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USE OF INORGANIC WASTES IN CIVIL ENGINEERING PURPOSES

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ABSTRACT

Polymer modified bitumen for engineering purposes have been reviewed in this paper. Inorganic wastes that affect the environment adversely have been used in engineering purposes. PET(plastic bottle), rubber (hand gloves) have been used in this research. Although these materials do not give better results in test but use of small percentages with bitumen is mixable and effective. Some tests for bitumen properties have been conducted to investigate the PMB properties. As these are inorganic, these are not mixed with the soil but hamper the ecological life. That is why these have been used with bitumen to reduce the percentages of wastes from the environment.

Keywords: Pavement, PMB, PET.

Introduction:

Now a day's environmental pollution by inorganic matters is the burning question all over the world. But no effective steps are taken to reduce the pollution. If proper steps are taken, the wastes could be the wealth. Bitumen is used for road construction, dpc, joint filler, coating etc. This paper has tried to use small percentages of inorganic wastes with the bitumen.

Bitumen as binder:

Bitumen is an binding material produced from the distillation of crude petroleum oil. Distillation removes lighter crude oil components, such as gasoline and diesel, leaving bitumen behind. It is refined to improve its grade. It also occurs in nature. Naturally occurring bitumen can be got form the bottom of ancient lakes. Bitumen is thermoplastics in nature. They have no specific melting, boiling or freezing point. Bitumen is insoluble in water but water is the enemy for bitumen.

Tests on bitumen to check quality and suitability:

To ensure the quality of bitumen, several tests are performed which are as follows.

1. Penetration test
2. Flash and Fire point test
3. Softening point test

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1. Penetration Test on Bitumen

Penetration test measures the hardness & consistency of bitumen. The test provide also the grade identification of bitumen. Bitumen is imported by grade value. Higher the grade, softer the bitumen. Grade is determined by penetrometer apparatus. 60/80 grade bitumen is commonly used in our country. Inclusion of plastic decreases the grade of bitumen that gives better assumption. But plastic modified bitumen could not be used in pavement construction.

Fig: Penetration Test

2. Flash and Fire Point Tests on Bitumen

The flash point of bitumen causes the bitumen to catch fire in the form of a flash. The fire point causes the bitumen to ignite. Flash and fire point test helps to control fire accidents during heating of bitumen under controlled temperature. Flash & fire point are determined by Cleveland open cup apparatus.

Fig: Flash & Fire point test

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3. Softening Point Test

Softening point is the minimum temperature at which the bitumen tends to melt. Softening point is determined by ring and ball apparatus. Softening point of bitumen provides the information about the starting of melting. Due to global warming effect most of the bituminous road is being affected. This test helps to control the damage of the roads in hot weathered countries.

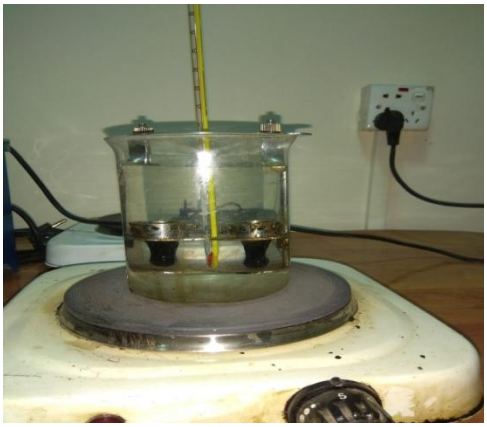

Fig: Softening Point Test

Medical Gloves:

Medical gloves are being used mostly at present to prevent the corona virus contamination. These are also used in pathological and surgical purposes. This helps to prevent cross contamination. Improper disposal management causing environmental pollution. That is why this research has used this latex with bitumen.

Fig: Hand Gloves

PET Bottle:

Use of pet bottle is being increased day by day. But the recycling against production is negligible. Disposal of plastic in open surface polluting the land & wetland. There is a few recycling agent all over the world. But the waste could be wealth if it would be properly recycled. That is why this research has used the waste plastic in addition with bitumen.

Fig: Pet Bottle

Recycling of PET bottle:

Plastics that disposed on nature can take hundreds of years to degrade. About 30-40 % of plastics are being recycled all over the world. Now a day's PET bottles are recycled for various purposes. New products can be made from the waste bottle. Many research's work are being done on recycling of plastics. Recycling of plastic involves collecting, sorting, washing, melting and pelletizing.

Environmental Impacts of Plastic:

Plastic pollution is now the burning question all over the world. It affects the environment adversely for wildlife, humans like as:

- Plastic wastes are detrimental to human and animal health.
- Plastic bags cause drain blockages which cause urban flooding during storm.
- Chemical ingredients of plastics disturb the natural processes of degradation
- Plastic pollutes land & wetland.
- About million tonnes of plastic waste enters the ocean.
- Additives present in plastics can cause cancer.
- Additives present in plastics cause dermatitis

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Data analysis:

Weight of bitumen = A

Weight of plastic & rubber, B = A X % weight of plastic/ rubber

For Example:

Weight of bitumen, A = 200g

Weight of plastic & rubber, B = [200g X 15% weight of plastic/ rubber]
= 30g

Table: Laboratory test results for waste plastic modifier

Test	% by weight	Test Result
Penetration Test	**0%**	**60/70 grade**
	10%	**50/60 grade**
	15%	**40/50 grade**
	20%	**20/30 grade**
Softening Point Test	**0%**	**57 °C**
	10%	**76 °C**
	15%	**78 °C**
	20%	**94 °C**
Flash & Fire point Test	**0%**	**310 °F**
	10%	**342 °F**
	15%	**343 °F**
	20%	**356 °F**

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Table: Laboratory test results for waste hand gloves modifier

Test	% by weight	Test Result
Penetration Test	**0%**	**50/60 grade**
	10%	**50/60 grade**
	15%	**40/50 grade**
	20%	**40/50 grade**
Softening Point Test	**0%**	**57 °C**
	10%	**59 °C**
	15%	**66 °C**
	20%	**68°C**
Flash & Fire point Test	**0%**	**315°F**
	10%	**320°F**
	15%	**335°F**
	20%	**345°F**

Discussion:

Inclusion of plastic & rubber during boiling with bitumen, these are mixable. Increasing of percentages of plastic & rubber increase the bitumen grade. This results in hardening of bitumen mix, indicates good consistency of bitumen mixes. Besides increasing of softening, flash, fire points indicates the safety during high temperature & heating.

Conclusion:

Production of inorganic wastes over the world is increasing day by day. With the increasing production, there is no proper disposal and management system. That is why this research has tried to use the inorganic wastes in engineering purposes. After some experimental research, it has come to know that a small percentage as 10%, 15% and 20% of inorganic materials by weight gives satisfactory result. Those are soluble with bitumen. In conclusion it can be said that some percentages of wastes can be reduced from environment. But PMB should not be used in major construction. It can be used in minor works such as DPC, filling joints in concrete structure etc.

References:

1. *"Medical Gloves and Gowns". FDA. Retrieved 2010-03-10*. Medical gloves are disposable gloves used during medical procedures.
2. *"Personal Protective Equipment FAQ". Centers for Disease Control and Prevention. Retrieved 2013-06-08*
3. *Researchgate.net/publication/327671451_Study_of_Bitumen_characteristics_with_Use_of_Waste_Plastic*
4. *hindawi.com/journals/jchem/2018/8759549/*
5. *Highway Engineering, S.K.KHANNA*