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Utilization of Waste Egg Shell Modified Bitumen in Hot Mix Asphalt

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Abstract - The utilization of waste materials to modify the performance of bituminous pavement is trending globally. The introduction of egg shell powder as a sustainable modifier is the focus of this study in order to achieve the goals of lowering the weight percentile, cutting expenses, and enhancing the economic viability of hot mix asphalt. One of the latest innovations in construction cost reduction is the use of waste materials, one of which is eggshell as modifier. This research has the interest to introduce the egg shell powder as a sustainable modifier to fulfil the objectives of reducing the weight percentile, reducing costs and improving the economic viability of hot mix asphalt.
This research was conducted performing a number of experimental tests on virgin and modified asphalt by adding egg shell powder (2, 4, 6, and 8%) by weight of asphalt to evaluate the physical properties of asphalt cement as well as the mechanical properties of hot mix asphalt. The results of the study demonstrated a decrease in penetration and the ductility value as well as a valuable increase in flash point versus increasing percent of the waste material. The mechanical tests showed improvement in stability-flow results with increasing egg shell percent. This paper recommends that egg shell can be used successfully for increasing performance of asphalt.

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1. INTRODUCTION

A few years ago, many studies towards the use of alternative materials for road construction and some of them have shown positive and encouraging results. This promoted the use of organic and inorganic materials as modifiers or additives in asphaltic pavement such as plastics, polymers, glass, oils, fibers, etc. With this, not only can solve the problem of the lack of original material in asphaltic pavement construction, but also give alternatives by recycling process.
It is estimated that roughly 100 million tons of hen egg shell is generated throughout the world every year without realizing that it has many uses in other areas, perhaps most distinguishes the eggshell is fit on mineral salts such as calcium, phosphorus, manganese, molybdenum, iron, copper, chromium, fluorine, zinc. The researchers chose this material in order to investigate its effect on bitumen as long as it's having an effect on the chemically cement material. These egg-shells waste are non-biodegradable and the majority of eggshell waste is deposited as landfills. Egg-shell waste in landfills attracts vermin due to the attached membrane in landfills and causes problems associated with human health and environment. So this egg-shell waste is useless as a landfill material. However, it aids in project cost reduction and also helps to create a more environmentally friendly workplace.

1.1BITUMEN

Bitumen is a thick, oily byproduct that is dark black and viscous and is made from hydrocarbon mixes that have had their volatile components removed through natural or manmade processes. Petroleum removes bitumen from fractional distillation while there is air present. A well-assembled bituminous mix is chosen as the end product because it is thought to be strong, long-lasting, economical, and environmentally benign.
The naturally occurring combination obtained through the distillation process. The primary goal is to employ bitumen as a better-quality binder material that adheres and is waterproof. Because of the bitumen's viscoelastic properties, it is quite easy to cause long-lasting deformation and fissures. Depending on the petroleum source, bitumen's chemical make-up varies. Bitumen is used to build almost 85% of the pavements in the globe, making it a more practical and popular choice. About 5-6% of the overall bitumen mixture is made up of bitumen, which coats

and bonds the aggregate particles. It is a naturally occurring combination of hydrocarbons that is often dark brown or black in color.

1.2 USES OF BITUMEN

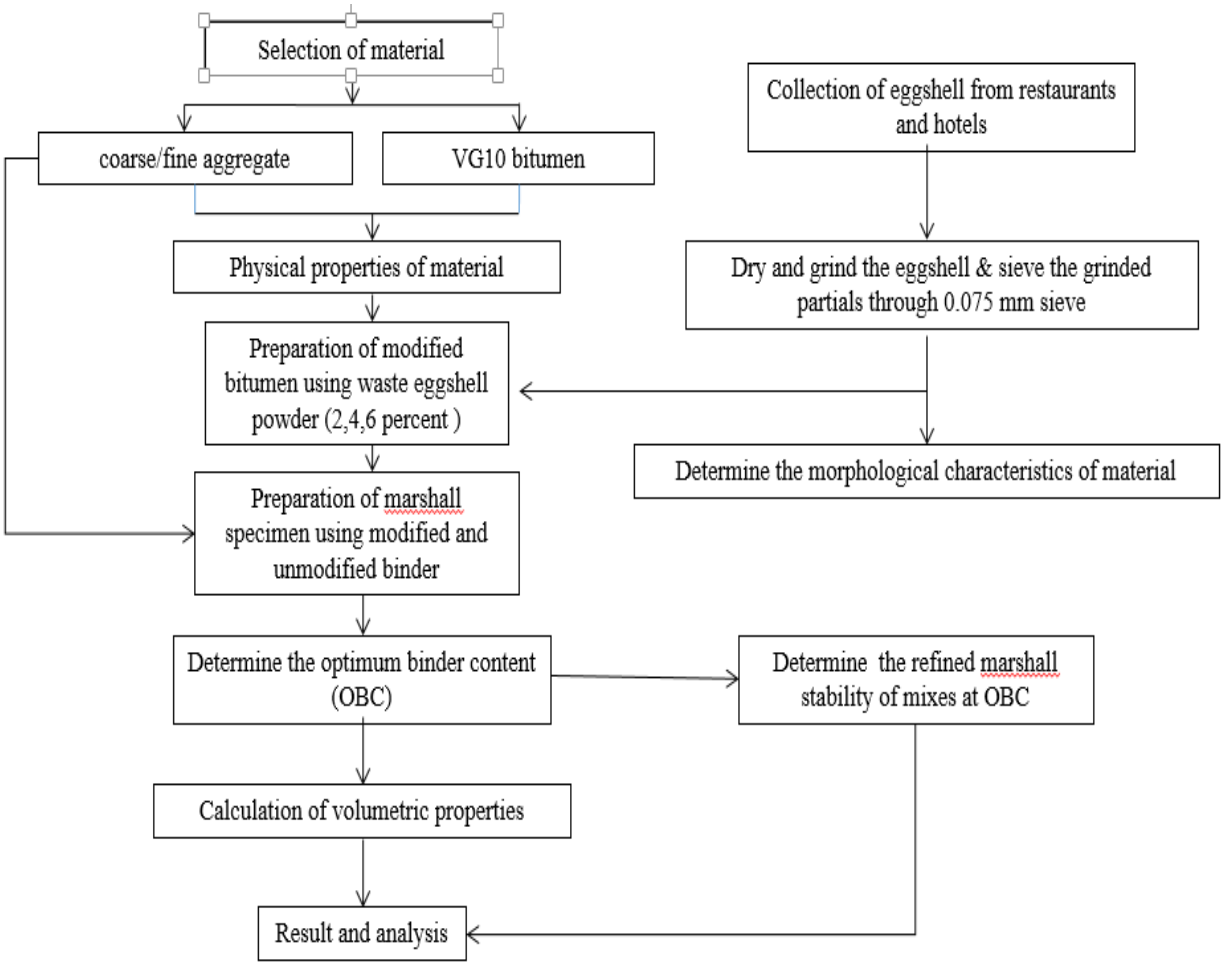
In road construction bitumen can be used in hot mix asphalt and cold mix asphalt on the road surface. Both of these two types of asphalts are used in flexible pavement.In hot mix asphalt, paving grades bitumen which are penetration grade and viscosity grade are used. Bitumen is used in the waterproofing process and rust-proof coating.
In the waterproofing process it can be used in different forms of bituminous paint, bituminous membrane and bituminous coating to prevent water penetration into the surfaces.

1.3 What is modified Bitumen?

Bitumen Modification is a process that involves adding polymers or chemicals to bitumen to improve its performance and durability. Modified bitumen is made up of asphalt combined with polymerized rubber or plastic, then reinforced with fiberglass to create rugged yet flexible waterproofing membrane and also improved performance, Increased Durability, Enhanced safety, Environmentally friendly.

2. METHODOLOGY

Fig. 1 Methodology



3. OBJECTIVES

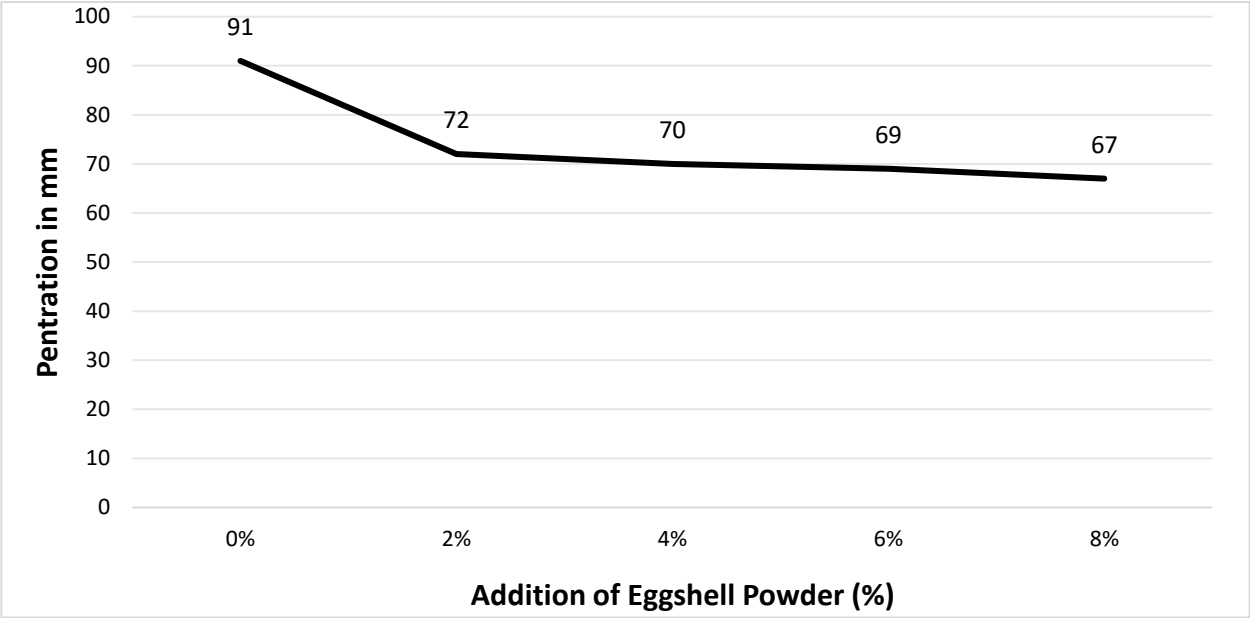
- To prepare the waste micro and Nano eggshell powder.
- To prepare modified bitumen using eggshell powder.
- To determine the engineering properties of unmodified bitumen and eggshell modified bitumen.

4. Result and discussion

TESTS **Adding % of Powder**	**0%**	**2%**	**4%**	**6%**	**8%**	**IS CODE USED**
PENETRATION TEST	92 mm 92 mm 90 mm	72 mm 74 mm 70 mm	72 mm 74 mm 70 mm	71 mm 69 mm 70 mm	66 mm 67 mm 69 mm	IS: 1203-1978
DUCTILITY TEST	110 cm 108 cm 109 cm	107 cm 108 cm 107 cm	106 cm 107 cm 105 cm	103 cm 102 cm 101 cm	95 mm 100mm 101mm	IS: 1203-1978
FLASH & FIRE POINT TEST	Fire pt= 280 °C Flash pt=230°C	Fire pt= 280 °C Flash pt.=230 °C	Fire pt= 280 °C Flash pt=230 °C	Fire pt= 280 °C Flash pt=230 °C	Fire pt= 280 °C Flash pt=230 °C	IS: 1203-1978

a. Penetration Test

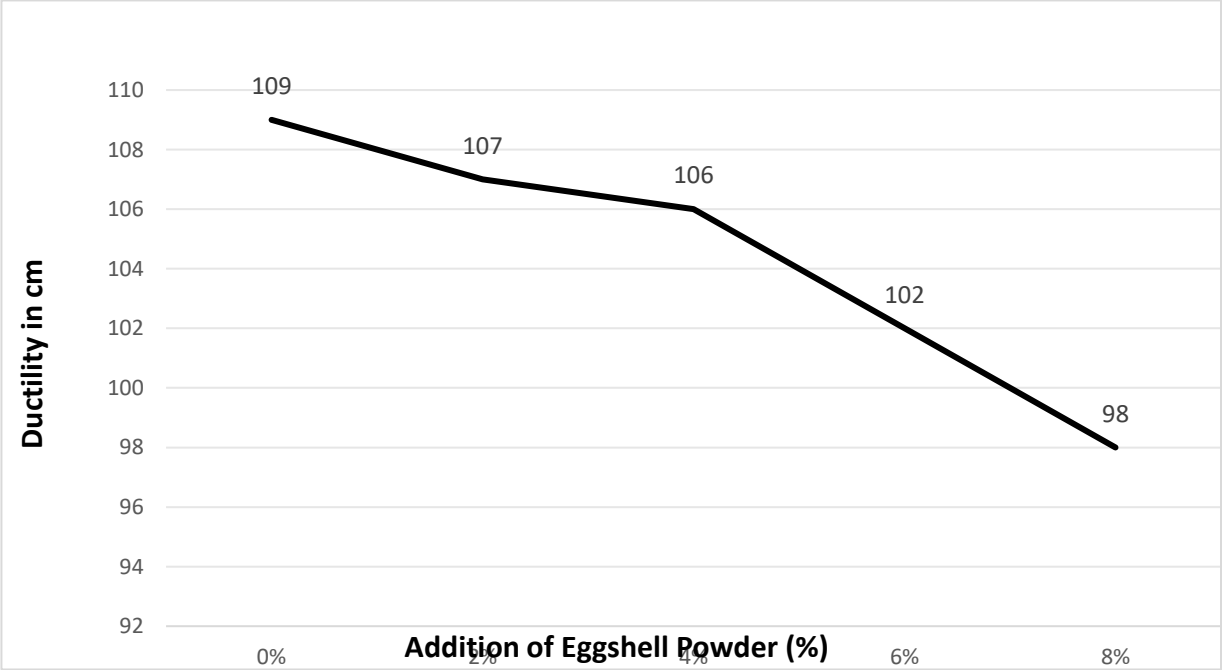
The graphical representation of Penetration value are shown in Fig.



b. Ductility Test

The graphical representation of Penetration value are shown in Fig.

5.



MAKING OF SPECIMEN

Fig.2 Waste egg Shell

Fig.3 Crushed Eggshell powder

Fig.5 Modified Eggshell powder

Fig.4 Muffle Furnace

5.1 TESTS OF SPECIMEN

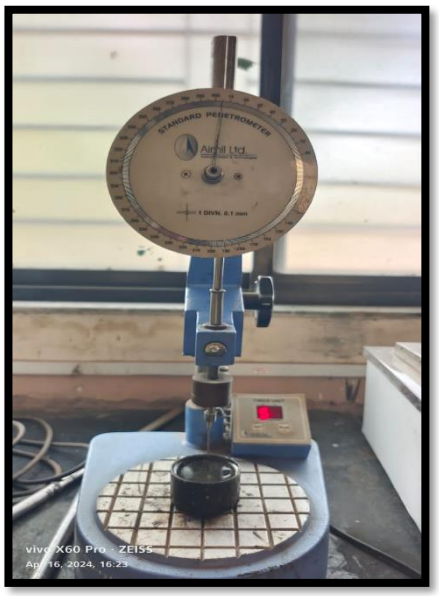


Fig.6 Penetration Test

Fig.7 Flash & Fire Test

Fig.8 Ductility Test

6. CONCLUSIONS

After the intensive research we have highlighted the following results-

- The Penetration value have decreased by 21%,23%,25% and 27% for the addition eggshell powder by 2%,4%,6% and 8% respectively.
- The Ductility value have decreased by 3%, 4%, 7% and 8% for the addition eggshell powder by 2%, 4%,6% and 8% respectively.
- The Flash and Fire point mostly not changed and remains same.

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