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A Categorical Review of Shrink Wrap Packaging

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Abstract: In this paper, in order to carry out in-depth study regarding shrink wrap packaging , generalized design of shrink wrap packaging machine, properties of shrinkable film and research methodology and exhaustive literature review is carried out and is presented in this paper.

Keyword: Shrink wrapping machine, PVC packets, shrinkage properties, cloth peg

I. Introduction.

In order to develop shrink warp packaging machine for cloth pegs, an exhaustive literature review is carried out for holding cloths at a space when cloths are kept for drying. They are made of plastic material. Presently packaging of cloth pegs are carried out manually. By providing shrink wrapping machine it will be convenient to handle cloth pegs, its appearance is good and glossy, the shrink wrap safeguard cloth pegs from scratch. In manual process of shrink wrapping, the operator use to pick up cloth peg, insert it into a PVC packaging i.e. shrink and then the packet is hold behind the dryer by giving gentle rotation from top to bottom side because of heating shrinkage of shrink film takes place and film occupy volume of product. In order to reduce drudgery of operator, an attempt is made to develop a mechanized system for shrink wrapping of cloth peg. The first step before going for mechanized system of shrink wrapping machine for cloth peg is to carry out an exhaustive literature review regarding shrink wrapping process.

II. Literature review.

1) Properties of shrinkage film.
2) Application of shrink wrap packaging.
3) Structure approach for synthesis of mechanism.
4) Research methodology.

1) Properties of shrinkable film.

Shape memory polymers which comes under a class of polymers that unveil how stimulus to such polymer changes the shape of polymer [1]. The research presented here focused on characterization of material of thermally stimulated shape memory polymers, explicitly heat shrinkable bands which are most of the times use in packaging in the food and the medical industry. Regulatory agencies are more and more shoving the use of non-PVC materials industry wide. The study show an experimental approach for evaluation of polyester shrink bands (non-PVC) comparing with PVC with respect to thermo mechanical and shrinkage properties.

Even if the heat shrinkable PVC sheets in food packaging industry have unique applications, a few works have been performed to study the shrinkage behavior of such sheets [2]. Thus, in this work, investigation is made on shrinkability of PVC sheets and what influence this different parameters has on the above-mentioned property has been effectively focused. This paper shows the results of research points at characterizing the shrinkage behavior of PVC sheets along with the outcome of different additives and their weight fractions on the shrinkability of the prepared sheets using experimental design Taguchi method. Moreover, study has been carried out on shrinkage behavior of PVC sheets at optimum conditions along with its stretching and shrinking temperature effects have also been investigated. The result from the research is that among seven investigated variables, plasticizer has the convincing effect on the shrinkability of PVC sheets. Also, an increase in the stretching temperature can vastly influence polymer's crystalline structure at optimum conditions and eventually, shrinking temperature.

2) Application of shrink wrap packaging.

Shrink wrap packaging which tell it is one of finest and newest techniques for storing tamarind pulp briquettes [3]. This paper focuses on various thicknesses of flexible films namely 19 micron LLDPE, 38 micron LDPE and 63 micron MDPE has been used for standardized individual shrink temperature along with residence time inside the shrink wrap machine tunnel.

Packaging of fruits. Packaging of individual apple fruit is necessary not only to make inclination of customer towards product but also helps in protecting the post-harvest quality while distribution and marketing [4]. A study was made on effectiveness of polymeric shrink-wrap to individual fruit and 3 fruit in a tray-wrap for packaging option for retail marketing. In this, apples are shrink wrapped with the help of 15 and 25 micron film and were stored for 4 weeks at ambient condition (30-38ºC, 52-58% RH) and its evaluation is done for physico-chemical quality in comparison to the apples without wrap. Different parameter were taken to determine changes in quality like by visual observation, weight loss due to desiccation, change in firmness, titrable acidity, total soluble solids, water activity, decay, colour and sensory test. After two weeks, unwrapped apples were found inappropriate due to exceptionable loss in physiological weight, colour and firmness; and dehydrated fruit surface. Wrapped fruits remained almost unchanged in terms of colour and firmness during the period of storage. The study shows that 25 micron shrinkable film performed better compared to 15 micron for wrapping of apple fruit either individually or in a tray of 3 fruits. Analyzing cost for shrink wrapping of individual apple fruit and 3 fruits in a tray estimated that cost goes around Rs. 0.50 - 0.60 per fruit and Rs. 1.50 - 2.00 per tray of 3 fruits. The polymeric shrink-wrapping gives a protective and safe coating over the fruit surface that enables extension of marketable shelf-life of apples by at least two weeks comparing with unwrapped fruits.

Immature green cucumber. 'Padmini' fruits were individually shrink wrapped with Cryovac D955 (60 guage) film and storage condition were like 12 ± 1 °C, 90-95% RH and having ambient condition of 29-33 °C, 65-70% RH [5]. At this given storage condition, individual shrink wrapped cucumber got minimum Physiological weight loss has been noted which is 0.66%when compared with unwrapped fruits which is 11.11% at the end of refrigerated storage which is of 15 days. The sagginess was observed in unwrapped cucumbers whereas in shrink wrapping there was minimum loss in firmness was there after 12 days storage at given storage condition but more loss of weight and firmness makes the control cucumbers unsaleable after storing for 9 days. The rotting were not at all present both in shrink wrapped and unwrapped cucumbers upto 15 days of storage at given storage condition. After 15 days storage of shrink wrapped cucumbers at given storage condition, there was fading of green colour and also growth of yellowness and decay. In terms of sensory attributes score in shrink wrapped cucumbers scored highest comparing with unwrapped cucumbers at end of both storage conditions. Thus, conclusion taken from this experiment is that individual shrink wrapped cucumber can be stored well upto 15 days at given storage condition and for upto 5 days at ambient conditions with maximum retention of its colour, no spoilage, minimum weight and firmness loss and very good sensory quality aspect whereas, unwrapped fruits can be stored well upto 9 days given storage condition and for 2 days at ambient conditions with maximum retention of physico-chemical quality aspect.

3) Structured approach for synthesis of mechanism.

General method which is aimed to find the optimum set of physical parameters of a mechanism in a fashion that a definite physical characteristic of the system will befitting the required physical characteristics in the operating range of the mechanism [6]. This physical characteristic to be required here may be an angular displacement, a linear displacement in two or three dimensions, a spatial force or a spatial moment of force, etc. The physical parameters to be enhanced and make perfect may be angular, linear dimensions, masses, moments of inertia of the elements, or physical properties of the elastical members of the mechanism.

Mechanisms which various machines uses to obtain the desired motions [7]. If the number of links and degrees of freedom go on increasing, then more and more complex it become to synthesis the mechanism. The blend mechanisms comes with some limitations to get the required motions as satisfied. For these reason mechanisms consisting of multi-degrees of freedom, adjustable mechanisms and mechanisms along with variable topology need to be concentrate on.

The aim of this paper is to highlight similarities and differences across numerous case study designs and to examine their contributions to theory [8]. Even if different designs tell us some common elementary characteristics, a comparison of such case study research designs demonstrates that case study research incorporates different scientific goals and collection and analysis of data. This paper relates this comparison to a more general debate of how different research designs contribute to a theory continuum. The fine-grained analysis in this demonstrates that case study designs fit differently to the pathway of the theory continuum. This results in the contribution is a portfolio of case study research designs. In this case study designs the heterogeneous contributions portfolio is

demonstrated. Considering this portfolio, better evaluation can be done of theoretical contributions of case study designs that can be in terms of understanding, theory-building, theory development, and theory testing.

4) Research methodology.

Research methodology that defines what the activity of research is, how to begin, how to measure progress, and factors which lead to its success [9]. It help us in providing advancement of wealth of human knowledge, tools of the trade to perform research, tools that helps in looking at things in life even-handedly, develops a critical and scientific attitude, make us think in disciplined way to observe even-handedly; skills of research especially in the 'age of information'. Also it explains the way in which the data for research project are collected. In this paper, two components of the research methodology from a real project it presented; the theoretical design and framework respectively.

III. Mechanized system for Shrink wrapping machine of cloth peg.

Initially synthesis of mechanism is carried out. For the type synthesis belt drive, chain drive and gear drive for roller is considered. But chain drive is selected as there is heating zones near coil. Similarly, metallic conveyor belt, rollers are taken into consideration but considering the life factor, simple and robust rollers are taken into consideration. The length was estimated 600 mm for placing cloth peg packets, its travel through heater coil and its exits, hence it is decided to take roller of 25 mm diameter along with sprocket of 40 mm. Center to center distance between rollers is 40 mm. On pipe in order to avoid overheating a pvc pipe coating is provided. A speed controller for geared D.C. motor whose maximum speed is 100 rpm, is incorporated in order to obtain optimize result of shrink wrapping of the product. All the rollers are rotated by single chain drive. From the in-depth study of a shrink film it is observed that at 65 to 70º, it wraps around the product, hence heating coil temperature of the heater is set at 80 deg. In order to have effective heating height of the coil is placed at a distance of 50 mm from the top surface of the product. Similarly for better finish of product surface area of heating coil is considered as 250 x 250 mm. Speed of fan is 2500 rpm. These data is collected by carrying out experiment. Experiments and trials are carried out by taking 45 sample size of cloth peg packet and considering best quality of shrink wrap cloth peg packet as good appearance, glossy, uniformly shrink wrapped and pressed corners, independent parameters angular velocity, height of heating coil, temperature of coil, speed of fan are finalized. After selecting the optimized independent parameters, in order to avoid heat loss, the heaters are covered from bottom side so that power consumption can be reduced.

IV. Conclusion.

Exhaustive literature review is carried out to know works carried out by earlier researcher and to sum up significance of Shrink wrapping machine. Here an attempt is made to design and develop mechanized system of Shrink wrapping machine for cloth peg. Similarly there is huge scope to design and develop shrink wrapping machine for other products.

References:

[1] Zehra S.Kalkan-Sevinc, Caitlin T. Strobel, (2015). Material Characterization of Heat Shrinkable Film. *Journal of Testing and Evaluation*. Volume 43, Issue 6.

[2] Pejman Hadi, A.A. babuluo, (2017). Additives effects on the shrinkage behavior of PVC sheets. *Journal of Applied Polymer Science*. Volume 106, Issue 6, pages 3967-3974.

[3] Bhagwatkumar and S.Patel, (2018). Application of Different Flexble Films in Shrink Wrap Packaging Machine for Packing of Tamarind (*Tamarindus indica* L.) Pulp Briquettes. *Advances in Life Sciences 7(1)* Print: ISSN 2278-3849, 57-59.

[4] Thakur, A. K., Kumar, R., Bhushan Shambhu, V., & Shekhar Singh, I. (2017). Effectiveness of Shrink-wrap Packaging on Extending the Shelf-life of Apple. *International Journal of Current Microbiology and Applied Sciences*, *6*(12), pages 3365–3374.

[5] Rajinder Kumar Dhall, Sanjeev R.Sharma, B. V. C. Mahajan, (2012). Effect of shrink wrap packaging for maintaining quality of cucumber during storage. *Journal of Food Science and Technology*. Volume 49, Issue 4, pages 495-499.

[6] Dr. Han Chi-Yeh (2003). A general method for the optimum design of mechanisms. *Journal of Mechanisms* Volume 1, Issues 3–4, Pages 301-313

[7] **Prashant B Tadalagi, Shrinivas S Balli, (2019). A Review on Mechanisms with Variable Topology (Revisiting the Variable Topology Mechanism).** ***IOP Conference Series: Materials Science and Engineering*** **Volume 691.**

[8] Hans-Gerd Ridder, (2017). The theory contribution of case study research designs, *Business Research volume 10, pages281–305.*

[9] Noel Pérez. Research Methodology: An example in a Real Project. Laboratory of Optics and Experimental Mechanics, Instituto de Engenharia Mecânica e Gestão Industrial.