

EXPERIMENTAL ANALYSIS OF BITUMEN WITH HDPE AND PVC

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ABSTRACT

Bitumen is a binding material mostly used in construction projects like road surfacing, airports, parking lots etc. This is primarily because of their excellent binding characteristics and water proofing property. The study results show that rheological properties like Penetration, Ductility of waste plastic and PVC modified bitumen decrease with increase of these contents. While Softening point, increases with increase in polymer contents in bitumen. The Marshall stability test results show that the polymer increases the stability values of the compacted mixes with increasing. The polymer content in the bitumen up to optimum level (i.e.4%). The values obtained in the Marshall stability test show increasing pattern up to 4% of PVC and waste plastic content, whereas the density of the compacted mixes slightly decreases with the increase of polymer contents in the bitumen. This paper presents a research study the behavior of BC mix modified with waste polythene and PVC. Various percentages of these polymer are used for preparation of mixes with a aggregate grading as given in the IRC Code.

Keyword: -:Bitumen, pvc dust, waste polythene, LDPE etc.

1. INTRODUCTION

The blending of polymer with bitumen is a difficult task. Compatibility is the first and main problem that we must face when we try to modify bituminous rheology by adding polymer to it. Blending depends on the compatibility (Baker, 1998) of polymer and bitumen to each other. There are generally considered to be three basic processes which may utilize recycled plastic (Polymer) and PVC Dust in the production of different types of asphalt concrete pavements. These processes are known as the Dry Process, the Terminal Blend Process, and the Wet Process. In this study bitumen mixed with PVC dust and waste plastic. the success of blending of a polymer with particular

1.1 TESTING

In this step material bitumen, LDPE, PVC dust are taken for sample preparation according to requirement of sample preparation. Such as Bitumen 200 gm for each sample, LDPE 2.5%, 5%, 7%, 10% of bitumen and PVC dust 2.5%, 5%, 7%, 10% of bitumen and these material are mixing and sample are prepared. In this step following steps are following

- 1) For HDPE cement bags waste plastic is taken and weighted after that it is shredding in small part 2-3 mm as shown in figure
- 2) For PVC are taken from 3mm Sage university area. And it is weighted for preparation of sample
- 3) 60-70 Penetration grade bitumen (200gm for each sample).
- 4) Sieve analysis is done for aggregate and aggregate retained on 4.75mm IS sieve is taken after sieve analysis aggregate size of 12mm, 8mm, 4.75mm, 2mm and 2% filler material taken.

S.No.	Bitumen(gm)	HDPE(gm)	PVC (gm)
1	192	4	4
2	184	8	8
3	176	12	12
4	168	16	16

Table 1. Quantity detail of material for sample

Based on above chart 3 sample are prepared for each combination and test are perform on these sample after that result are discuss below

Penetration test

Ductility test

Softening test

2. PENETRATION TEST

Penetration test of Bitumen determines the hardness or softness of bitumen by measuring the depth in millimeter to which a standard loaded needle will penetrate vertically in five seconds while the temperature of the bitumen sample is maintained at 25°C

Chart -2 Penetration test value

S. No.	Sample No.	Quantity of Bitumen (gm)	Quantity of HDPE (gm)	Quantity of PVC (gm)	Penetration Value (mm)	Average value (mm)	Accepted Value as (IS 73:2013) (mm)
1	1	192	4	4	55	53	44
	2	192	4	4	51		
	3	192	4	4	53		
2	4	184	8	8	46.8	47	
	5	184	8	8	47.4		
	6	184	8	8	47.5		
3	7	176	12	12	41.1	42	
	8	176	12	12	42.8		
	9	176	12	12	42.3		
4	10	168	16	16	34.8	35	
	11	168	16	16	35.1		
	12	168	16	16	35.7		

3. DUCTILITY TEST

In this test take 200 gm bitumen and it is replace by 2.5%,5%,7.5%and 10 % of LDPE and pvc dust and calculation given below

Chart 3 - Ductility test value

Table 3.1 96% bitumen, 2% HDPE, 2% PVC

S. No.	Sample No.	Quantity of Bitumen (gm)	Quantity of HDPE (gm)	Quantity of PVC (gm)	Ductility value (cm)	Average value (cm)	Final Average value (cm)	Accepted Value (IS 73:2013) (cm)
1	1	192	4	4	70.4	70.63	71	40
					70.6			
					70.9			
	2	192	4	4	71.2	71		
					70.7			
					71.1			
	3	192	4	4	70.9	71.33		
					71.5			
					71.6			

Result- As per IS code 73:2013 Serial 1 sample 1, 2 & 3 falls under accepted value

Table 3.2 92% bitumen, 4% HDPE, 4%PVC

S. No.	Sample No.	Quantity of Bitumen (gm)	Quantity of HDPE (gm)	Quantity of PVC (gm)	Ductility value (cm)	Average value (cm)	Final Average value (cm)	Accepted Value (IS 73:2013) (cm)
3	7	176	12	12	50.2	50.9	51.14	40
					50.9			
					51.6			
	8	176	12	12	50.4	51.13		
					51.2			
					51.8			
	9	176	12	12	51.8	51.4		
					51.5			
					51.9			

Result- As per IS code 73:2013 Serial 3 sample 7, 8, &9 falls under accepted value

Table 4.4 88% bitumen, 6% HDPE, 6% PVC

S. No.	Sample No.	Quantity of Bitumen (gm)	Quantity of HDPE (gm)	Quantity of PVC (gm)	Ductility value (cm)	Average value (cm)	Final Average value (cm)	Accepted Value (IS 73:2013) (cm)
2	4	184	8	8	59.3	60.06	60	40
					60.2			
					60.7			
	5	184	8	8	59.5	60.23		
					60.5			
					60.7			
	6	184	8	8	60.1	60.56		
					60.7			
					60.9			

Result- As per IS code 73:2013 Serial 3 sample 7, 8, &9 falls under accepted value

Table 3.4 84% bitumen, 8% HDPE, 8% PVC

S. No.	Sample No.	Quantity of Bitumen (gm)	Quantity of HDPE (gm)	Quantity of PVC (gm)	Ductility value (cm)	Average value (cm)	Final Average value (cm)	Accepted Value (IS 73:2013) (cm)
4	10	168	16	16	35.2	36.06	36.20	40
					36.2			
					36.8			
	11	168	16	16	36	36.43		
					36.5			
					36.8			
	12	168	16	16	35.4	36.13		
					36.1			
					36.9			

Result- As per IS code 73:2013 Serial 4 sample 8, 11&12 not Falls under accepted value

4.SOFTENING POINT TEST

In this test take 200 gm bitumen and it is replace by 2.5%,5%,7.5%and 10 % of LDPE and pvc dust and calculation given below

Chart 4 - Softening point value

Table 4.6 calculation for Softening Point

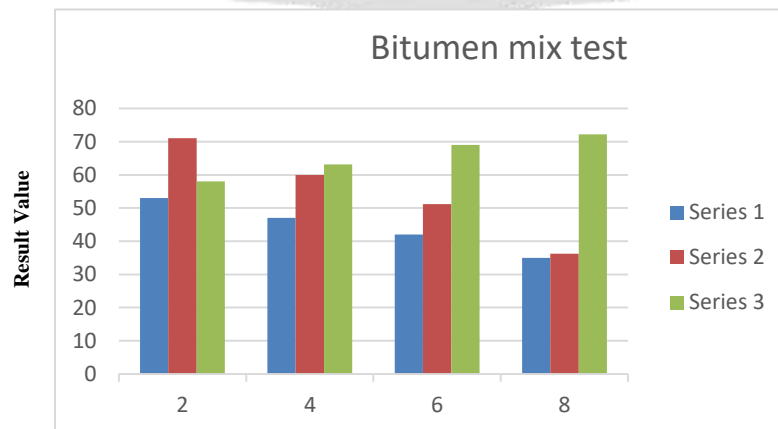
S. No.	Sample No.	Quantity of Bitumen (gm)	Quantity of HDPE (gm)	Quantity of PVC (gm)	Softening value (°C)	Average value (°C)	Accepted Value (IS 73:2013) (°C)
1	1	192	4	4	57.2	58	47°
					58.1		
	2	192	4	4	57.4		
					58.9		
	3	192	4	4	58.1		
					59		
2	4	184	8	8	62.8	63.13	
					63.7		
	5	184	8	8	62		
					62.7		
	6	184	8	8	63.4		
					64.2		
3	7	176	12	12	68.6	69	
					69.1		
	8	176	12	12	68.8		
					69.2		
	9	176	12	12	68.3		
					69.5		
4	10	168	16	16	71.3	72.2	
					72.6		
	11	168	16	16	72.2		
					73		
	12	168	16	16	71.2		
					72.9		

Result- As per IS code 73:2013 Serial 1,2,3,&4 sample accepted value

5. CONCLUSIONS

the results of various laboratory tests of the sample mixes with bitumen and test of bitumen with various composition discussed.

Chart 5.1 Bitumen testing



Based on research work and test perform in various composition of mixture of bitumen polythene and PVC dust up to 4% each give the best result which is 48 mm as shown

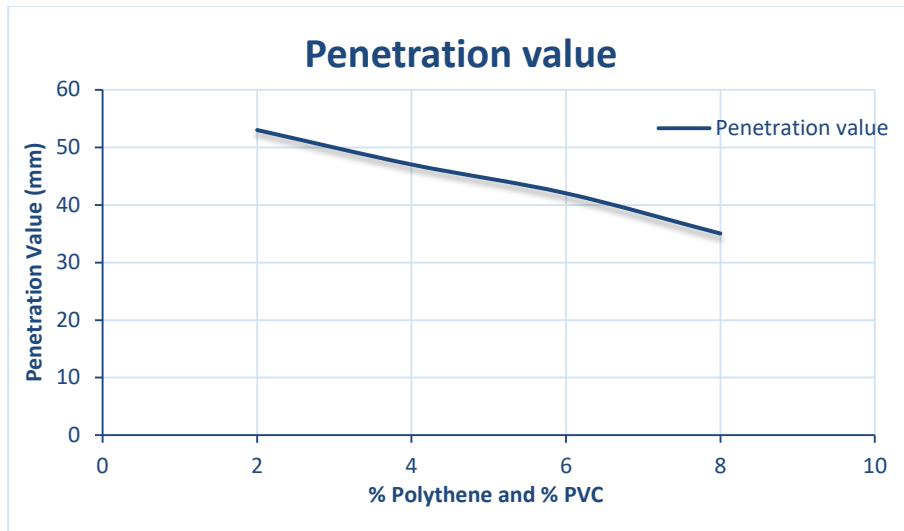


Chart 5.2 Penetration value with %polythene and %PVC

Based on research work and test perform in various composition of mixture of bitumen polythene and PVC dust each up to 6 % give the result which is 41.14 mm as shown in figure

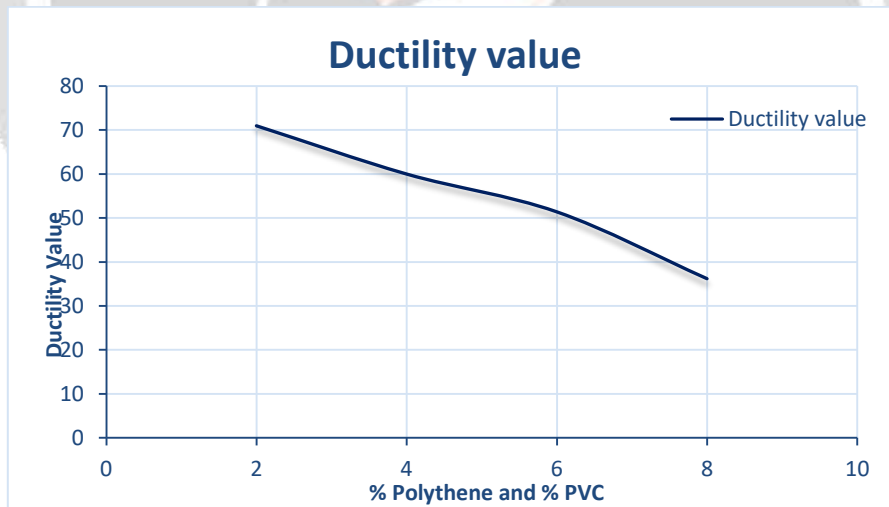


Chart 5.3 Ductility value with %polythene and %PVC

Based on research work and test perform in various composition of mixture of bitumen polythene and PVC dust up to 8 % give the best result which is shown in figure

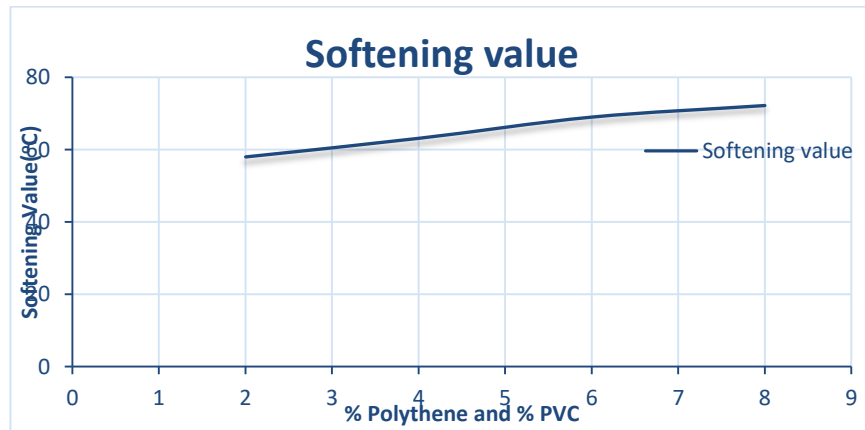


Chart 5.4 Softening value with %polythene and %PVC

Based on experimental work results from the study of the behavior of polythene and PVC modified bitumen. It was found that the modified mix possesses improved Marshall Characteristics mentioned below.

- i. Penetration value decrease with increase % of polythene and PVC. But at 4% of polythene and PVC respectively it falls under the value of IS 73:2013 acceptable value.
- ii. Ductility value also decrease with increase of % of polythene and % of PVC. But up to 6% of polythene and 6% of PVC dust result value under specified value of IS 73:2013.
- iii. Also, the values of the parameter Softening point are within the required specifications. And very good result obtained at 8% of polythene and 8% of PVC dust.

6. REFERENCES

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