vanlanduit, S., Weeren, A., Springael, J., & Braet, J. (2017). Poor transport conditions can result in an accelerated decay in beer quality. Optimal beer packaging should minimize the impact of temperature changes and vibrations, which occur during (long-haul) transport. In this research, the performance of different beer packagings (BP) regarding vibration damping and thermal insulation was investigated. Three BP's were tested (A: 24×33 cl cardboard crate/B: 6×25 cl cardboard crate + plastic foil/C: 24×25 cl plastic crate).

Cardboard in combination with plastic foil (BP- B) appears to be the best packaging strategy due to the positive thermal insulation properties of cardboard. The plastic foil ties the beer bottles together leaving little space for the bottles to move and therefor reduces the air transfer contributing to better thermal insulation properties. Finally, cardboard in combination with plastic foil exhibits damping characteristics. With a holistic BP strategy, one can control vibrations and temperature biases, which is beneficial for the quality of beer.

RESEARCH METHODOLOGY

1. Type of research

Qualitative research is a research that uses quality data to analyze. That is, using numbers to analyze, summarize and present the results of the research into numbers as well. Therefore, this type of research aims to explain events. By relying on the confirmation numbers to show large quantities instead of using descriptive texts

2. Populations and Sample Group

Is the use of qualitative data And don't use math Or statistics to help Data collection can be done by Using observation, interviews, recording, data analysis by content analysis. And summarize as issues to answer research problems

3. Tools

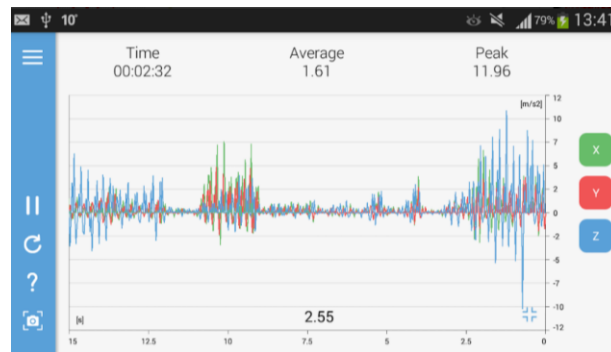
Vibration meter is an app called seismograph or seismometer, which measures the strength of vibration, quakes, earthquakes, vibrations of the human body or any other objects around you.

Our app allows for detecting and recording of seismic waves generated by earthquakes, volcanic eruptions, avalanches and other sources of vibration and shocks. Accelerometer in your mobile phone is used for detection of vibrations and measurement analysis.

Graph presents a record of the ground motion at a measuring point. Ground movement or an object is presented as a function of time in the three Cartesian axes, with the z axis perpendicular to the Earth's surface and the x- and y- axes parallel to the surface.

Mercalli intensity scale is a seismic scale used for measuring the intensity of an earthquake. It measures the effects of an earthquake and it is distinct from the moment of magnitude. Richter Scale assigns a magnitude number to quantify the energy released by an earthquake. Peak Ground Acceleration (PGA) is equal to the maximum ground acceleration that occurred during earthquake shaking at location. PGA is equal to the amplitude of the largest absolute acceleration recorded on an accelerogram at a site during a particular earthquake.

In this app we use Instrumental Intensity Scale (developed by The United States Geological Survey) which maps peak ground acceleration and peak ground velocity on an intensity scale similar to the felt Mercalli Scale. These values are used to create shake maps by seismologists on around the world.



Vibration Meter

4. Data Collection

From the field study and data collection of OTOP products, Baan Nong Kong Housewife Group, Ban Phue District, Udon Thani Province Made him aware that the problem was The most problems were found in the delivery process. And also being called by customers to return to the topic of Bananas that have received too much breakage problems Cannot be resold and not appetizing The study analyzes the causes of fear fracture problems. By using the Fishbone diagram to find the cause of this problem By analyzing the problems from the packing process Moving step And the process of transportation Can be analyzed according to the following diagram

Moving during filling too much After the bananas are fried, the bananas are placed in a large hot bag. And the bananas are stored until the order from the customer then fill in the packaging Causing it to be moved many times Causing the bananas inside the large bag to be broken

The movement of goods for delivery to the consumer after having an order from the customer, starting from bringing The products delivered in Ban Phue District will be transported by tricycle. And forwarding to the district bus queue for transportation to Mueang District Udon Thani Province And transported to Bangkok, transported by bus via the Mittraphap Road from Udon Thani To Bangkok distance of 580 kilometers.

5. Data Analysis

Measurement Tool Vibration measurement requires the use of a vibration meter to select the appropriate vibration signal. The movement or vibrations of the instrument can be measured both Motion distance, such as using Proximity Probe. Speed measurement using a probe with a Huawei Pro 9 mobile phone as a tool to detect vibration. And the most popular method for measuring vibration is Accelerator (Accelerometer) that has a very wide range of measured frequencies from low frequencies to close to 0 m / s² in the measurement of vibration, transportation to high frequencies that the human ear can hear is 20 m / s² Huawei mobile phone The Pro 9 acceleration can measure very little vibration. To a very high range (High dynamic range). Choosing to use the accelerator signal is considered as one factor in the successful vibration measurement When conducting tests in accordance with standards or measurements, tests should be taken into account when choosing this accelerator. Vibration Checklist The researchers measured the vibration value according to the driving speed of the car from 10-120 kilometers per hour. The examined route is Friendship Road. In the sampling inspection, the test length is 1 kilometer.

RESEARCH RESULTS

In the vibration measurement is Accelerator (Accelerometer) that has a very wide range of measured frequencies from low frequencies to close to 0 m / s² in the measurement of vibration, transportation to high frequencies that the human ear can hear is 20 m / s² Huawei mobile phone The Pro 9 acceleration can measure very little vibration. To a very high range (High dynamic range). Choosing to use the accelerator signal is considered as one factor in the successful vibration measurement When conducting tests in accordance with standards or measurements, tests should be taken into account when choosing this accelerator. Vibration Checklist The researchers measured the vibration value according to the driving speed of the car from 10-120 kilometers per hour. The examined route is Friendship Road. In the sampling inspection, the test length is 1 kilometer. Results As in the table below

Speed	Xmax	Ymax	Zmax	Damaged weight
10 km / h	1.32	6.92	9.77	90
20 km / h	1.43	6.53	9.56	128
30 km / h	2.12	5.67	10.89	190
40 km / h	1.87	5.02	11.56	234
50 km / h	2.53	4.56	12.54	258
60 km / h	3.27	3.67	15.27	284
70 km / h	3.45	3.55	14.98	302
80 km / h	3.55	3.54	15.76	342
90 km / h	4.09	3.87	16.77	414
100 km / h	4.67	4.24	17.93	467
110 km / h	5.69	4.78	17.65	509
120 km / h	5.36	4.57	18.54	510

DISCUSSION

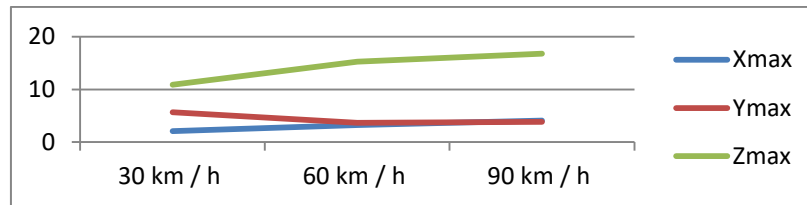
The study of vibration measurement results Therefore, there is a concept to develop, design, create distinctive points of banana packaging of Ban Nong Housewife Group, Ban Kho Subdistrict, Ban Phue District, Udon Thani Province, with graphic. The researcher has the design concept in accordance with the vibration. And supports vibration In which the study has chosen to use packaging materials suitable for the product. And create a unique identity to attract attention to the packaging Is the identity of Udon Thani province And choose to use the color in orange tones because the color display is already the provincial color of Udon Thani It can be seen that if the brand's jars and colors are visible, it is thought of the province of Udon Thani and the banana packaging of the Ban Nong Kong Housewife Group, Ban Kho Subdistrict, Ban Phue District, Udon Thani Province. First

CONCLUSION

This research study Is a qualitative study Will study the basic information of the Ban Nong Kong housekeeper group, the data from the field visit, interview and apply the concepts and theories related to the measurement of vibration and impact of the freight trucks that affect the product. sweet banana crisps To increase the value of product quality From the operation can be summarized as follows.

The results of the analysis in the packaging of the product, putty, weight 1000 grams / 1 bag, capture data, vibration sensor, or (G-sensor) data recorded can be saved in the file. By testing

the speed between 10 km / h to 120 km / h will find that when tested at a low speed of 30 km / h measure vibration according to gravity ($X_{max} = 2.12$ G, $Y_{max} = 5.67$ G, $Z_{max} = 10.89$ G) The impact of 190 grams of putty banana product damage, representing 19 percent, speed 60 km / h, is the speed required by law to drive trucks in Thailand. Measures vibration according to gravity ($X_{max} = 3.27$ G, $Y_{max} = 3.67$ G, $Z_{max} = 15.27$ G) Effect of packing banana slices Lost 284 grams percent. 28.4, High speed 90 km / h, can measure vibration according to gravity ($X_{max} = 4.09$ G, $Y_{max} = 3.87$ G, $Z_{max} = 16.77$ G). Impacts contain 414 grams of damaged banana peel products, representing 41.4% of the result. Analysis of exploratory experiments, vibration and shocks When the vibrations according to gravity vary, the speed results in the impact of the damaged banana peel products as well.



Measure vibration by gravity.

SUGGESTIONS

This research study There is a time period for analysis. And study the problem of banana packaging packaging in Ban Kho Subdistrict, Ban Phue District, Udon Thani Province Has a short period of time, therefore conducted only one type of pickup truck transportation Therefore, Ban Nong Kong Housewife Group, Ban Kho Subdistrict, Ban Phue District, Udon Thani Province should conduct additional experiments In addition to the experimentation of the students, including buses, vans and tour buses in order to get real results and to develop further.

Design the package to be uniquely local To attract more attention But has not studied the needs of consumers In terms of packaging benefits Packaging properties And the potential of the package Therefore, consumers' needs should be studied as follows.

- Benefits of packaging to be useful in the prevention of broken plaster bananas. Prevents deterioration of the quality of the banana. And the packaging can be easily transported.

- Packaging properties to be colorful There are many sizes to choose from. With a modern shape Has a unique and unique characteristics, with a clear date / month / year, production date - expiration date and clearly specify the components of the product.

- Packaging potential to help extend the shelf life of bananas for a long time can decompose by itself or can be reused and strong.

REFERENCES

- [1] Anuchnam Pinyo. (2019). The influence of distribution management and delivery service efficiency of large retail businesses that satisfy customers in the metropolitan region. *Journal of Logistics and Supply Chain College*, 5 (1), 82-98.
- [2] EXPORTERS, T. O. F. (2019). Factors influencing the selection of carriers for Thai ornamental fish export companies. *Panyapiwat Journal*, 11 (1), 79.

- [3] Paternoster, A., Vanlanduit, S., Springael, J., & Braet, J. (2018). Measurement and analysis of vibration and shock levels for truck transport in Belgium with respect to packaged beer during transit. *Food Packaging and Shelf Life*, 15, 134-143.
- [4] Paternoster, A., Vanlanduit, S., Springael, J., & Braet, J. (2018). Vibration and shock analysis of specific events during truck and train transport of food products. *Food packaging and shelf life*, 15, 95-104.
- [5] Paternoster, A., Van Camp, J., Vanlanduit, S., Weeren, A., Springael, J., & Braet, J. (2017). The performance of beer packaging: Vibration damping and thermal insulation. *Food Packaging and Shelf Life*, 11, 91-97.