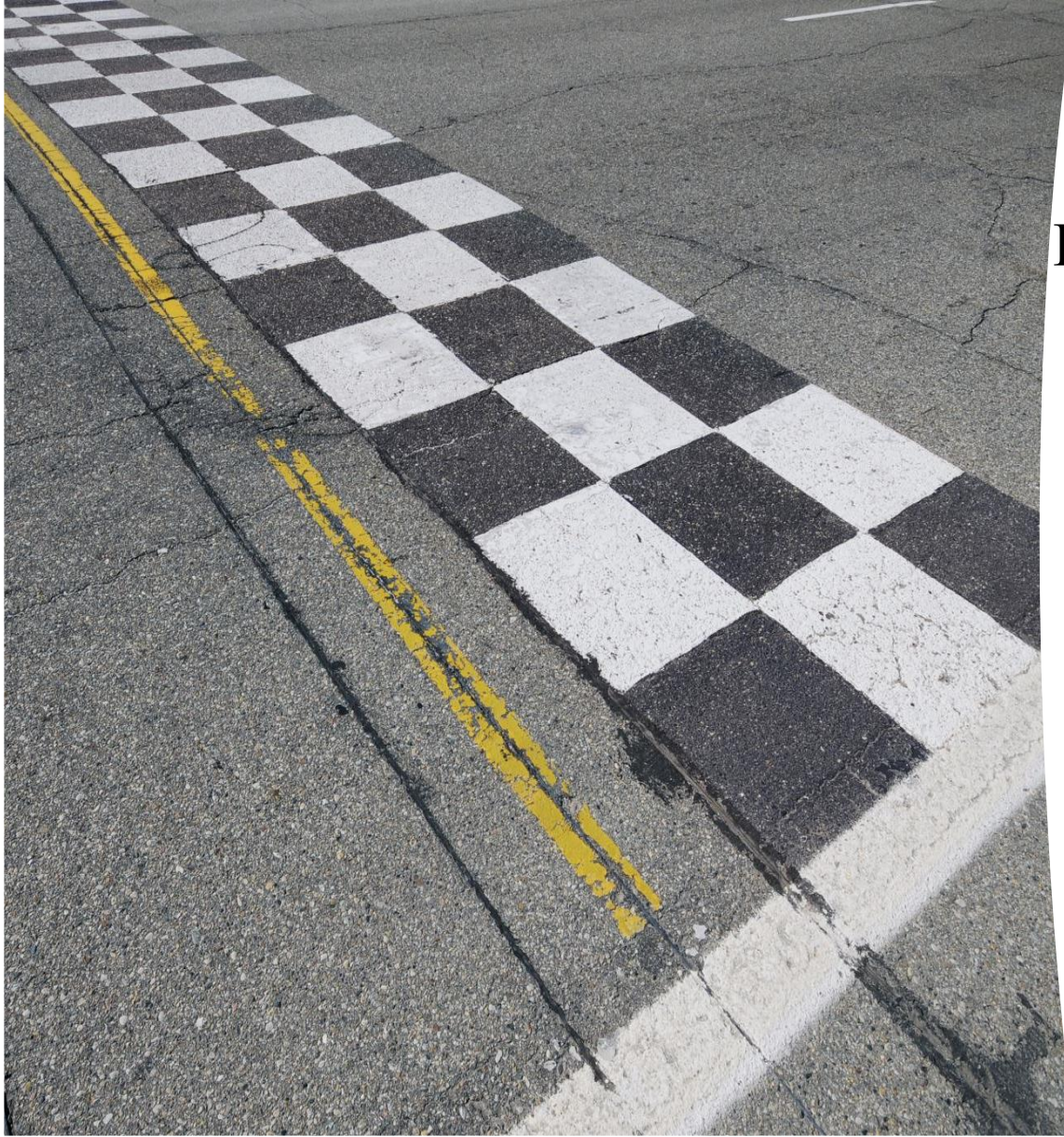
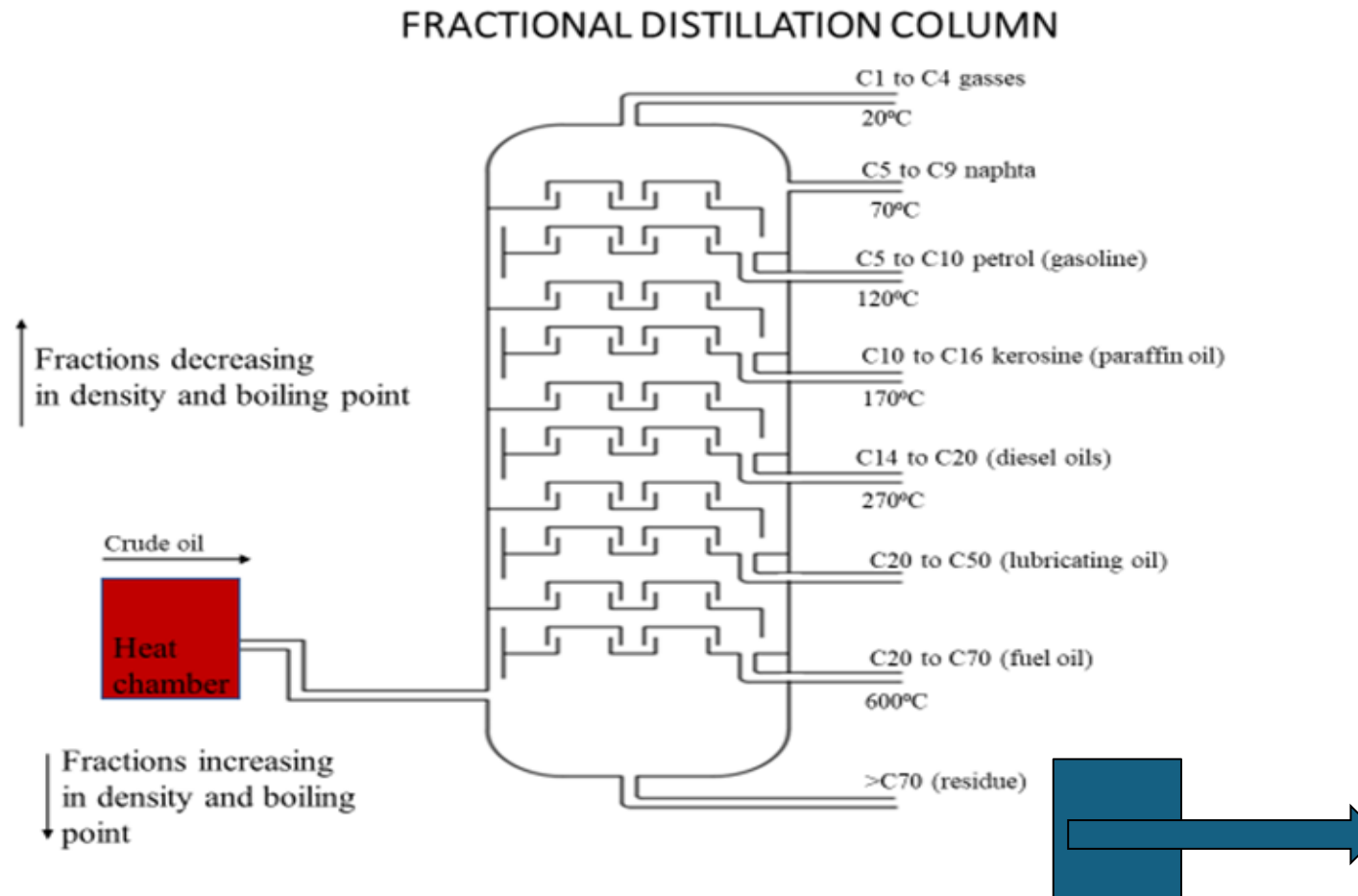
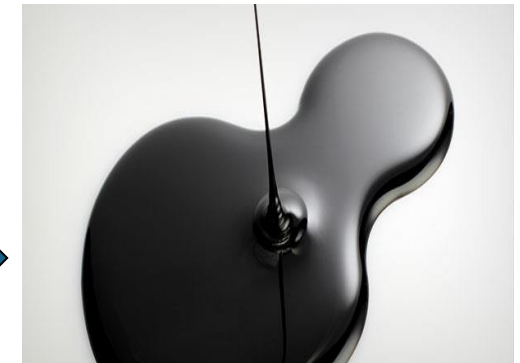




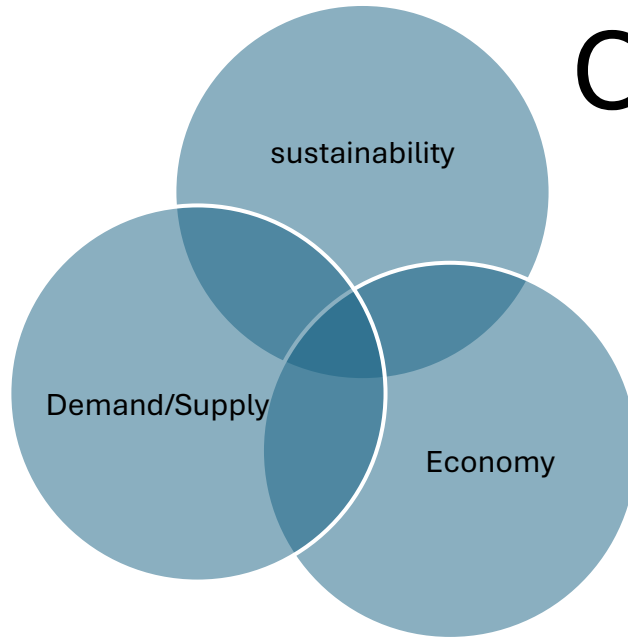
Performance Analysis of Natural Asphalt



How is bitumen manufactured



Challenges

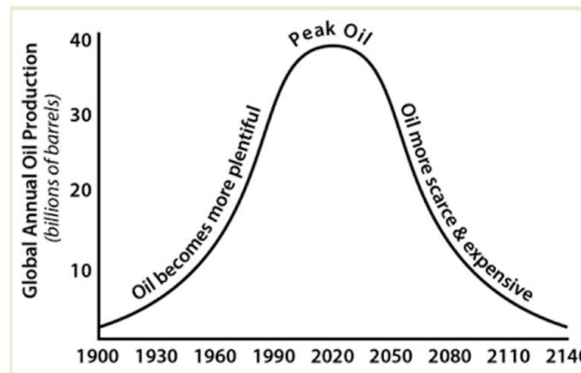


300billion naira annually



TUDelft

Declination of crude oil reserve

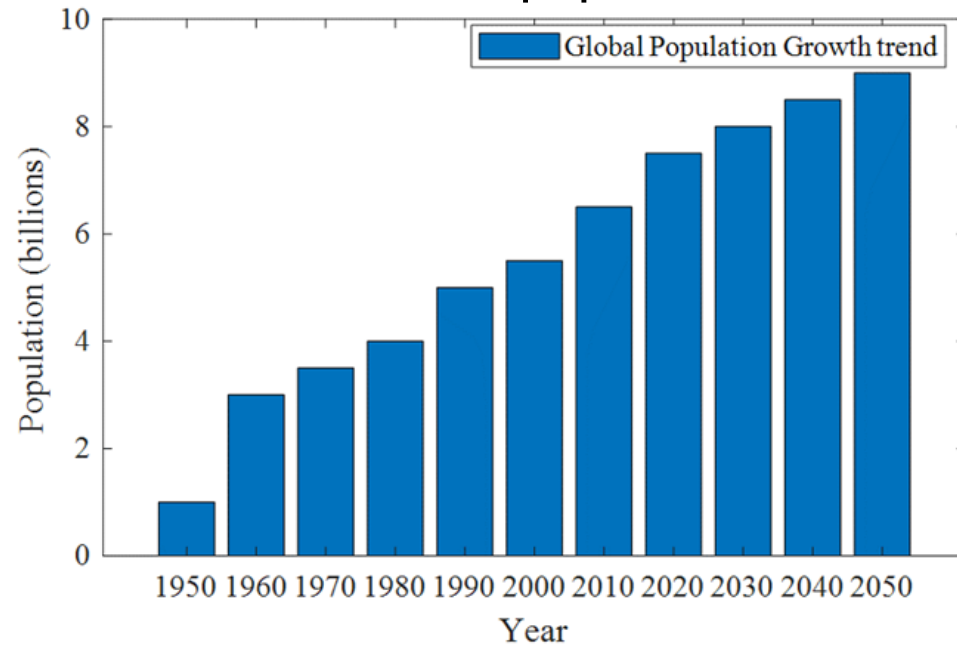


Pollution/global Warming

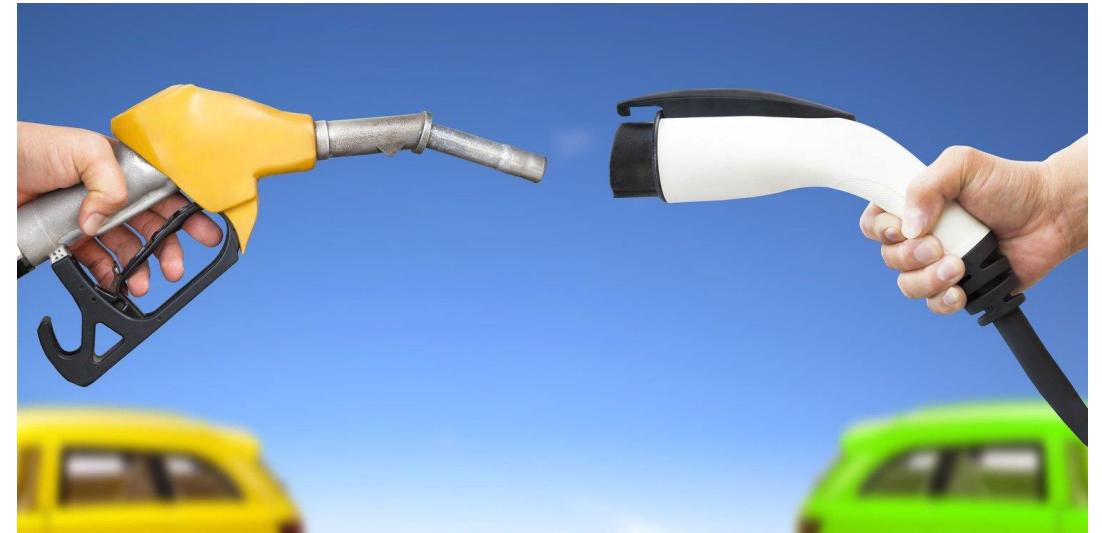


Challenges

Increase in Global population



Increased Campaign for electric cars



Bridging the Gap



Lignin



Green Algae



Shale oil



Wood waste



Natural asphalt



Animal Waste.

What are Natural Asphalt



Sand asphalt



Trinidad Lake



Rock asphalt



Gilsonite



Binder near the surface of the water



Natural occurring plain binder

World natural asphalt resources(in million barrels)

Area	Demonstrated	Inferred
NORTH AMERICA		
United states	22,823	33,709
Canada	1,685,725	831,100
Total	1,708,548	864,809
SOUTH AMERICA		
Trinidad	60	
Venezuela	50,400	
Total	50,460	
EUROPE		
Albania	371	
Italy	1,260	
Romania	25	
U.S.S.R.	18,837	
Total	20,493	
ASIA		
Peoples Republic of China	10,050	
U.S.S.R.	66,213	
Total	76,263	
AFRICA		
Madagascar	35	31
Nigeria	1,000	
Zaire	30	
Total	1,065	31
MIDDLE EAST		
Syria	13	
Total	13	
SOUTHEAST ASIA		
Indonesia	10	
Republic of the Philippines	1	1
Total	11	1
WORLD TOTAL	1,856,853	864,841

Source: Meyer, R.F. and W. De Witt 1990

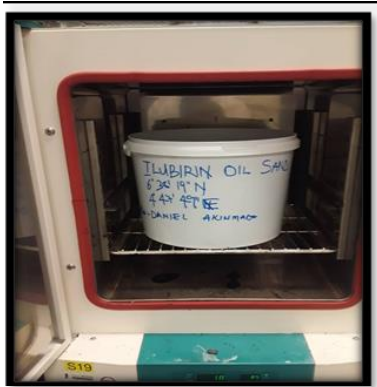
Sample collection



Sample Location	Sample Coordinate	
Ilubirin	6°38'33"N,	4° 49'44"E
Isowa	6°42'25"N,	4°52'12"E
AkindoluEmaye	6°39'3"N,	4°53'29"E
AkindoluEmaye	6°39'19"N,	4°51'48"E

- ◆ Variability and Heterogeneity of material was a major concern

Sample preparation and testing



Heat up the sample to about 30degree



Mixing the Bituminous sand with Di-chloroethane



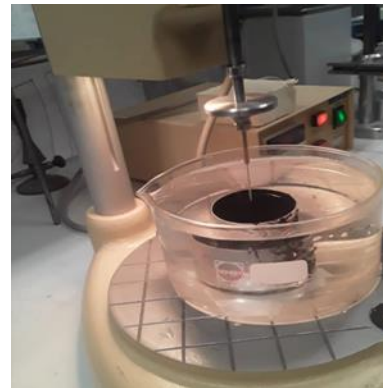
Extraction processes



Extracted bitumen samples



Extracted grain size



Penetration test.



Softening point test



Viscosity test

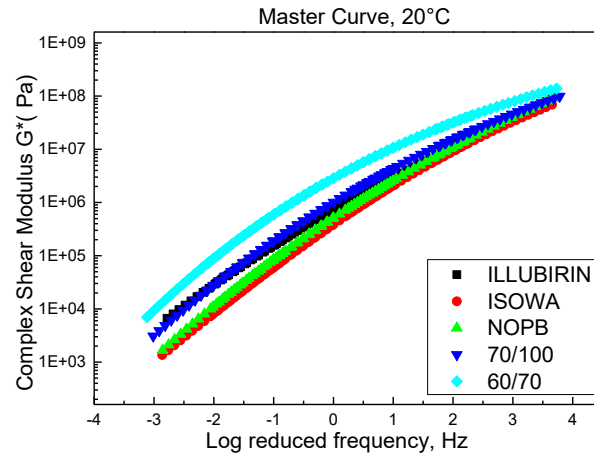
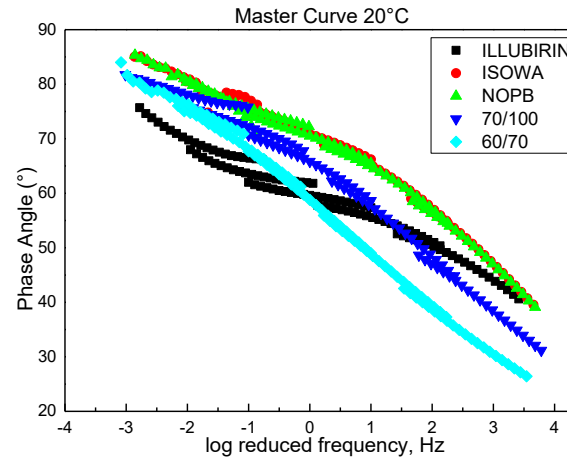
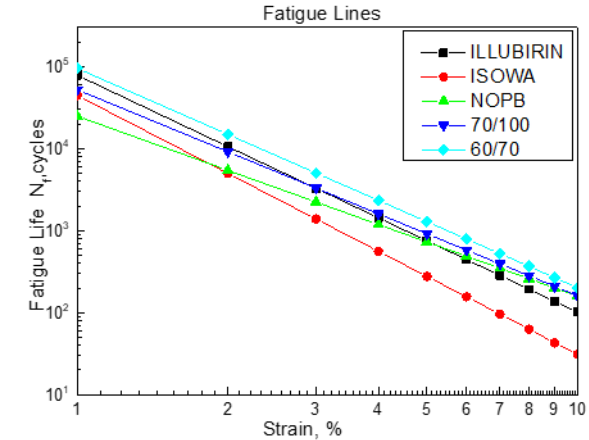
Results

Source	Penetration (0.1mm)	Softening point (°C)
Isowa	100	49
Illubirin	64	52
NOPB	210	40
70/100	90	48
60/70	65	48

Source	Mixing Temperatures(°C)	Compaction temperatures (°C)
Isowa	165	160
Illubirin	158	155
NOPB	129	125
70/100	165	160
60/70	NR	NR

Sample ID	Isowa	Illubirin	Akindolumaye
% Bitumen	11.4	10.7	11.9

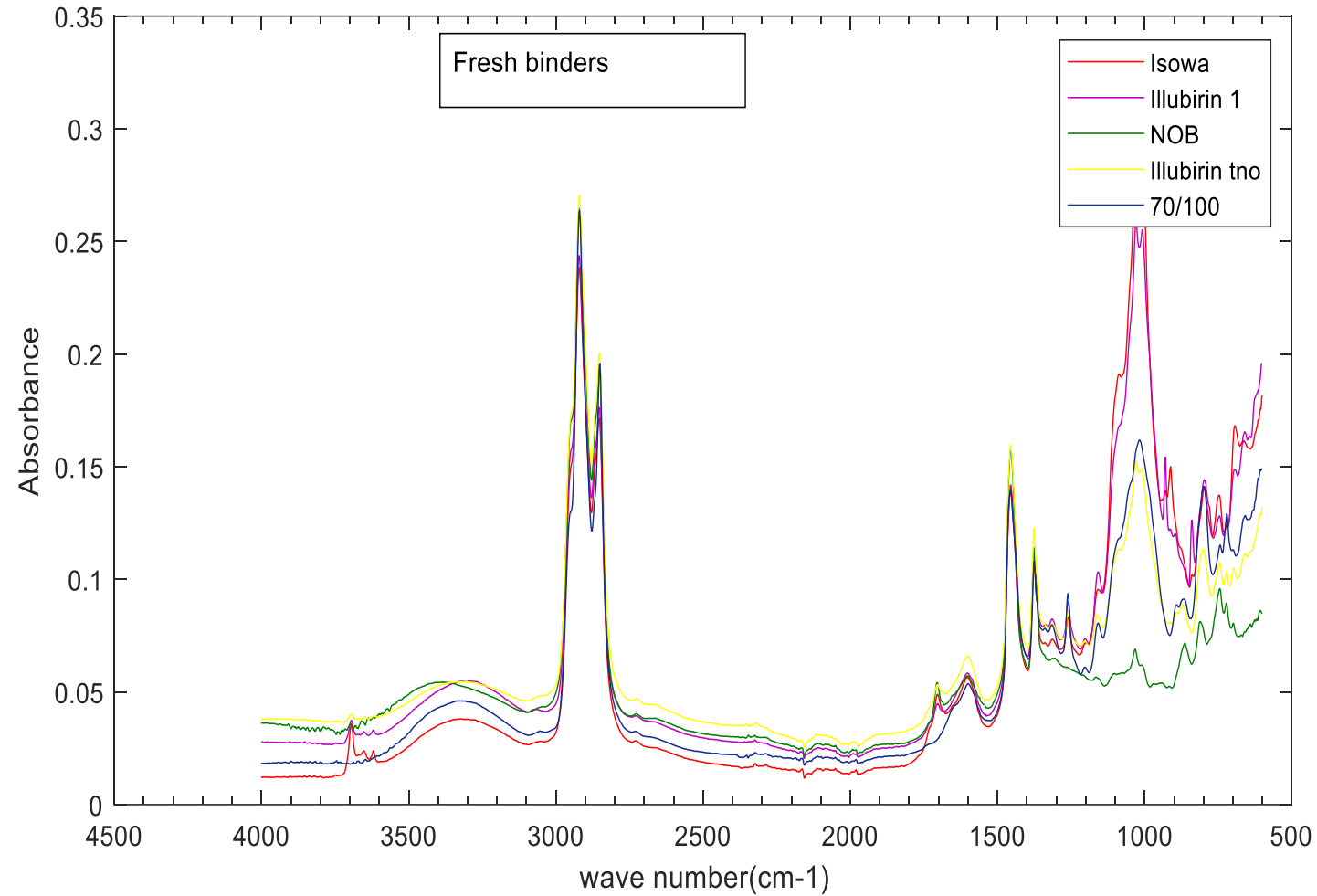
Rheological Properties of Natural Binders

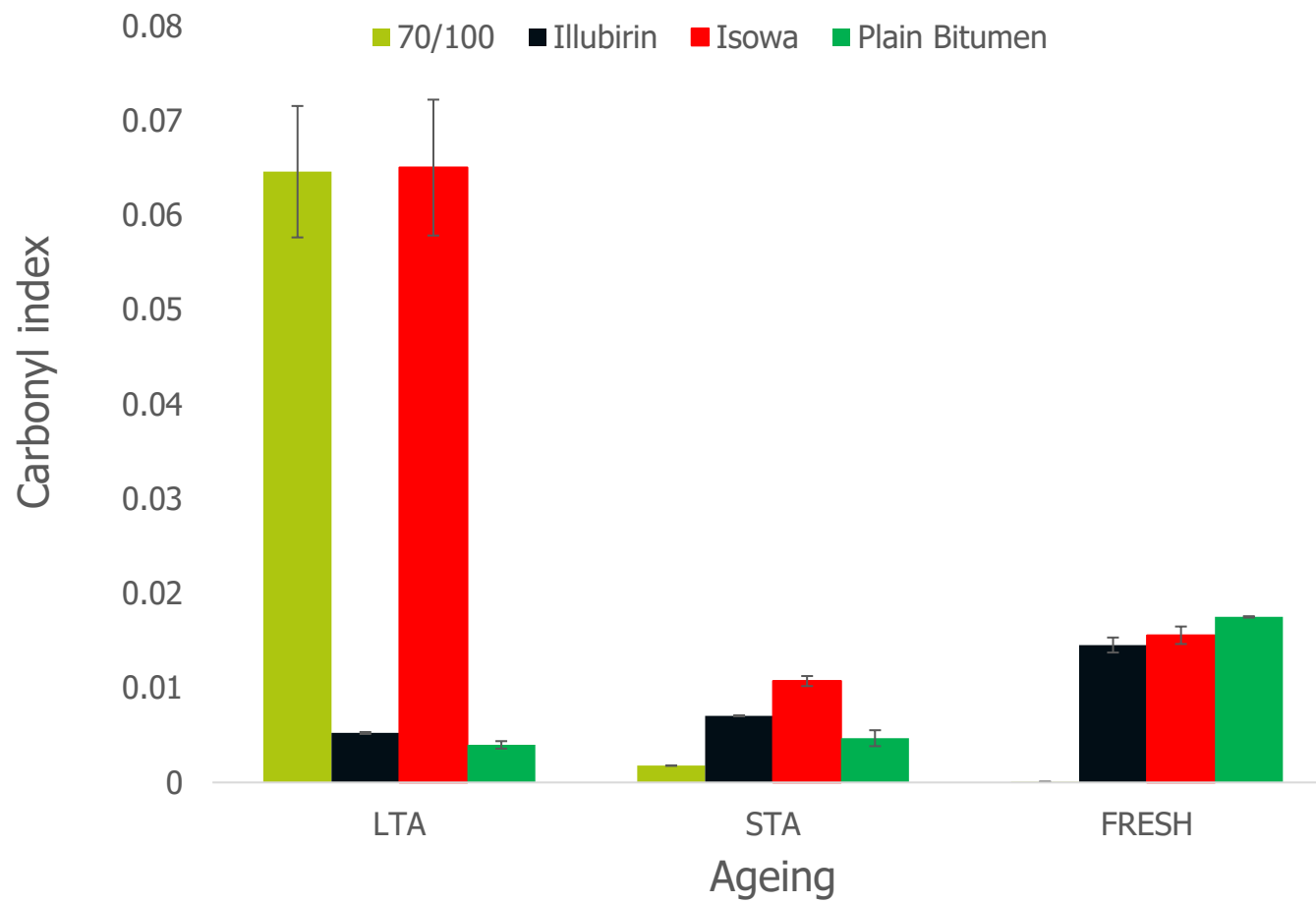


Natural bitumen from Illubirin appears to possess properties similar as 60/70 bitumen.

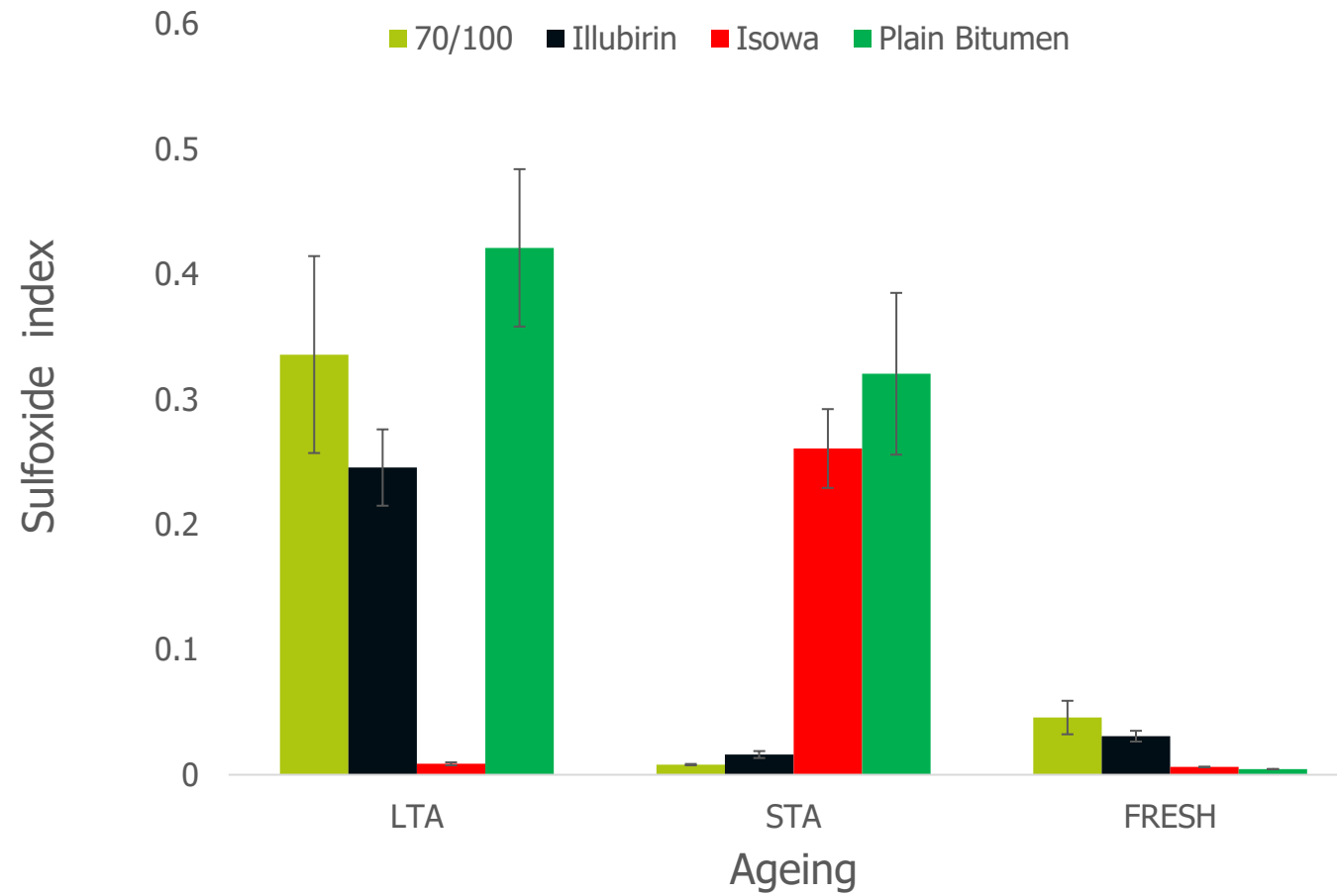
The fatigue life among the Natural bitumen samples seems similar as well.

Chemical Properties

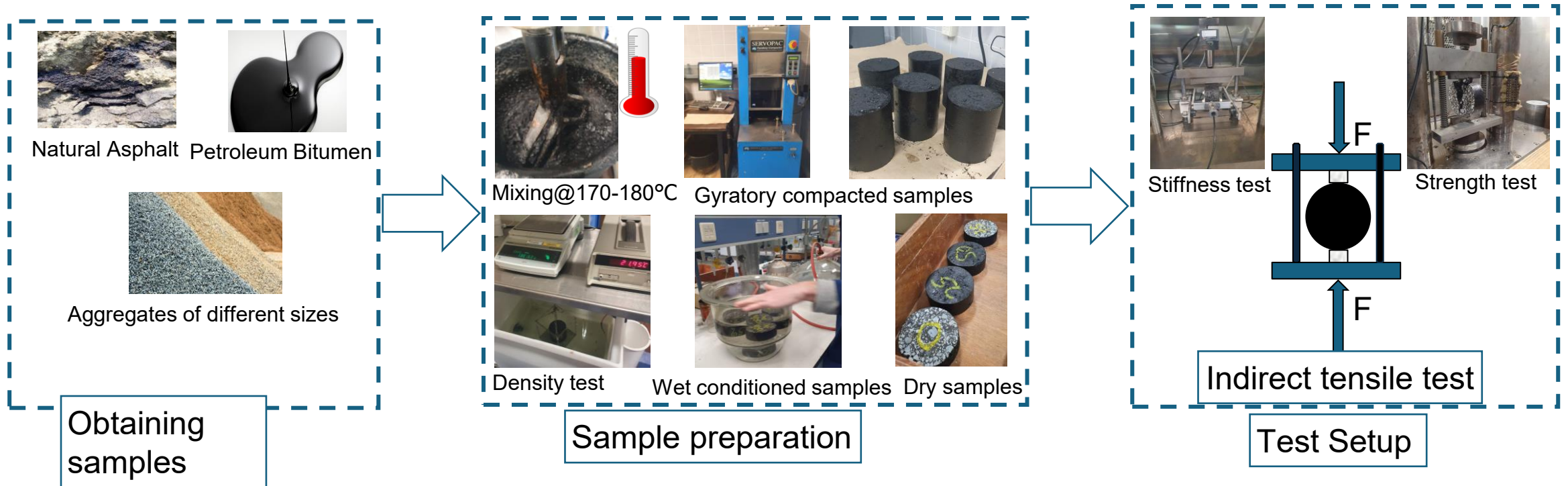




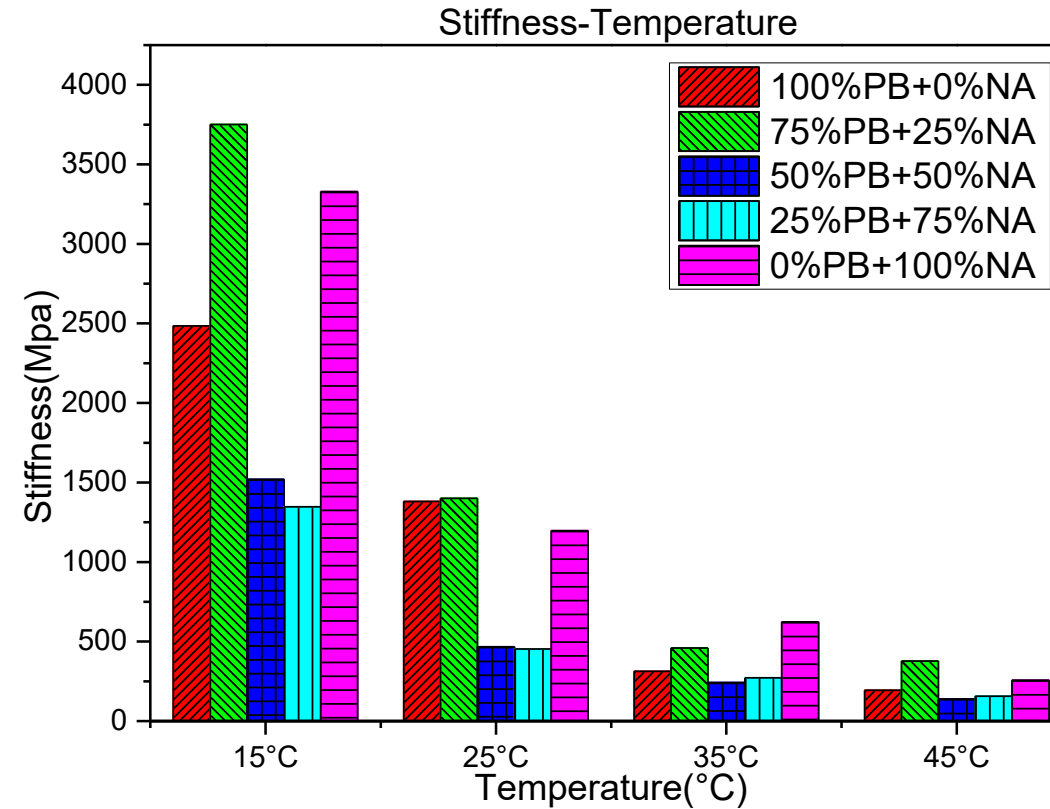
FTIR



Ongoing Test

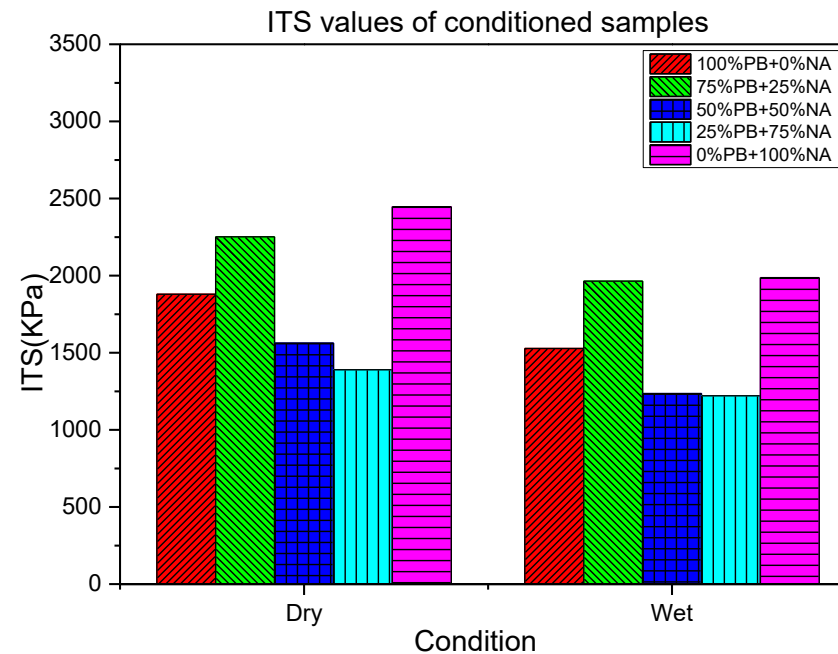
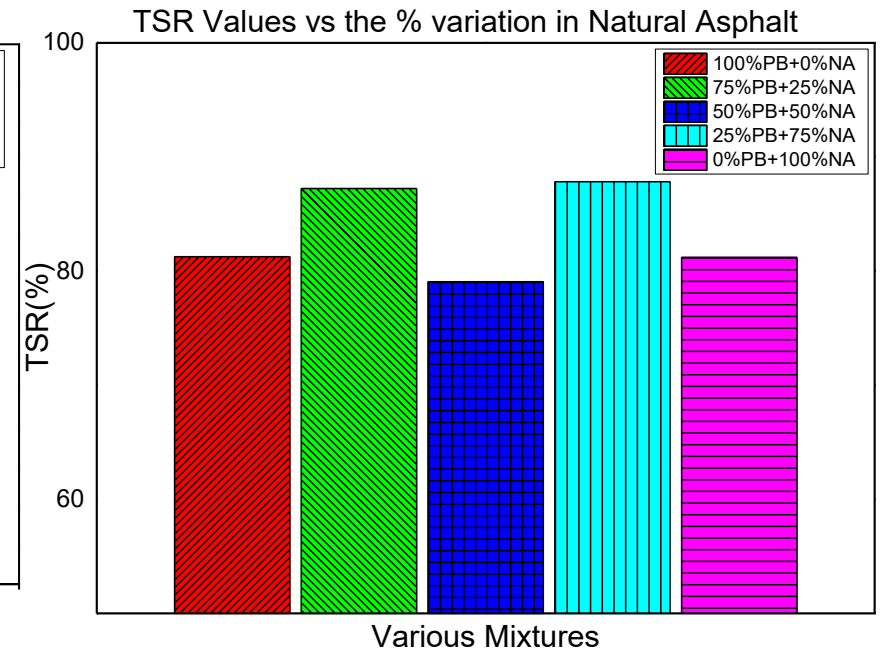


Stiffness result



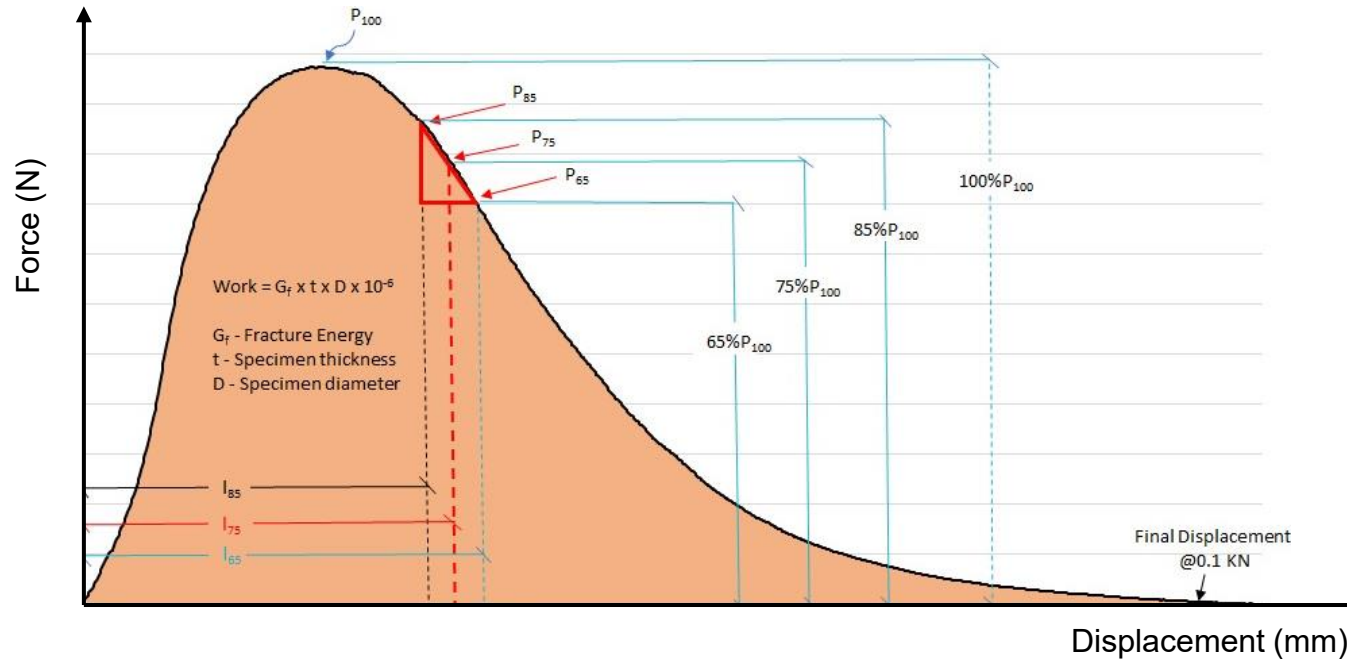
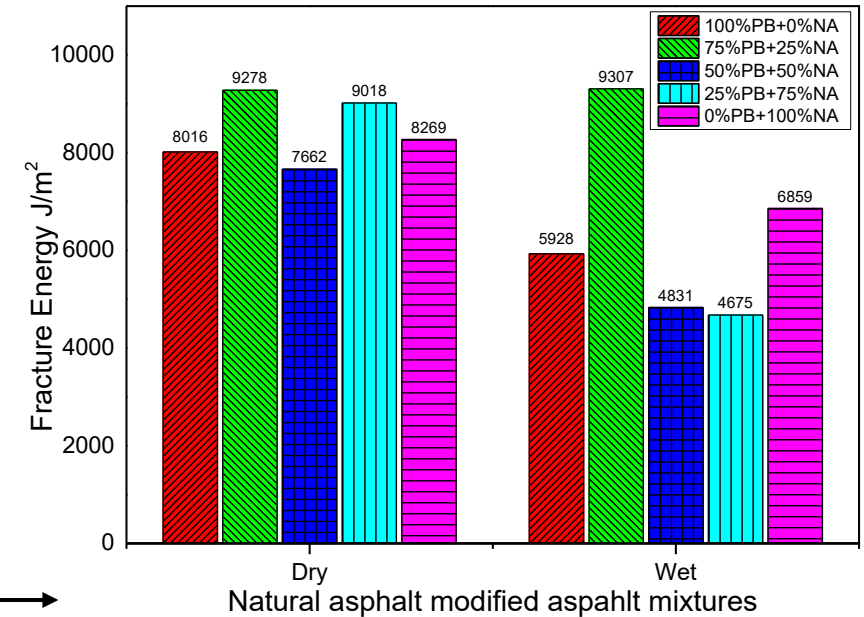
Observation: 75% Replacement of weight of Optimized percentage of Petroleum bitumen with 25% Natural Asphalt has the maximum stiffness values as the temperature increases.

Tensile test:



Observation: 75% Replacement of weight of Optimized percentage of Petroleum bitumen with 25% Natural Asphalt has the maximum strength and tensile strength ratio values above 80%.

Indirect tensile test: Total Energy



The addition of 25% NA: 15.74% **increase in the fracture Energy**

Observation: 75% Replacement of weight of the Optimized percentage of Petroleum bitumen with 25% Natural Asphalt resulted in a 15.74% **increase in the fracture Energy of the control samples**



Field performance



Conclusion

- viscoelastic properties of the Natural bitumen obtained from the Natural bitumen were found to be comparable to those of the Petroleum binder.
- Indirect Tensile strength values increased in Natural bitumen-modified asphalt mixtures with the increase in Natural bitumen percentage. Nevertheless, it was found that the addition of 10% of Natural bitumen met all Indirect tensile mixture design criteria.
- The FTIR spectral for both the Natural binder and petroleum binder are similar.
- Visual inspection, the field trials utilizing Natural bitumen optimised for pothole maintenance exhibited commendable performance in comparison to sections using Petroleum bitumen.



Performance of natural asphalt as a paving material: A laboratory and field evaluation

Daniel Akinmade^{a, b}, Kumar Anupam^a  , Cor Kasbergen^a, Sandra Erkens^a,
Duna Samson^b, Poot Marco^a

[Show more](#) 

 Add to Mendeley  Share  Cite



Review

A state-of-the-art review of Natural bitumen in pavement: Underlining challenges and the way forward

Kumar Anupam^a, Daniel Akinmade^{a, b}  , Cor Kasbergen^a, Sandra Erkens^a,
Festus Adebisi^c

[Show more](#) 

 Add to Mendeley  Share  Cite