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Enhancement in stabilization of bituminous roads using Polypropylene and Calcium Hydroxide

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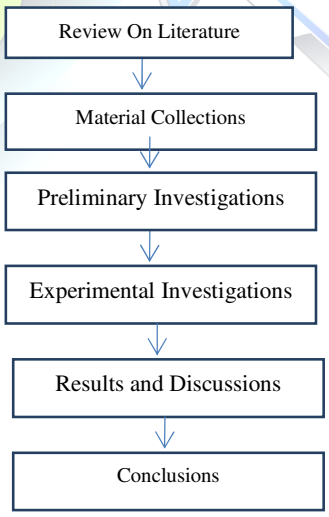
Abstract: This paper presents a part of research on the rheological properties of bitumen modified by polypropylene polymer with calcium hydroxide used as a binder. polypropylene polymer obtained as a waste inverted battery cover plastic, whose disposal is a matter of concern can be used successfully to modify the bitumen, these waste polymers are added in 1%, 2%,3%,4% and 5% percentages in S65 grade bitumen with 1%, 2%, 3% of calcium hydroxide and its effect on different properties of bitumen are evaluated. The obtained bitumen content with polypropylene plastic are used to assess the volumetric properties of Marshall Mix design to evaluate the stability of flexible pavement. The rheological study of polymer modified bitumen (PMB) was done by using penetration, ring & ball, softening point and viscosity test. The results are related to the changes in the rheological properties of polymer modified bitumen. It was observed for polymer specimens that the Engineering properties are increased and flow values reduced in a recognizable way, which shows that the modified bitumen is preferred for national highways and high temperature zones. The change of the properties of bituminous mixture shows the constructive outcome of polypropylene plastic.

Keywords: Waste inverted battery plastic cover as polypropylene polymer, calcium hydroxide, Polymer modified bitumen.

I. INTRODUCTION

This paper presents a part of research on the rheological properties of bitumen modified by polypropylene polymer with calcium hydroxide used as a binder. Polypropylene polymer obtained as a waste inverted battery cover plastic, whose disposal is a matter of concern can be used successfully to modify the bitumen, these waste polymers are added in 1%, 2%, 3%,4% and 5% percentages in S65 grade bitumen with 1%, 2%, 3% of calcium hydroxide and its effect on different properties of bitumen are evaluated. The obtained bitumen content with polypropylene plastics are used to assess the volumetric properties of Marshall Mix design to evaluate the stability of flexible pavement. The rheological study of polymer modified bitumen (PMB) was done by using penetration, ring & ball, softening point and viscosity test. The results are related to the changes in the rheological properties of polymer modified bitumen. It was observed for polymer specimens that the Engineering properties are increased and flow values reduced in a recognizable way, which shows that the modified bitumen is

II. METHODOLOGY



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III. MATERIALS USED

Bitumen: It is a black viscous mixture of hydrocarbons obtained naturally or as a residue from petroleum distillation. It is used for road surfacing and roofing.

Aggregate: It is commonly considered inert filler, which accounts for 60 to 80% of the weight of concrete. It is usually greater than 4.75mm (retained on a no.4 sieve).

Polypropylene: It is a synthetic organic compound with the chemical formula $(C_3H_6)_n$. It is a viscous colourless liquid which is nearly odourless . Its density 0.855g/cm3, Melting point 130 to 171°c.

Calcium Hydroxide: It is inorganic compound with the chemical formula $Ca(OH)_2$It is a colourless crystal or white powder and is obtained when calcium oxide(called lime or quick lime).calcium hydroxide is used in many applicatios including food preparation.

IV. PRILIMINARY TEST

A. Aggregate test:

1. Specific gravity test.
2. Water absorption test.
3. Impact test.
4. Crushing test.

B. Bitumen test:

I. Penetration test.
II. Softening point test.
III. Viscosity test.
IV. Ductility test.

S.No	DESCRIPTION	OBTAINED VALUES
1.	Water absorption test	1.4%
2.	Specific gravity test	2.70
3.	Crushing strength test	4.67%
4.	Impact test	3.68%

Table No.4.1 Tests results on Bitumen

V. Results and Discussions

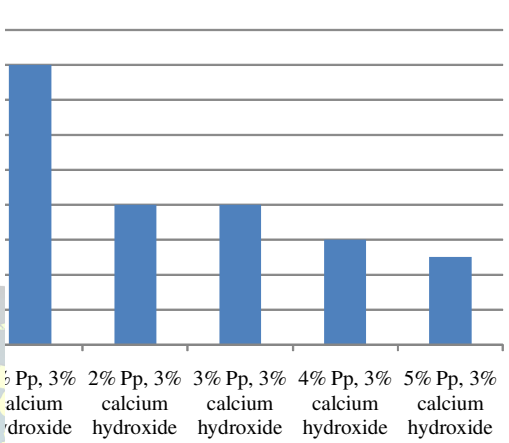

Fig.No.5.1Penetration results

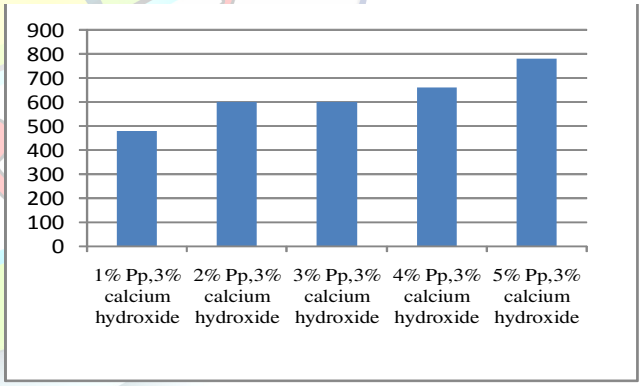

Fig.No.5.2 Viscosity results

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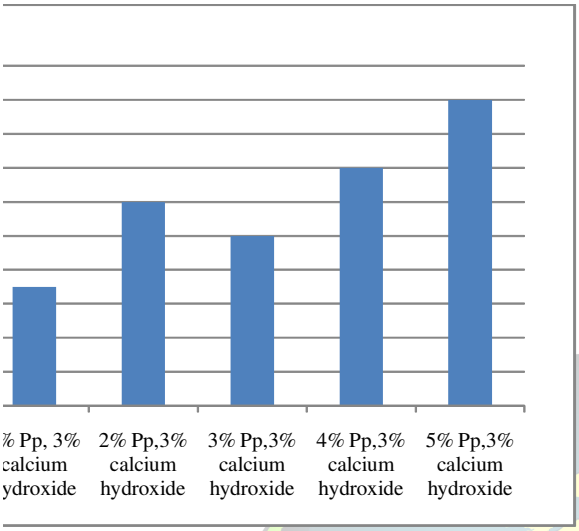

Fig.No.5.3.Softening Values

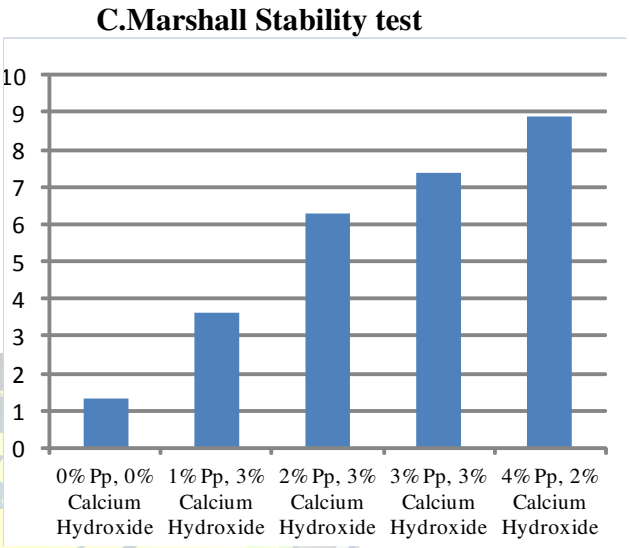

Fig.No.5.5 Marshall Stability Values

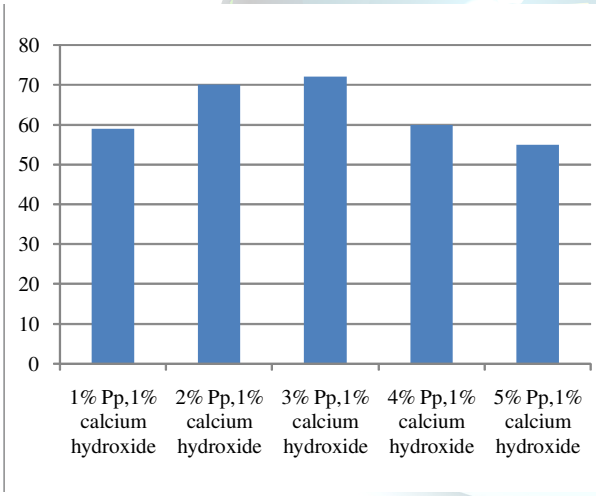

Fig.No.5.4.Ductility Values

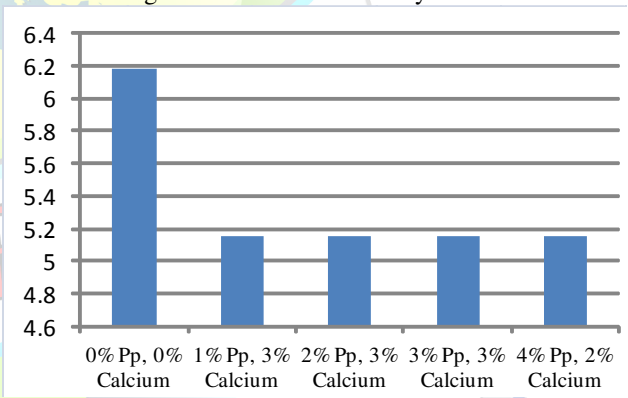

Fig.No.5.6 Marshall Flow Values

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S.NO	SAMPLE	STABILITY VALES (KN)	FLOW VALUE (mm)
1.	Bitumen 0% Pp with 0% calcium hydroxide	1.3	6.18
2.	Modified Bitumen-I 1% Pp with 3% calcium hydroxide	3.6	5.15
3.	Modified Bitumen-II 2% Pp with 3% calcium hydroxide	6.3	4.29
4.	Modified Bitumen-III 3% Pp with 3% calcium hydroxide	7.4	3.62
5.	Modified Bitumen-IV 4% Pp with 2% calcium hydroxide	8.9	2.14

VI. CONCLUSION

From this project on the Enhancement in stabilization of bituminous roads using polypropylene with calcium hydroxide, polypropylene polymers are added in 1%, 2%, 3%,4% and 5% in bitumen with 1%, 2%, 3%,of calcium hydroxide and its effect on different properties of bitumen are studied and evaluated. Also it is found that, the marshall stability value increases with decreases in marshall flow value upon the addition of polypropylene and sodium silicate i.e. the resistance to deformations increases under heavy wheel load. i.e. the resistance to deformations increases under heavy wheel load. It is found that polymer modified bitumen i.e. 5% of polypropylene with 1% of calcium hydroxide shows the better improved properties for flexible pavement construction. The result of this polymer modified bitumen of 5% of polypropylene with 1% of calcium hydroxide is found to be satisfactory. The test values are within the required specifications and also it may offer resistance to rutting. So, polymer modified pavements would be a boon for India's hot and extremely humid climate condition. This also can reduce the amount of polypropylene plastic waste which otherwise are considered to be a threat to the hygiene of the environment.

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REFERENCES

[1] Yadav santosh , Anil kumar , Arora T.R "Performance Evaluation of waste plastic and Bitumen mix in flexible pavement " International journal of scientific and Engineering Research ,volume 4 , Issue 10, October 2013.

[2] Noor zainab Habib , Ibrahim Kamaruddin , Madzalan Napiah and Isa Mohd Tan "Rheological properties of Polyethylene and Polypropylene Modified Bitumen " . International Journal of Civil and Environmental Engineering (2011).

[3] Shirish N.Namade & Prashant .V." Utilization of Polymer waste for modification of bitumen in Road constructions" in scientific Reviews and chemical communications (2013)

[4] Syed Usman Husainy, H. Syed Saleem, M.R. Faizan Ahmed, N. Syed Kahmruddin Fazeel, C. Neeladharan, K. Mohan, "Enhancement of Stabilization in Bituminous roads using Polyethylene and Epoxy resin," International Research Journal of Engineering and Technology, vol. 4, no. 4, pp 2401-2404, 2017.

[5] IS 1206-1978 Methods for testing Tar & Bituminous material for Viscosity.

[6] IS 1203-1978 Methods for testing Tar & Bituminous material for determination of penetration.

[7] IS 2386(Part 1) -1963 Methods of testing a Aggregates for concrete particle size and shape.

[8] IS 2386- 1963 (Part 3)Methods of test for Aggregates for concrete Specific gravity, Absorption , (Part 4) Methods of test for Aggregates for concrete Impact value.