



UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)

AUTOMATIC CABLE STRIPPER

Thesis submitted in accordance with the partial requirements of the
Universiti Teknikal Malaysia Melaka for the
Bachelor of Manufacturing Engineering (Robotics & Automation) with
Honours

By

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This thesis submitted to the senate of UTeM and has been accepted as fulfillment of the requirement for the Bachelor of Manufacturing Engineering (Robotics & Automation) with Honours. The members of the supervisory committee are as follows:

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DECLARATION

I hereby, declare this thesis entitled “**Automatic Cable Stripper**” is the result of my own research except as cited in the references.

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ABSTRACT

Automatic Cable Stripper is a machine to separate core from coaxial cable for recycling purpose. In this project, the mechanism of cable stripping is investigated to study its application from existing machines. The suitable equipment and material were identified for the application of stripping the cable. The relevant information was analyzed to know the size of cable and speed of motor that is used in stripping process. The relationship is made for different size of cable and pulley height to ensure various size of cable can be fed. In theory the expected result was the Automatic Cable Stripper will strip and separate between core and coaxial cable automatically.

ABSTRAK

Automatic Cable Stripper (ACS) atau Pemotong Kabel Automatik adalah mesin untuk mengasingkan jalur logam daripada kabel getah secara automatik bertujuan untuk dikitar semula. Dalam melaksanakan projek ini, mekanisma pembelahan kabel pada mesin yang sedia ada dikaji untuk mengenalpasti penggunaannya. Segala maklumat yang berkaitan dengan projek ini dianalisis untuk mengenalpasti toleransi saiz kabel dan kelajuan motor yang sesuai digunakan untuk membelah kabel. Peralatan dan bahan yang sesuai juga turut dikenalpasti untuk membuat prototaip Pemotong Kabel Automatik ini. Nisbah antara saiz kabel dan tinggi takal diambil kira untuk membenarkan pelbagai saiz kabel dapat diasingkan. Secara teori, jangkaan hasil yang akan diperolehi adalah Automatic Cable Stripper dapat membelah dan mengasingkan antara jalur logam dan kabel getah secara automatik.

DEDICATION

For my parents, Nasri bin Rawi and Salmiah binti Aziz, for my siblings and friends.

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LIST OF ABBREVIATION

ACS	-	Automatic Cable Stripper
DC	-	Direct Current
AC	-	Alternate Current

CHAPTER 1

INTRODUCTION

1.0 Introduction

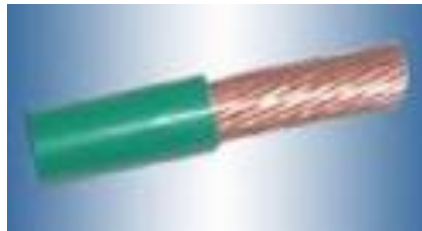


Figure 1.1 : Coaxial Cable

Coaxial cable is consisting of a round conducting wire (core), surrounded by an insulating spacer, usually surrounded by a final insulating layer (jacket). It is used as a high-frequency transmission line to carry a high-frequency or broadband signal. The electromagnetic field carrying the signal exists (ideally) only in the space between the inner and outer conductors, hence it cannot interfere with or suffer interference from external electromagnetic fields.

Cable stripping machine is a conventional method to separate core from coaxial of cable. Generally, many companies that involved in cable recycling use manual method to separate coaxial and core. Normally use grinder and cutter to cut the coaxial and take out the core. With Automatic Cable Stripper (ACS) it will help to separate coaxial from cable stripper effectively.

ACS uses an AC motor to push the cable into cutting path or line. The cable will be drawn to the cutting disc through a pulley. The purpose of using pulley is to make the cable movement straight to the cutting disc. When the cable was drawn through the pulley, cutting disc will cut coaxial and only its core will be pulled into the box. To provide variability in cable size, the pulley is adjustable so that various size of cable can be stripped with the ACS.

1.1 Background of Problem

From the visit that was made in Telekom Cable House, the cable stripper used always facing problems especially at the motor section. The motor always stuck because of core overload. This has burdened the company because the maintenance cost is very expensive.

Other method to separate coaxial from cable is using oven. In the big oven, the cable was placed on a net metal filter. Then, the oven will be heated and melt the coaxial. The coaxial then will drop down and the core will remain at the filter. This process consume a lot of time because it will take about 3-4 days for the coaxial to be melt completely. The problem of using oven is that some of the rubber coaxial will stick at the filter and is needed to separate it.

Another method commonly is to strip the coaxial by using knife, cutter and grinder. This process is very slow and consumes a lot of time and man power.

1.2 Objective

The aim of this project is to separate coaxial and core automatically using an Automatic Cable Stripper. To achieve this, there are three objective involved:

1. To fabricate a prototype of Automatic Cable Stripper.
2. To analyze requirement and features which is suited with Automatic Cable Stripper.
3. To increase the efficiency and productivity by removing a big amount of coaxial in short time.

1.3 Scope

As guidance to this project, the project scopes are required for assisting development of the project. The scope of this project will cover on the design and fabrication of a cable stripper machine. The design will involved on intended modification features as the machine is already in the market. The design work will include the ACS of modeling so that the features of modification can be clearly observed. The software used to draw the design is AUTOCAD and SolidWorks. The modification features will be design to achieve optimum design efficiency of productivity by removing large amount of coaxial in short time. The fabrication of cable stripper machine will also involve manufacturing process and also assembly. The manufacturing processes that involved are cutting, bending, drilling and welding.

1.4 Significance Of The Study

The research to fabricate ACS is a broad topic because the study needs to make a research on cable, and mechanism of stripping. Research on cable is related with Material Engineering and stripping mechanism is related with Mechanical Engineering. Stripping mechanism also related with automation. To fabricate the prototype, the study of Manufacturing Process had been recalled. The skill of manufacturing process such as drilling and cutting had been used to fabricate the prototype. Reference from the previous research and current product can guide in fabricating the ACS. The complete prototype of ACS can be very useful especially in recycling industries. A lot of cost can also be reduced by the industry in using the existing prototype of ACS rather than to purchase it from manufacturer.

1.5 Conclusion

As a conclusion, this project will give an opportunity to student to show their abilities and skill gain during the study in conjunction of completing the project. Students are willing to show the highest level of discipline and behavior as bachelor student of UTeM.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will emphasize on past studies and researches done which relates with ACS and recycling activity. The research is focus on recycling method, type of cable, and current product of cable stripping machine. Generally, cable recycling method is quite similar which the cable is combusted. The study of cable type is to gain information about cable's diameter and jacket's width. From current product, the idea to fabricate the ACS is obtained. The mechanism of cable stripping also obtains from current product. The source of literature review is taken from journal, article, book and website.

2.1 Recycling Of Cable Waste

Each year, a huge number of cables become obsolete and no longer in use. This is because of several factors such as cable's thief, damage from manufacturing, earth disaster, relocations of cable and etc. The cables consist of one or several metal circuit lines and layers of plastic insulation. The metal is copper, which has high value. The cable's recycling also generates plastic waste (insulation) which approximates has no value.

Mattias Lindahl and *Mats Winsnes* has written about cable's recycling in their article, "*Recycling of Cable Plastics -A Life Cycle Assessment of Several Different Alternatives*". The article discusses about seven different recycling alternative of cable waste. Next page gives brief explanations of seven method of recycling cable waste from their article:

2.1.1 Mechanical recycling in the Vinyloop process

Presently, only one Vinyloop plant exists, which is located in Fererra, Italy. However, it is not considered economical to transport material so far. Therefore an imaginary plant, located in Malmo, Sweden, is assumed. Transportation to this imaginary plant will occur via long distance truck.

2.1.2 Chemical recycling in the Stigsnaes process

This plant is located in Kors6s in Denmark. Transportation will be via long distance truck.

2.1.3 Energy recovery in a garbage incineration facility

The energy recovery is assumed to be in Sundsvall Energy's garbage incineration plant. Transportation will be via truck.

2.1.4 Energy recovery in a cement kiln

An imaginary cement kiln is assumed to be located at Cementa Abs plant on Gotland, a Swedish island located in the North Sea. Transportation will be via truck and freighter.

2.1.5 Open burning in China

An imaginary open burning facility is assumed to be located in Guiyu, China. The transportation will be via long distance truck and freighter from Gothenberg harbor to Nanhai, China, and via truck from Nanhai to Guiyu.

2.1.6 Granulation and energy recovery in China

An imaginary granulation and energy recovery facility is assumed to be located in Guiyu, China. Transportation will be by long distance truck and by freighter from Gothenburg harbour to Nanhai, China and by truck from Nanhai to Guiyu.

2.1.7 Cable stripping in China

A cable stripping facility is assumed to be located in Guiyu, China. Transportation will be via long distance truck and by freighter from Gothenberg harbour to Nanhai, China and via truck from Nanhai to Guiyu.

2.2 Cable Combustion

Method one to six is quite similar, which the cable's is combusted by burning the impregnated paper of lead cables. The temperature is increased above 327°C which is the melting point of lead. Lead melts and ingots are produced. The copper remains solid and can be collected after burning. The combustion generates a lot of ashes along with dioxins, more carbon monoxide and other poisonousness substances.

Although cable's combustion is a simple and efficient technology to separate copper and coaxial, this technique was being prohibited in some country. The reason of prohibited is because of the emissions of heavy metals, dust and dioxins into the environment. The Dutch government band burning by not continuing the appropriate license, *L F Sijstermans* "Recycling of Cable Waste", KEMA, The Netherlands.

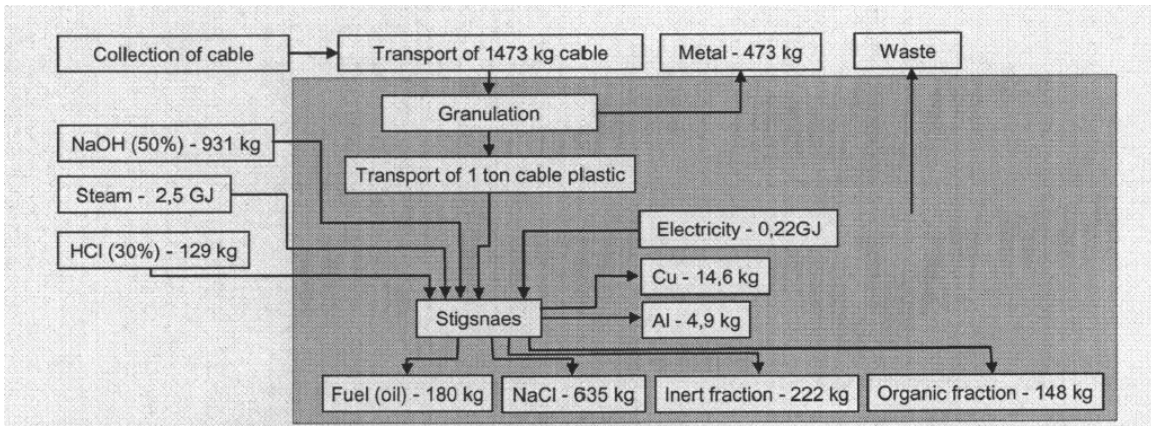


Figure 2.1: Flowchart of the Stignaes alternative.

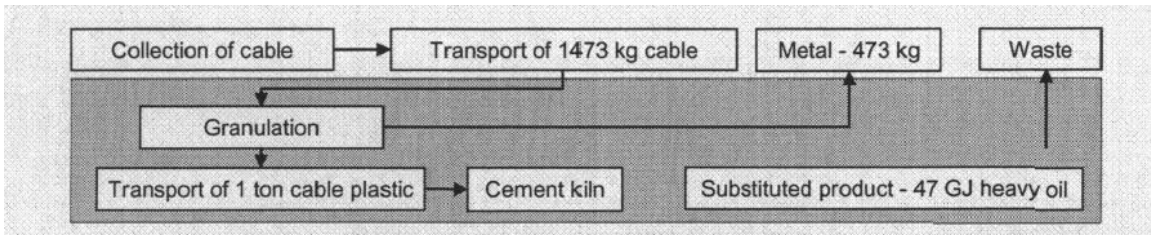


Figure 2.2: Flowchart of the energy recovery in a cement kiln alternative.

2.3 Cable Stripping

In cable stripping machine, cable are fed into a machine that tears the plastic from the electric cable, and very little metal ends up in the plastic fraction. The plastic fraction (PVC and PE) is sorted and used for products like shoe soles and substitutes newly produced PVC and PE. The insulation material is being split and peeled of the conductor. The stripping machine is manually fed and therefore has a low capacity. Cables with a small diameter cannot be stripped and must be shredded.

Four fractions are being produced during stripping of the energy cable. The results show that a copper product is produced with a grade of 99%, recovering 97% of the copper. All the lead is recovered with a grade of 98%. The residual waste contains 4% copper and 3% copper is lost. The results of cable stripping machine depend on the type of cable and process. Some conclusion can be made. Firstly, by using stripping technology to process cable scrap, higher metal grades and recoveries can be achieved. This mean can prevent higher metal grades from waste.

Because of money constrain and high maintenance of cable stripping machine, copper separation is often not practiced. Usually, only one or two company offer cable stripping in one big location.