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A Preliminary Study of Tinted Film from Onion Peel

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Abstract : This study covers Polyethylene Terephthalate (PET) which is used as a raw material in the manufacture of tinted films which are mostly used in the processing industry. Malaysia's hot and humid conditions have made tinted film an option for the majority of vehicle owners. This is because the tinted film can affect the temperature drop in vehicles or motorcyclists who use helmets. It can also minimize sunlight or light from outside that can interfere with the comfort and focus of road users. Moreover, with the advancement of technology nowadays, most of the natural materials that were originally used as materials in manufacturing are modified using synthetic materials. However, the move is seen as one of the causes of environmental pollution due to the chemicals it contains. Therefore, natural dyes will be used in this study as a measure to reduce the use of chemicals in the universal life. This onion peel dye will determine whether the tinted film produced can comply with safety standards or not. Finally, apart from providing protective comfort to users on the road, this study is also to ensure that the tinted film produced can minimize the impact of accidents. Shattered vehicle mirrors and helmet visors as a result of an accident can inflict more serious injuries on the victim. Therefore, the tinted film used can grip the fragments of the mirror so as not to scatter badly. Luxmeter used in this study. As a result, the lux meter shows lower reading when the mirror uses a tinted film.

Keywords: Tinted film, Onion Peel, PET,

1. Introduction

The use of tinted film on car mirrors or helmet visors is very commonly seen in any country. The main purpose of users choosing a tinted film is to filter or control the amount of sunlight especially that enters the vehicle or helmet. This is because the tinted film will give a darkening effect on the windows while providing good privacy for users [1]. The degree of darkness for a tinted film can be measured as Visible Light Transmission (VLT) [2]. The light intensity can rise as the percentage of VLT increases. As a result, visibility will gain.

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Regarding the effect of a tinted film that can darken the window, its use must be acceptable and follow the road rules established by the respective national authorities. This is to ensure the welfare of all road users as well as to deter any potential criminal activity. The tinted film is mostly made of Polyester Terephthalate (PET) due to its benefits. Polyester Terephthalate (PET) film, also known as polyester film, is a versatile plastic used in a wide range of applications, including packaging (e.g., food, pharmaceutical, health care, medical, industrial, and chemical packaging), electrical (photo-sensitive resistors, insulators, cable and wire wrap, capacitors, and circuits), and imaging (X-ray film, instant photos) [3].

For motorcyclists, the use of a helmet is mandatory because apart from protecting the head from any impact in the event of an accident, it can protect the face, ears and so on. The visor on the helmet also plays an important role because it protects the face where insects, foreign matter, dust or wind can injure the face and disturb the rider [4]. In addition, most visor helmets are equipped with a construction that can protect the rider from sunlight and other bright light incidents on the eyes. However, each helmet on the market is produced by a different manufacturer, so each one has its own set of benefits and drawbacks. One of the flaws that must be addressed is the helmet visor's ability to cause more serious injuries to the rider due to its shattering effect. This also happens for other types of vehicles where the glass fragments injured the victims. Based on the results of previous studies conducted by [5], Malaysia is located on the equator, with the lowest and highest temperatures of 23.1°C and 35.7°C, respectively. The stated temperature is in Peninsular Malaysia, and the reported temperatures are from the Malaysian Meteorological Department. Because of the constant recorded temperatures, road and highway users were obliged to install and utilise a covering or cover of the inside of their cars to ensure a smooth and comfortable ride to their destination. As a result, coloured glass is an alternative to that inner layer of protection. However, the topic of tinted glass is often addressed at the moment. The usage of tinted glass has several advantages and problems.

Taking into account the need for vehicle owners to use tinted film either on vehicle windows or on helmet visors, it is permissible based on established rules. The windscreen of a car can be tinted under Rule 5(1) of the Motor Vehicles (Prohibition of Certain Types of Glass) Rules, 1991, although it must allow transmission of at least 70% visible light, while side windows, including rear glass, must enable 50% light transmission [6].

In the plastics sector, colour selection is one of the most crucial factors to consider. Colour is an essential component of plastic material, and it should not be overlooked. A comprehensive systems approach must be used to deal with the entire system of coloration. Although the colour improves the part's usefulness, it also has the potential to damage some material attributes such as impact strength if not applied appropriately. Dyes and pigments are the colourants that are utilised in the plastic industry. Colour is produced through visible light absorption and scattering in both dyes and pigments.

Referring to the updated road rules, the tinted film is allowed on vehicle windows with the minimum visible light transmission (VLT) percentages are 70% for the front windscreen, 50% for the front side windows, and 30% for the rear windows and the rear windscreen. This was allowed as a result of so many requests to bend the rules and allow darker tints to ward off the heat and the authorities have considered that. However, no tolerance is given on the front side windows and windshield. Yet, many still look down on and ignore the rules that have been set. As a result, every year many lawsuits involving the misuse of the tinted film are filed against road users. Therefore, the tint level is very important to emphasize because comfort is the second priority after safety in all respects.

When it comes to plastic components, there is a lot written about the importance of material selection. However, while it may appear complex at first, appropriate material selection may make a significant difference in the results. The material used in the process of making the tinted film will be something that affects the final quality of the product. The strength, flexibility and functional requirements of the product must be considered to ensure they can be fulfilled by the material used.

Polyethylene Terephthalate (PET) is often used as the basic material for making tinted films. It is based on the characteristics it has. PET film has several desirable properties, including high tensile strength, flexibility, physical retention over a wide temperature range, electronic insulation characteristics, durability, heat resistance, gas-barrier characteristics, size resistance, chemical inertness, optical clearness and relatively low moisture absorption [7].

SRWF, also commonly known as anti-shatter film or security film, is one of the existing laminate products that are used to improve the post-failure performance of existing windows. This is because, broken mirrors can cause injuries or various types of danger to vehicle users. Applied to the interior or exterior face of glass, SRWF holds the fragments of broken glass together in one sheet, thus reducing the projectile hazard of flying glass. Although vehicles have been equipped with various technologies to minimize the impact of accidents, these window coatings help keep together shards of glass after an accident or when a window shatters, offering an extra layer of safety for drivers and passengers. The importance of this study is to produce tinted films for windshields and helmet visors that comply with safety guidelines (MS1).

2. Materials and Methods

2.1 Preparation of Materials and Chemicals

The most significant step in the fabrication of this tinted film is the manufacturing process of Polyethylene Terephthalate (PET) film. PET granules will be used to produce plastic films. It will be thawed with a hot temperature of around 255 °C using a beaker. Onion skins to make natural dyes are collected from grocery stores around the Muar area and residences. The collected onion skins consist of a mixture of yellow, red and purple colors. If the color to be produced is darker, more purple and red or dark onion skins are needed. There are two types of chemicals required in this study namely acetone and acetic acid. Acetic acid is used to extract the dye from the onion skin while acetone will be mixed into the finished natural dye solution.

2.2 PET Film Making Process

PET granules are placed in beakers and heated on hotplates. Stirrer hot plates are a combination of stirrers and hot plate. In combination with each other, each function can be used on its own. The diluted polyethylene Terephthalate (PET) will be poured into a silicone mold. To obtain a suitable plastic film thickness, the PET liquid is poured into the measuring cylinder according to the desired proportions before being poured into the mold.

2.3 The Process of Making Natural Onion Dye

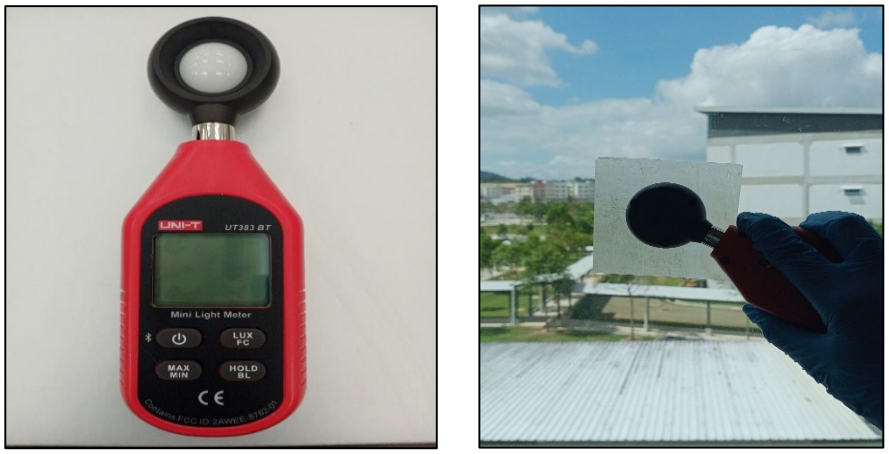
The natural dye extraction process is done using solvents like acetic acid and water. 1 g of onion peels were collected, and 10 ml of concentrated acetic acid was diluted in 90 ml of distilled water for extraction. As a result, acetic acid and water were mixed in a 1: 9 ratios. A magnetic stirrer is used to constantly stir the mixture. Throughout the experiment, the procedure was continually observed. Leave for a while until the desired dye color is achieved. Then, filter the solution to separate the natural dye from the rest of the onion skin.

2.4 The Process of Making Tinted Film

Overall, the two most important parts of producing this tinted film have been prepared in the previous process. Thus, Polyethylene Terephthalate (PET) film will be stained using natural dyes from onions. A small amount of acetone is dissolved into a natural dye solution to open the pores of the plastic film as well as make it easier for the dye to be absorbed by the film. Three types of samples with visible light transmission (VLT) according to standards were produced and tested.

3. Results and Discussion

The lux meter test is one of the measures that can be carried out to measure brightness in lux, fc or cd/m² (**Figure 1**). Some lux meters, for the recording and saving of readings, have an inbuilt memory or data logger. The tinted film should be examined using a lux meter in open locations or where sunlight can penetrate the tinted film



(a) (b)

Figure 1: (a) Lux meter (b) Lux meter test on tinted film

Table 1: Lux meter results

No.	Light (Lux)	Background Light (Lux)
1	12916.00	21682.00
2	13000.00	21598.00
3	13019.00	21579.00
4	12937.00	21590.00
5	12881.00	21557.00
6	12793.00	21549.00
7	12674.00	21489.00
8	12575.00	21459.00
9	12761.00	21434.00
10	12919.00	21412.00
11	13078.00	21405.00
12	13094.00	21396.00
13	12602.00	21380.00
14	12272.00	21386.00
15	12078.00	21353.00
16	12087.00	21294.00
17	12144.00	21281.00
18	12110.00	21293.00
19	12072.00	21247.00
20	12073.00	21210.00
Average	12604.25	21429.70

Light is the lux meter reading for the tinted film while background light is the reading for lux meter test without plastic film. This aims to see the difference in the level of light penetration of all samples. Based on the data (**Table 1**), it can be seen that the lux meter reading is lower when the mirror uses tinted film with an average reading of 12604.25 Lux. As for the background light reading, an average

of 21429.70 Lux was recorded and this also shows that there is a difference of 8825.45 Lux on average between mirrors with tinted film and without tinted film.

4. Conclusion

Analysis was conducted on tinted film samples for characterization. The lux meter test on the tinted film found that the tinted film produced can reduce the penetration of light that penetrates the mirror. Therefore tinted film based on onion peel dye was very suitable for the light penetration purpose.

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