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PRODUCTION OF HARD SHEETS FROM MUNICIPAL SOLID WASTE

Mohamed Magzoub Garieb Alla, Amel G. Elsharief
magzoub@hotmail.com

Abstract: Waste is actually the biggest feed stock available for processing, to produce useful and usable products. The increasing amount of waste is a characteristic of the modern human, though this discloses a more luxury life it presents an environmental hazard that cannot be ignored. Following this understanding we decided to impact on method of utilizing waste and converting it into useful and usable products as well as reducing the nuisance of waste. The methodology followed comes in steps; first a random trial to detect the use of unsorted waste and evaluating the equipment design, secondly improvement of blending of different components of waste, thirdly improvement of facilities for uniformity of heat and pressure, finally arriving at suitable formula regarding the ratio of the different waste components to give uniformity and better hold of the product.

Key words: waste, aseptic carton, plastic waste, hard Sheets.

I. INTRODUCTION

Human activities create waste, and the ways that waste is handled, stored, collected, and disposed of can pose risks to the environment and to public health. Solid waste management includes all activities that seek to minimize health, environmental, and aesthetic impacts of solid waste.

In urban areas, especially in the rapidly urbanizing cities of the developing world, problems and issues of municipal solid waste management (MSWM) are of immediate importance. Most governments have acknowledged the importance of MSWM; however, rapid population growth overwhelms the capacity of most municipal authorities to provide even the most basic services.

According to a United Nations Development Programmer survey of 151 mayors of cities from around the world, the second most serious problem that city dwellers face (after unemployment) is insufficient solid waste disposal (UNDP 1997). Typically one- to two-thirds of the solid waste that is generated is not collected. The uncollected waste is dumped indiscriminately in the streets and in drains, contributing to flooding, breeding of insect and rodent vectors, and spreading of diseases.

II. LITERATURE REVIEW

In recent years, environmental problems and recycling issues are being discussed with more popularity in most of the developed and developing countries. In 2006, 313000 tons of beverage carton were recycled within a total capacity of 12 billion tons recycled material that represents a recycling rate of 30% in Europe. Recycling is not only increasing at a high rate but also combining with recovery of material reaching to almost 636000 tons with an approximate value of 61% rate in European Union. It is expected that more than 70% of municipalities will have enhanced opportunities for recycling household packaging. Recycled food carton also has substantial amount of market share within recycling industry. Nyström(2000)

In Sudan, recently the discussion of environmental problems and recycling issues is started with more popularity. Recovering waste material from used beverage cartons (UBC) to manufacture a value-added product with an economical and efficient method is an important issue from the perspective of environmental pollution. Recycling of beverage cartons is a relatively new developing industry in Sudan. The material obtained from recycled UBC carton in world is predominantly used for the manufacture of paper and carton based products including shopping bags, cores for paper reel, sheets of cardboard, disposable kitchen towels, printing paper, plaster board lining and corrugated board.

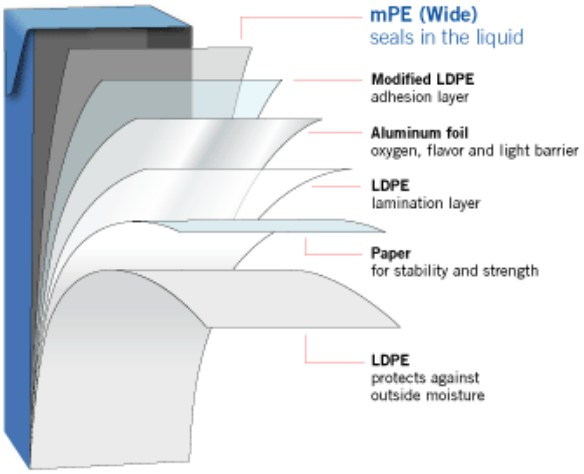

FIGURE 1: Aseptic carton

Throughout the manufacturing process, the cartons are treated in such a way that no other material including toxic adhesives are needed. Cardboard also offers excellent soundproofing and insulation qualities UBC carton can be recycled using a thermal compression process to manufacture home and building products. The dominating structure of a used beverage carton is seen in Fig.1. As an alternative to re-pulping for paper applications, an additional process converts shredded cartons into thermally compressed to make a high strength bio-composite panel alternative to traditional wood based panels such as particleboard, medium density fiberboard (MDF) and oriented strand board (OSB). This type of panel product was developed by Tetra Pak® and is produced in various countries under different brand names. Which is composed of 70 - 90% paper, 10 - 25% low density polyethylene (LDPE) and about 5% aluminum which are existing components of UBC used. UBC cartons collected from consumers are shredded and then molded together under

high temperature and pressure. The process uses the whole waste package without leaving any waste. UBC cartons are shredded into 5 mm particles and formed in a layer to get a desired thickness. The mat is then compressed under pressure and heat in a hot press. In this process, there is no need for the addition of an adhesive element due to 20% polyethylene in UBC carton raw material. The polyethylene content in the mat melts and binds fiber and aluminum pieces together in the form of a compact elastic matrix. Aluminum at the rate of 5% causes the heat to spread more uniformly. Nyström(2000)

A. Production of panel board:

It started as a project in Lund, Sweden, in mid-eighties. The first production site was built at Tetra Pak in Kenya 1987. Since then, other manufacturing sites operating in countries across the world have developed. Today's manufacturing plants are located in Argentina, Brazil, China, Germany, Kenya, Pakistan, Slovakia South Korea and Turkey.

Most plants are small-scale business with production operating at 1-2 shifts, 5 days/week. Capacities vary but are in general from 2-5 tons/day. The world production for 1999 is summarized in the table below. Nyström(2000).

Location	Commercial name	Tones/year
Argentina	T-PLAK	910
Brazil	Reciplak	200
China (2 factories)	Chiptec	1500
Germany	Tectan	500
Kenya	Lamiboard	350
Pakistan	Green Board	750
Slovakia	Tetra K1,K2,K3	645
Turkey	Yekpan	1400
	Total	6255

Production of the panel board is basically the same across the world and includes the following unit operations. Shredding, (washing, drying), forming, hot and cold pressing, handling / trimming.

The modern trend of utilizing natural resources is becoming more and more prime since the resources are limited and full utilization is no longer a luxury but a necessity. While reprocessing of water ,soil remediation , and the hot cakes other areas can be ignored paper processing has gained a remarkable momentum as raw material for paper are trees and forest which are getting exhausted.

In his endeavors to play a role however small it might be , he put in his mind the utilization of feed stock which nobody wants, and which actually is considered a bother and an environmental hazard, namely waste packaging material including:-

1- Paper
2- Aluminum foil
3- Plastics
4- Cartons
5- Shrubbes

Aseptic carton (commercially known as Tetrapak)

B. Hot press design:

The hot press should give:-

1- High temperature
2- High pressure
3- Uniformity

The first trials using steel plates were very tedious and did not give the required results due to:

1- High temperature burning the stock.
2- Non uniformity of selvedges heating.

The design changed using high resistant bricks similar to bricks use in bakeries and those gave the required results.

The next step was to improve the selection of the feed batches, in such a way that each batch contain similar ratio of different component, we took notice of the fact that to give repeatability of the production, we also made note of the fact that the plastic component under action of heat and pressure will act as binder to increase the composure and solid properties of the sheet.

Having obtained sheets of reasonable characteristics then proceeded to reduce the thickness to facilities production of corrugated sheets which are popular as ceiling.

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Trials:

The trails were done at different conditions such as different recipes of feed stock, different temperatures. But most of them were done at time between 10 to 15 minutes.

Trial 1:-

This is entry to the process to get adequacy of self-made simple equipments to give required results as governed by the production obtained. Waste was cut in small pieces mixed manually and randomly scattered to give a uniform layer. The production obtained:-

1- Lack in uniformity.
2- Selvage where not adequately heated and pressed.
3- The whole of the final product was doubtful as regards to its use for specific purpose.

Trial 2:-

As it was noticed that the feedstock suffered from burning also the heating plates had to be modified from iron plates to heat resistant bricks. This gave safer heating without causing change to the stock and modifying pressure. The result was better as regards to selvage heating and uniformity. Consistency was still a problem as hold.

Trial 3:-

In this trial we concentrate on more proper blending of the waste and the result was a visible improvement but lack in ability to cement.

Trial 4:-

Concentration was on how to give a better hold avoiding as much as possible any expensive additions so it was thought that the incorporation of thermoplastic should be consider a prime factor in the percentage of polyethylene to be used was give more than step child attention, so minium of:-

1. 25% linear chain polyethylene of the used a cheaper packs which always available around is made a rule.
2. The polyethylene is cut in small pieces and uniform distributing the blend.

The use of poly ethylene is important as binding agent as a dissolve under the reaction of heat and pressure and then solidified acting as glue improving the whole and giving a better light reflection.

Trial 5:-

Was done using Aseptic Carton (terapack) as major component the recipe runs as follows:-

75% paper
20% polyethylene
5% aluminum foil

The purpose behind the use of aluminum is it shiny looks and luster and extra strength it gives to the product.

General speaking we made more than twenty trails for plain sheets

C. Corrugated trials:

A mold was designed to produce corrugated product to be used as fencing and roofing. Results were encouraging even compare to standard light weight international products available in the market. The same recipe was done in the corrugated trials.

Plate1. Different trials

III. CONCLUSION

The best recipes according the trials are:

1. 50% plastic and 50% agricultural waste (Shrubbes). This trial was done under temperature 80˚C.
2. 30% newsprint waste, 30% agricultural waste and 40% plastic. This trial was done under temperature 80˚C.

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