

Study of performance of bituminous mixes using palm oil waste

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Abstract: The number and types of residues have increased dramatically as a result of developments in industrial technology, particularly during the processing of agricultural goods. With the paradigm shift toward renewable energy and sustainability, biomass energy is receiving a lot of attention throughout the world, which generates a lot of waste every year. Because these residues are not efficiently handled and utilized, they are becoming a growing problem. As a result, using them in the paving sector is one solution. This study reviews existing works of literature pertaining to the use of various residues in the pavement industry, such as Palm Oil Fiber (POF), Palm Oil Fuel Ash (POFA), Palm Oil Clinker (POC), and Palm Kernel Shell (PKS). The papers conclusion recognizes these residues' better sustainability potential, based on positive and satisfactory performance as a consequence of various research studies. In addition, there is a reduction in CO₂-emissions, minimal radioactivity, and a low amount of heavy metal leaching. As a result, the assessment recommends that the residue be explored and utilized more in the pavement business, as it promotes safety and harnesses sustainability.

Index Terms: Stone Matrix Asphalt (SMA), Dense Bituminous Macadam (DBM), Emulsion (CMS), Marshall Properties

INTRODUCTION

Highway Engineering has contributed a ton in headway of human advancement, innovative advancement and improvement of a country. Regular materials are exhausting. The world is elevating to utilization of optional materials in street development. An immense amount of rural waste item is arranged ashore. Waste usage in development will help in diminishing the weight on customary assets. Some of the waste are fly powder, pvc, steel slag, palm shell. Palm oil is a local of Guinea shore of Africa. Its logical name is *Elaeis guineensis*, family palmie and clan cocoineae. Palm oil has two section, obvious meaty part and stony seed. In the event that think about Indian situation, palm development covers 2.03lack hectare, in which Andhra Pradesh adds to 85%. This gives a decent stage for the utilization palm oil in development of streets in regarded territories. Since the earth condition required is of temperature of 20 to 35 degree Celsius and yearly precipitation of 2000 mm. the life of palm plant can be as long as 200 years while the most extreme yield is in seventh to tenth year of its developing age. Every one of these variables encourages the utilization of palm shell as nature condition matches Indian tropical atmosphere. These materials present ecological contamination in the close-by territory on the grounds that huge numbers of them are non-biodegradable. Customarily soil, stone totals, sand, bitumen, concrete and so forth are utilized for street development. Characteristic materials being modest in nature, its amount is declining step by step. Likewise, cost of separating great nature of characteristic material is expanding. Worried about this, the researchers are searching for elective materials for parkway development, and mechanical squanders item is one such classification. In the event that these materials can be reasonably used in expressway development, the contamination and transfer issues might be halfway diminished. Without different outlets, these strong squanders have involved a few sections of land of land around plants all through the nation. Remembering the requirement for mass utilization of these strong squanders in India, it was thought convenient to test these materials and to create particulars to improve the utilization of these modern squanders in street making, in which higher financial returns might be conceivable. The conceivable utilization of these materials ought to be created for development of low volume streets in various pieces of our nation. The essential particulars ought to be planned and endeavors are to be made to augment the utilization of strong squanders in various layers of the street asphalt. Post development asphalt execution studies are to be accomplished for these waste materials for development of low volume streets with two-crease benefits: (an) it will help clear important place where there is colossal dumps of squanders; (b) it will likewise safeguard the regular stores of totals, along these lines securing the earth. The modifier is utilized to make the fastener firm and to avoid channel down of the bitumen. Next to avert channel down issue, the stiffer bitumen fastener will likewise oppose rutting at higher temperatures. Palm oil is one of the elective arrangements which can be utilized in street development. Oil Palm Fruit Ash (OPFA) is result of palm oil plant, or the fiery remains from consuming mesocarp of fruitlets of the palm oil natural products. This result has been arranged as waste along these lines dirtying the earth and influencing the wellbeing of network Surrounding. Physically, OPFA is grayish in shading and turned out to be dull with expanding extents of unburned carbon.

FLEXIBLE PAVEMENTS

Flexible pavements are classified "adaptable" since the all out asphalt structure "twists" or "avoids" because of traffic loads. This asphalt structure commonly made of a few layers of materials which can suit this "flexing". In this kind of asphalts, material layers are generally organized in the request of slipping burden bearing limit with the most astounding burden bearing limit material (and generally costly) on the top and the most minimal burden bearing limit material (and most economical) on the base. The surface course is the stiffest and contributes the most to the asphalt quality. The basic layers are less hardened however are as yet imperative to asphalt quality just as seepage and ice insurance. A commonplace adaptable asphalt structure comprises of surface course, base course and subbase course (discretionary).

The surface course is the top layer in contact with traffic loads. This layer gives the attributes, for example, contact, smoothness, clamor control, groove obstruction also, waste. What's more, it serves to counteract the passageway of overabundance amounts of surface water into the fundamental base, sub base and subgrade courses. The highest layer of the surface course which is in direct contact with traffic burdens is the wearing course. This can be evacuated and supplanted as and when it progresses toward becoming harmed or exhausted. The wearing course can be restored before misery engenders into the basic transitional/folio course. This layer which establishes the real bit of the surface course is intended to convey the heap coming over it. The base course is the layer straightforwardly beneath the surface course which helps in transmitting the heap to the subgrade and by and large comprises of total either settled or unstabilized. Bituminous blends like Hot Mix Asphalt can likewise fill in as a base course. Under the base course layer, a layer of more affordable/substandard quality material can be given as subbase course material over the subgrade. The subbase course is discretionary much of the time.



Figure 1.1: Flexible Pavement Structure

PALM OIL WASTES

Palm oil wastes include palm oil mill effluent(POME), empty fruit bunch(EFB), palm oil mill sludge(POMS), oil palm fronds(OPF), oil palm trunks(OPT), decanter cake, seed shells and palm pressed fibers(PPF). When it is to extract one ton palm oil, it has 6 tons of old leaves , 1 ton of trunk, 5 tons of empty fruit bunch , 1 ton of peel fiber, 0.5 tons of palm kernel shell,0.25 tons of pomace and 3 tons of palm oil mill effluent. The wastes account for high proportion in the process of palm oil production. Palm oil waste management is an severe issues in the producing countries.

OBJECTIVES OF THE STUDY

Following are the various objectives of the study:

1. To determine the optimum palm waste content in the flexible content.
2. To determine the Marshall stability by using oil palm waste.
3. To determine the Flow value and mineral content percentage in the flexible pavement by using oil palm waste.

RESULTS AND GRAPHS:

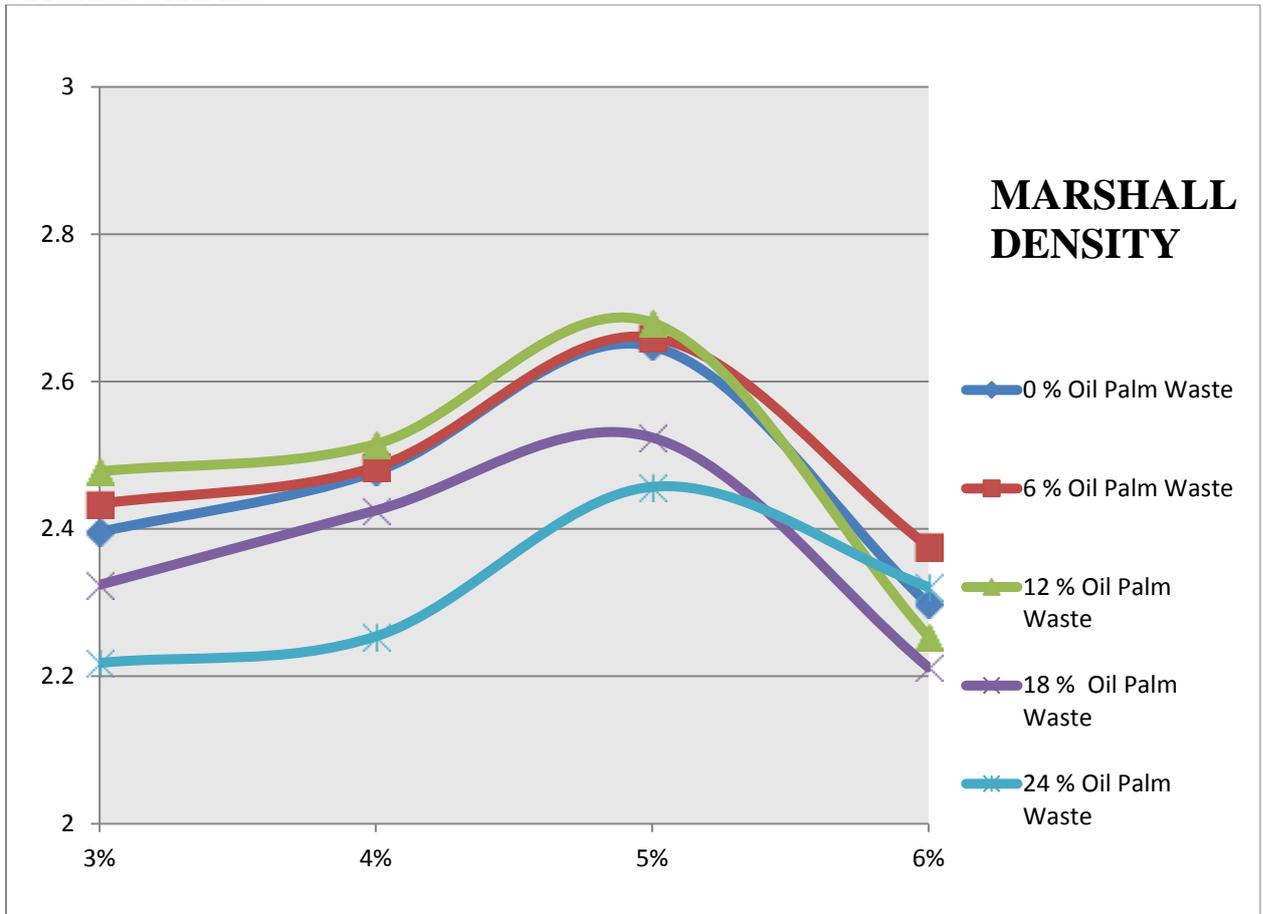


Figure : Variation of Marshall Density With %age of Oil Palm Waste

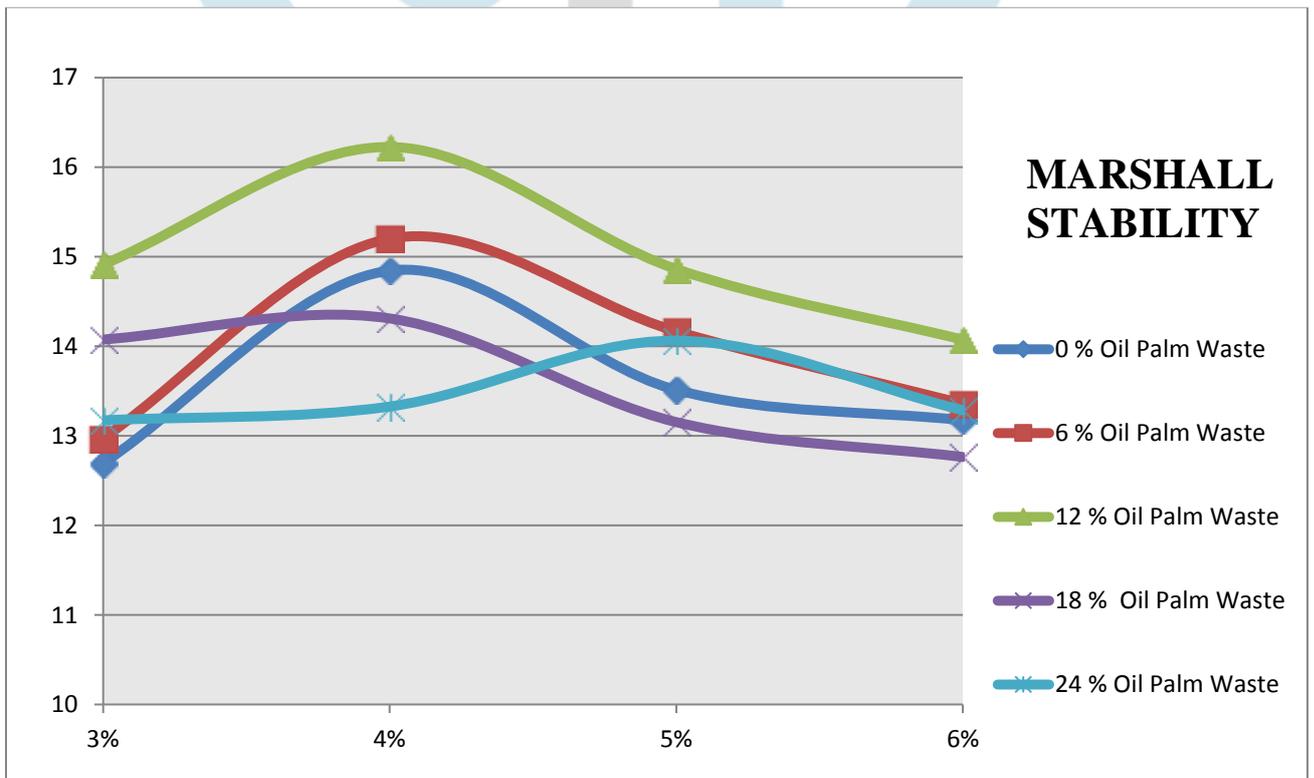


Figure : Variation of Stability With %age of Oil Palm Waste

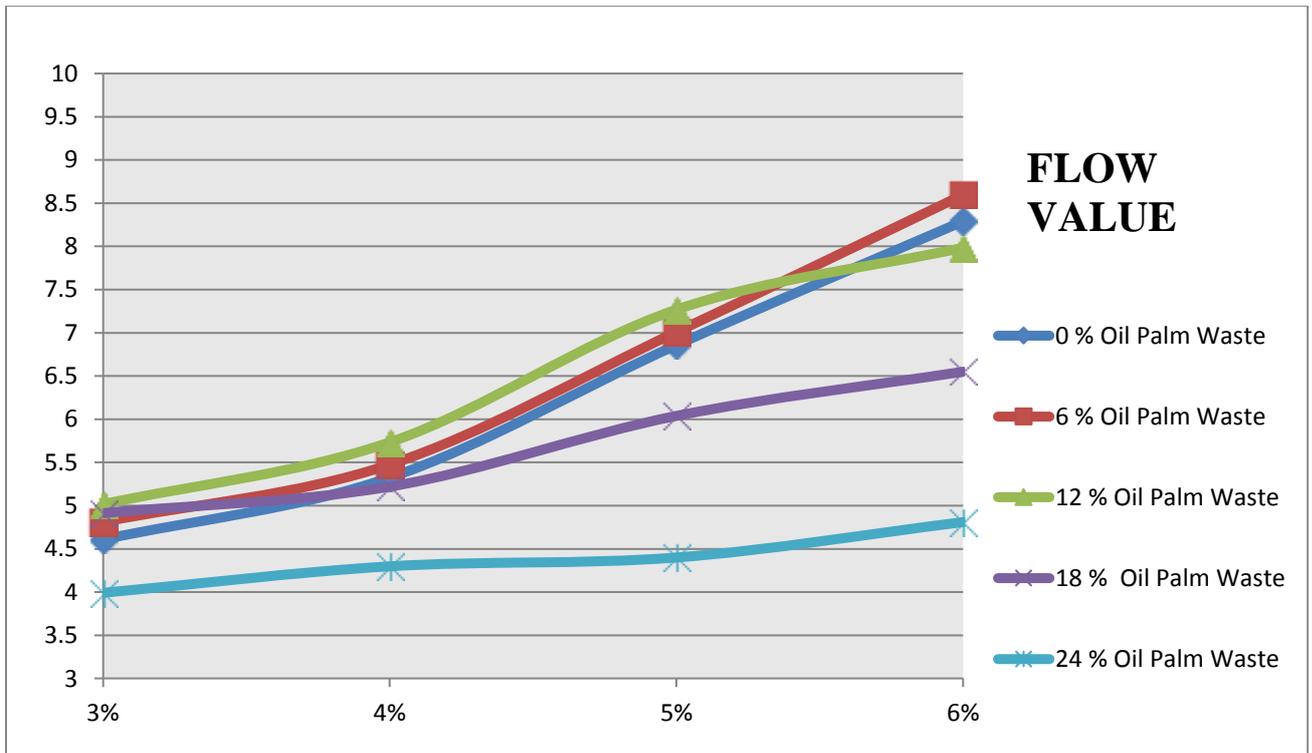


Figure : Variation of Flow Value With %age of Oil Palm Waste

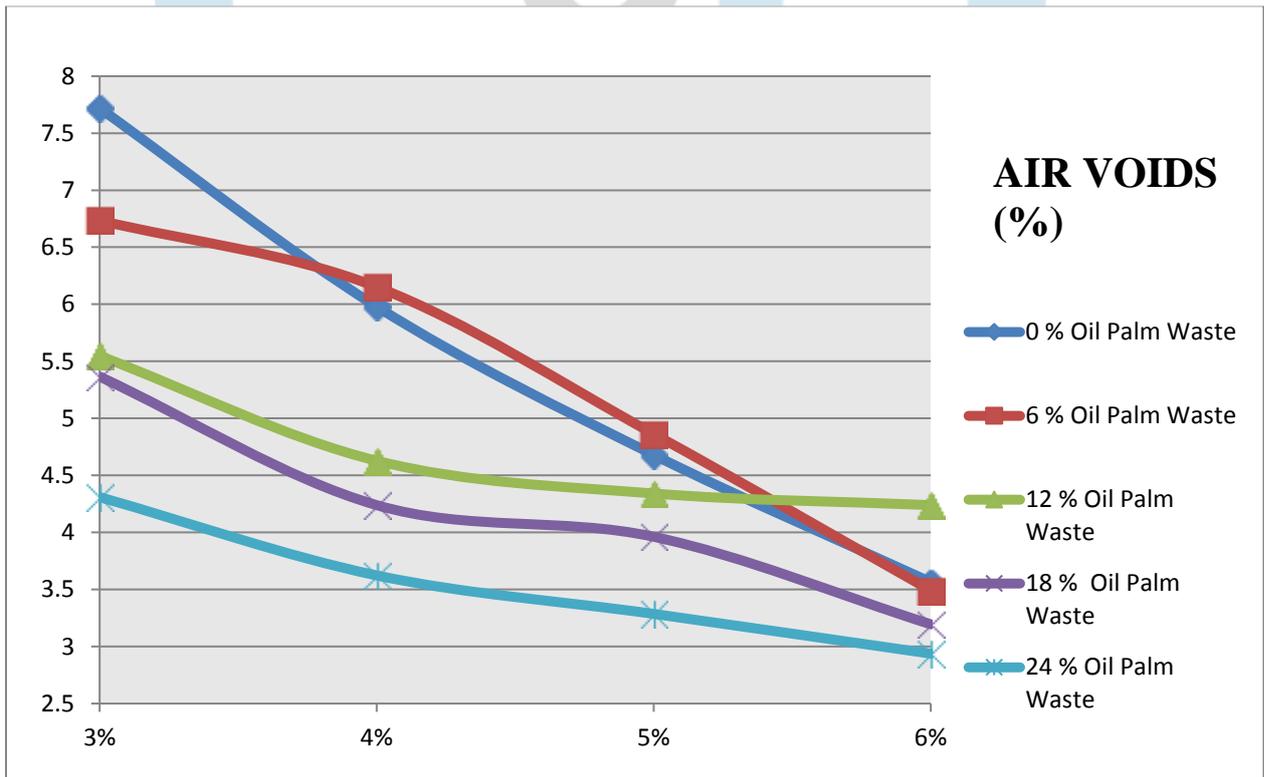


Figure : Variation of Air Voids With %age of Oil Palm Waste

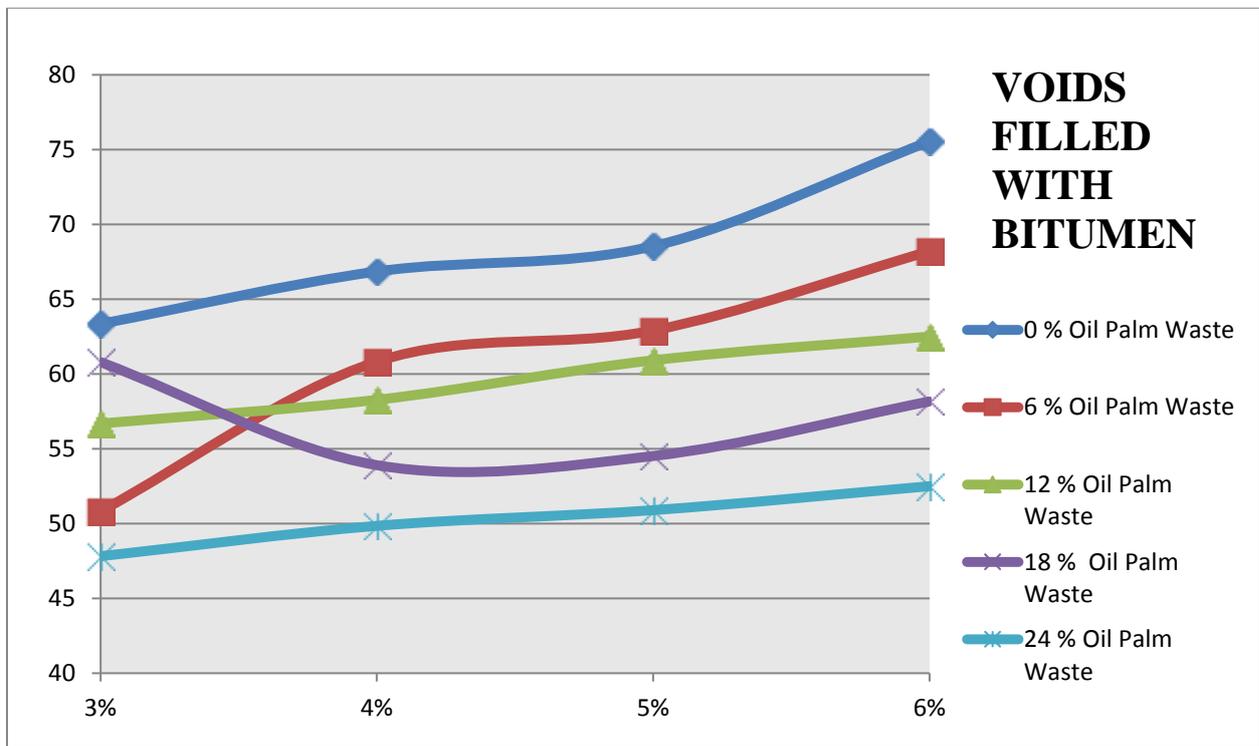


Figure: Variation of Voids filled with bitumen with %age of Oil Palm Waste

CONCLUSION

The objective of road constructions and others structure is to contain the waste material in a manner that is protective to human health and the environment. On the basis of above study, following conclusions is drawn:

1. Marshall Stability value for 12% Oil Palm Waste addition is greater than 6%, 18% and 24% Oil Palm Waste addition and almost double then conventional samples.
2. The optimum bitumen content is 4.28 % after studying the Marshall Stability test.
3. The optimum slag content is 12 % after studying the Marshall Stability test.
4. Air voids remain almost same as compared to HMA at 12 % Oil Palm Waste.
5. The physical properties of Oil Palm Waste bituminous mixture basically satisfy the requirements of Marshall Specification for the design.
6. The use of Oil Palm Waste for road construction can save the environment, increase the service life of roads and serve the society with additional income for those associated with it.
7. The voids filled with bitumen increases with increase in the bitumen Content.
8. It can be concluded that utilization of industrial wastes and byproducts in SMA results in the improvement of the engineering properties
9. Generally, the addition of Oil Palm Waste can decrease the penetration, increase softening point, increase the penetration index, and that is better in hot climates.
10. The voids in the mineral aggregate and void filled with bitumen increases with the increase in the bitumen content.
11. Due to the use of Oil Palm Waste in the bituminous mix, the disposal problem and the environmental problem can be reduced to certain extent.
12. The bulk density increases with the addition of Oil Palm Waste to the mix due to the fact that the specific gravity of Oil Palm Waste is high compared to the specific gravity of natural aggregate.
13. Softening point for all modified sample was increased hence, resistance to deformation.
14. Oil Palm Waste has the potential to use as admixture to improve the properties of bituminous mixture.
15. Addition of Oil Palm Waste of (12%) in aggregate of DBM grade II mix improves good interlocking and eventually improved the volumetric properties as well as the mechanical properties of the mix.
16. As the bitumen content increases the flow value increases.

FUTURE SCOPE

Following are the various future recommendations of this study:

1. The program of testing might be reached out to decide the dimensions of radioactive fixation in bituminous and bond bound materials to get exact data on the radioactivity dimension of the composites containing tin slag. Such data is critical to persuade the specialists and people in general of the wellbeing and practicality of utilizing Oil Palm Waste.
2. Oil Palm Waste can be replaced along with fly ash, silica fume and granulated blast furnace slag in bituminous pavement.

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