

January 2020

CIRCULAR ECONOMY

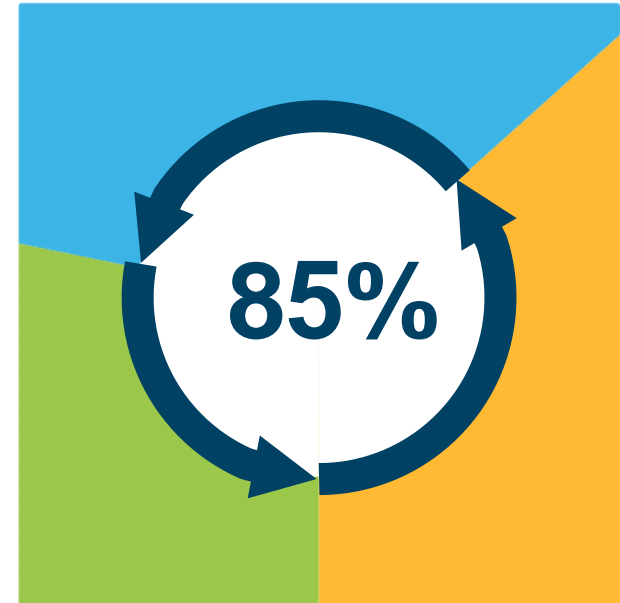
New bitumens from used oil regeneration



The mark of circular economy

Itelyum is the Italian player with more than half a century of history, internationally recognized for its technology, expertise and quality in the regeneration of lube oils, purification of solvents and chemical streams, and environmental services for the industrial sector.

Thanks to **16 companies**, **15 operating sites** and **500 people**, Itelyum offers sustainable solutions to over **20,000 customers** in more than **60 countries**.



% circularity over the total waste (>700,000 t) and raw materials (~40.000 t) managed by the group



Regeneration of lube oils

Circular excellence

Two plants for the regeneration of used lube oils, with advanced technologies and proprietary processes, capable of producing high quality lube bases.

The bases produced are ideal for the different applications in the automotive and industrial sectors, matching the most demanding performance and environmental requirements.

The reduced environmental footprint of the regenerated bases creates sustainable value for the market.



Italy: used oil selection criteria are the most severe in the world

At **ITELYUM** plants:

- Analysis performed by a certified third party lab.
- Standardized operational conditions and procedures
- Detailed analysis of used oil on the market (Italian and foreign) also using pot distillation in pilot and lab scale.

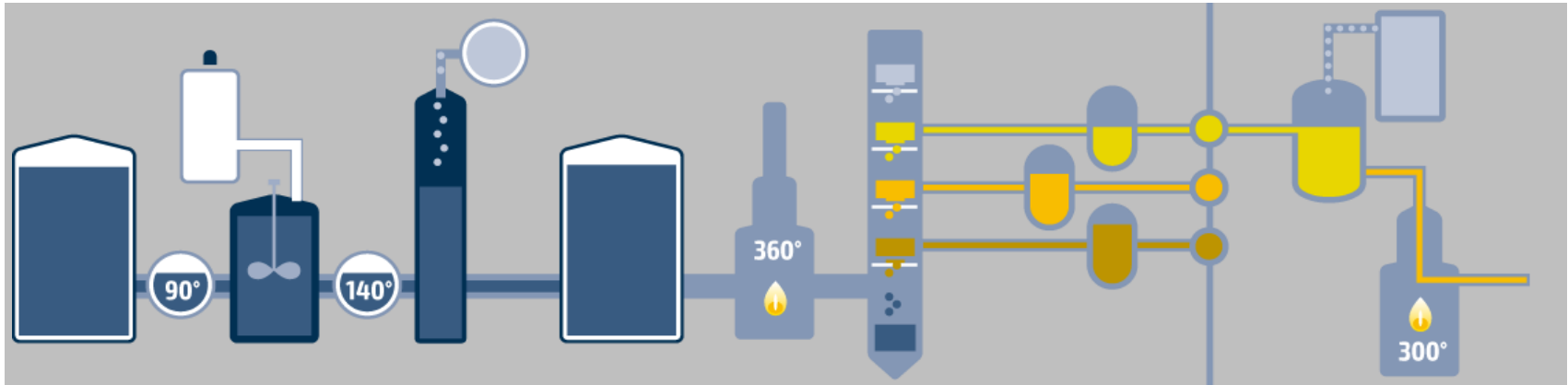
Parameter	Unit of measure	Limit value of acceptance
Water	% w	Max 15
Specific Gravity at 15°C	Kg/l	Max 0,92
Sediments	% v	Max 3
Viscosity at 40°C	°E	Min 1,8
Chlorine	% w	Max 0,5
PCB/PCT	mg / Kg	Max 25
Sulphur	% w	Max 1,5
Solvents	% v	Max 5
Cu+Zn	mg / Kg	Max 4000
Cd+Cr+Ni+V	mg / Kg	Max 50
TAN	mg KOH / g	Max 3,5
TBN	mg KOH / g	Max 18



ITELYUM Lube Oil Regeneration process

Innovation and technology

Pieve Fissiraga – plant flow chart



1 / Pre-flash

Waste lube oil is heated up to 140 °C to be distilled under low vacuum, separating water and light hydrocarbons.

2 / Thermal De-Asphalting (TDA)

The dehydrated product is distilled at about 360 °C in a vacuum de-asphalting column (TDA).

The asphaltic and bituminous products remain on the bottom, at the same time three lateral cuts with different viscosities are distilled.

3 / Hydro-finishing (HDF)

Oil and hydrogen are preheated to around 300 °C and fed to a catalytic reactor. The final result is a transparent oil with very low sulfur and polynuclear aromatic compounds (PNA), to the benefit of health, the environment and performance,



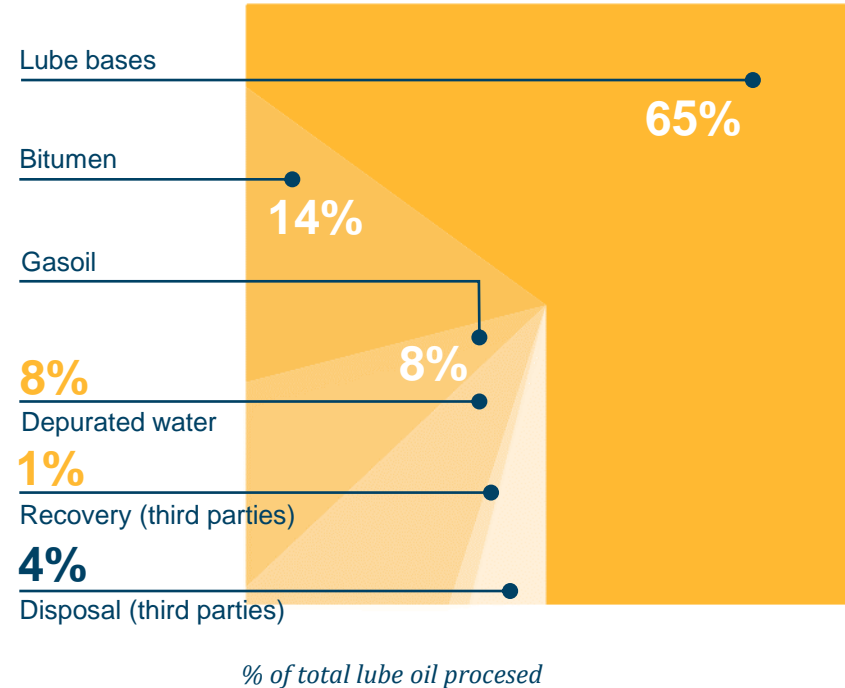
Regeneration of lube oils

Circular excellence

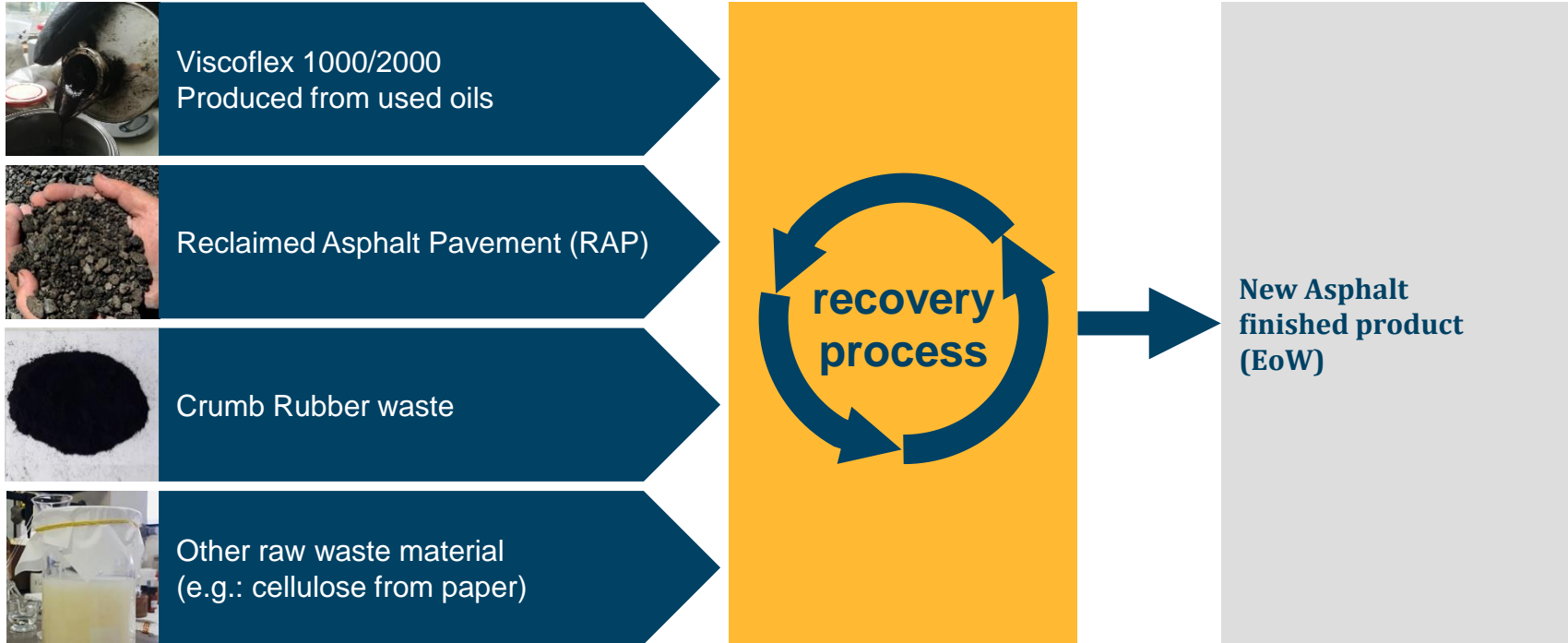
Benchmarked against primary production, regenerated lube bases produce:

- **half** emissions of CO₂
- **4 times less** emissions of fine dusts
- **5 times less** emissions of acidifying substances (NO_x, SO₂ and NH₃)

Moreover, at least **95%** of the lube oil processed is transformed into products, returned to the environment as purified water or recovered by third parties.



Recycling option #1



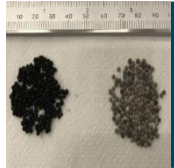
Recycling option #2



Viscoflex 1000
Produced from used oils



Exhausted Celite Waste from
Oil filtration plant



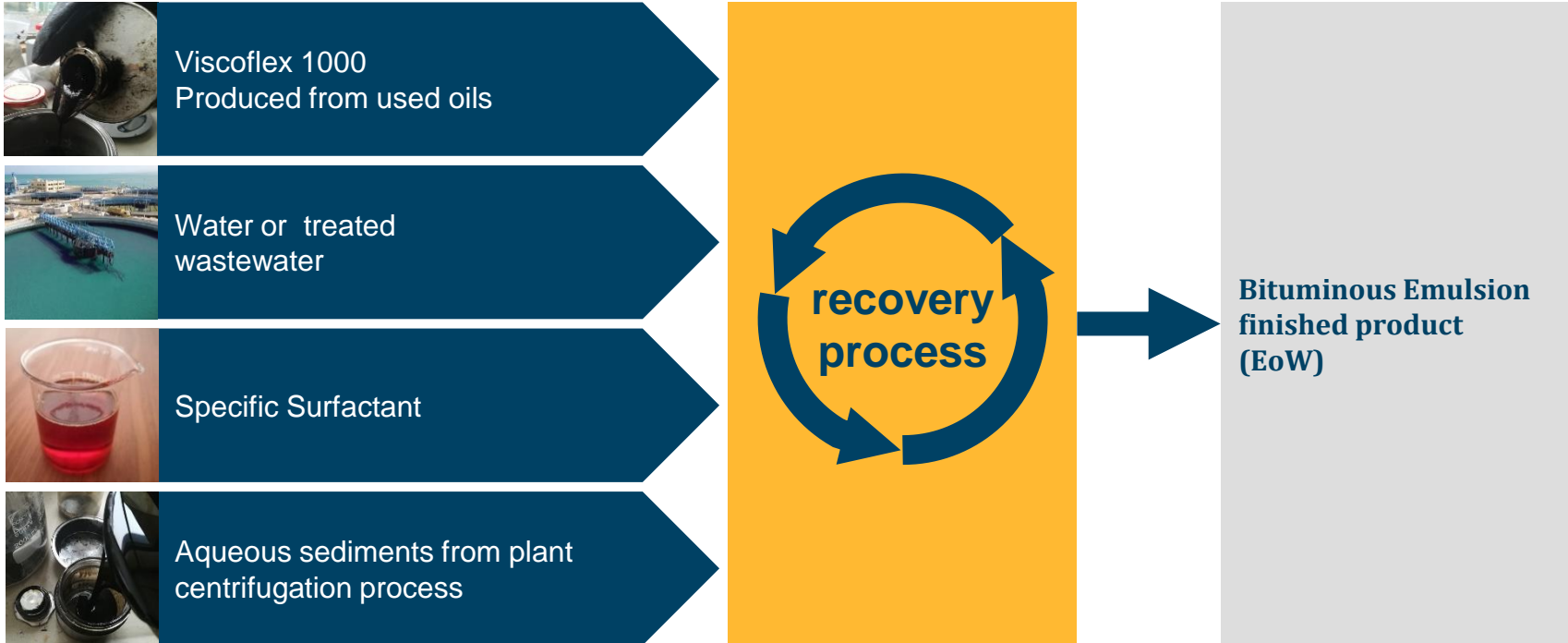
Exhausted Alumina
("greened" waste, $\gamma\text{-Al}_2\text{O}_3$)



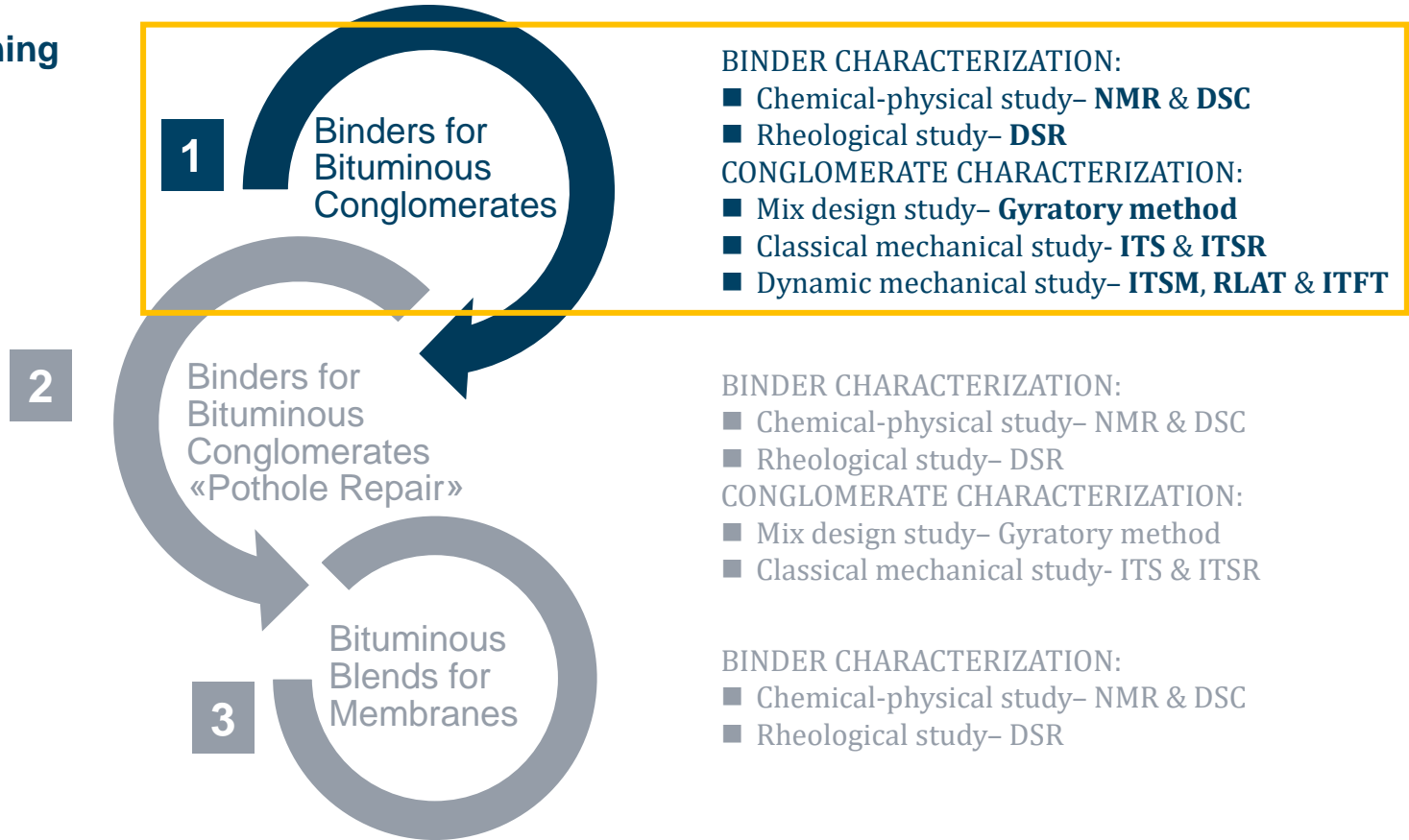
Dehydrated sediments from plant
centrifugation process



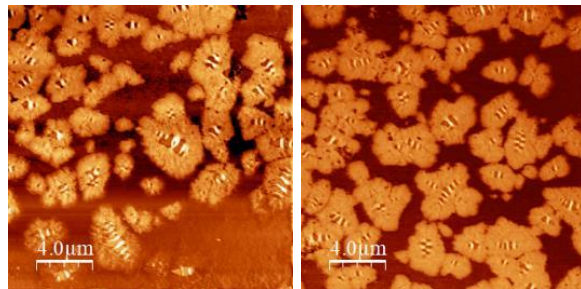
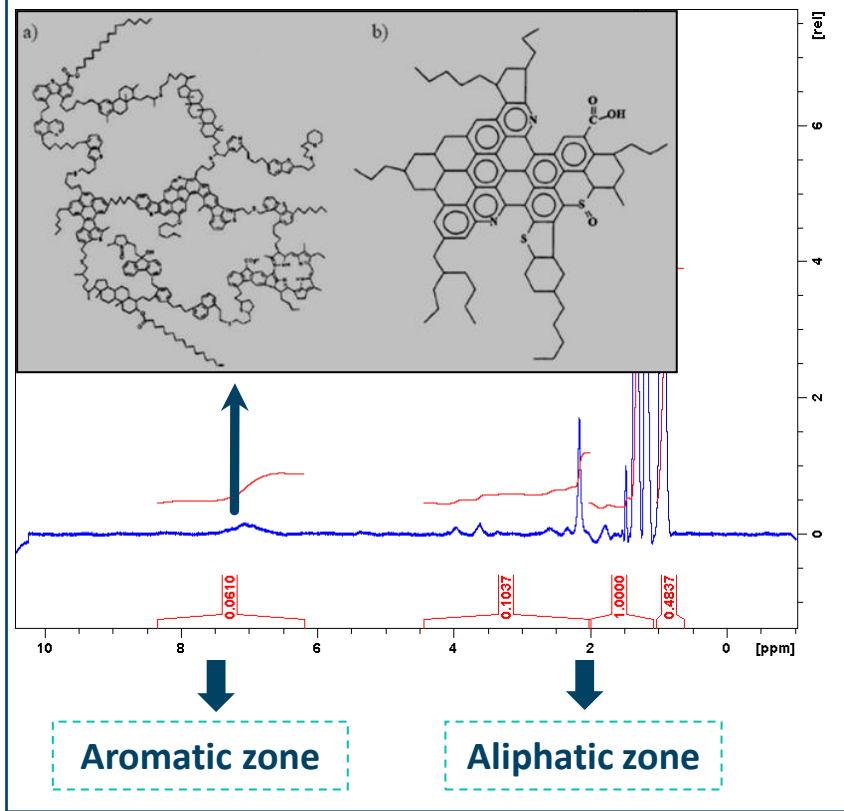
Recycling option #3



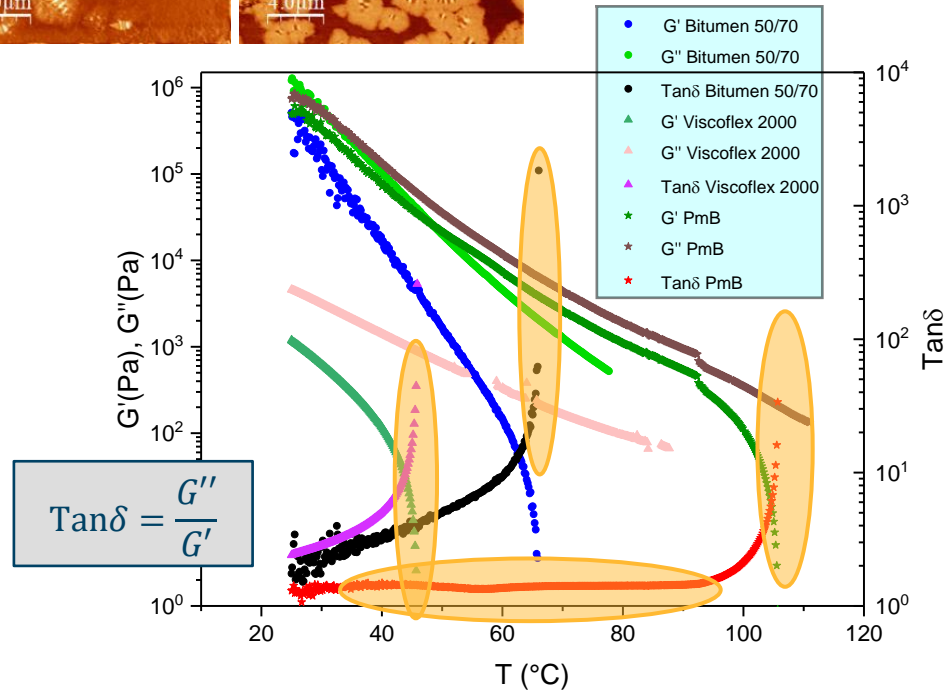
Work planning



Mix of Aliphatic Hydrocarbons and low percentage of polyaromatic molecules



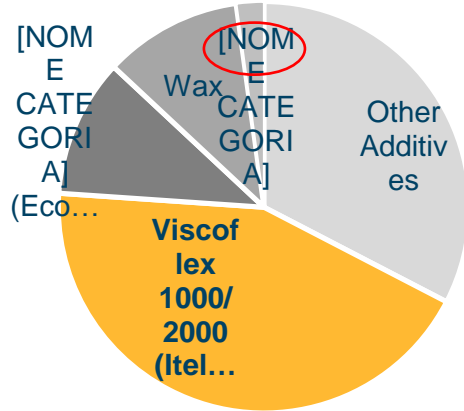
AFM pictures of Asphaltenes molecules



1

Binders for
Bituminous
Conglomerates

Mixture for binder formation



Mixture	Bitumen	V1000	V2000	R	WAX	SBS	Adhesion Promoter	P2	C2	CdN	CNC	RP	Nt	LiS
B23	/	/	60	15	10	0	0.3	14.7	0	0	0	0	0	0
B23 C2	/	/	60	15	10	0	0.3	0	14.7	0	0	0	0	0
B23 CDN	/	/	60	15	10	0	0.3	0	0	14.7	0	0	0	0
B23 CNC	/	/	60	15	10	0	0.3	0	0	0	14.7	0	0	0
B26	/	/	40	10	10	0	0	20	0	0	0	20	0	0
B27	/	/	60	5	10	0	0	15	0	0	0	10	0	0
B29	/	/	40	10	10	0	0	0	0	0	0	40	0	0
B30	/	/	40	0	15	0	0	14.7	0	0	0	25	0.1	5
B26 D	/	/	40	10	10	0	0	20	0	0	0	20	0	0
B27 D	/	/	60	5	10	0	0	15	0	0	0	10	0	0
B29 V1	/	40	/	10	10	0	0	0	0	0	0	40	0	0
B27-1	/	/	60	5	10	1	0.3	13.7	0	0	0	10	0	0
B29-1	/	/	50	10	10	0.5	0.3	0	0	0	0	29.2	0	0
CAM 26	/	/	40	10	10	0	0	20	0	0	0	20	0	0
CAM 29	/	/	40	10	10	0	0	0	0	0	0	40	0	0
CAM 29 V1	/	40	/	10	10	0	0	0	0	0	0	40	0	0

* The values are expressed as percentages

** D means Dense Viscoflex 2000

*** CAM is the acronym for "Criteri Ambientali Minimi", i.e. Minimum Environmental Criteria





Blend	ITMS (MPa)	ITS (MPa)
PmB (HARD)	4578	0.90
Bitume 50/70	9558	2.12
B 23	3179	0.40
B 23 C2	2704	0.37
B 23 CdN	3146	0.39
B 23 CNC	3388	0.38
B 26	8852	0.89
B 27	6186	0.85
B 29	8319	1.73
B 30	7769	0.99
B26 D	10402	1.06
B27 D	5875	0.66
B 29 D	14020	1.96
B 30 D	9937	1.36
B 29 V1	12382	1.07
B 27-1	4376	0.53
B 29-1	5978	0.62
CAM 26	4042	0.40
CAM 29	6540	0.67
CAM 29 V1	6178	0.57



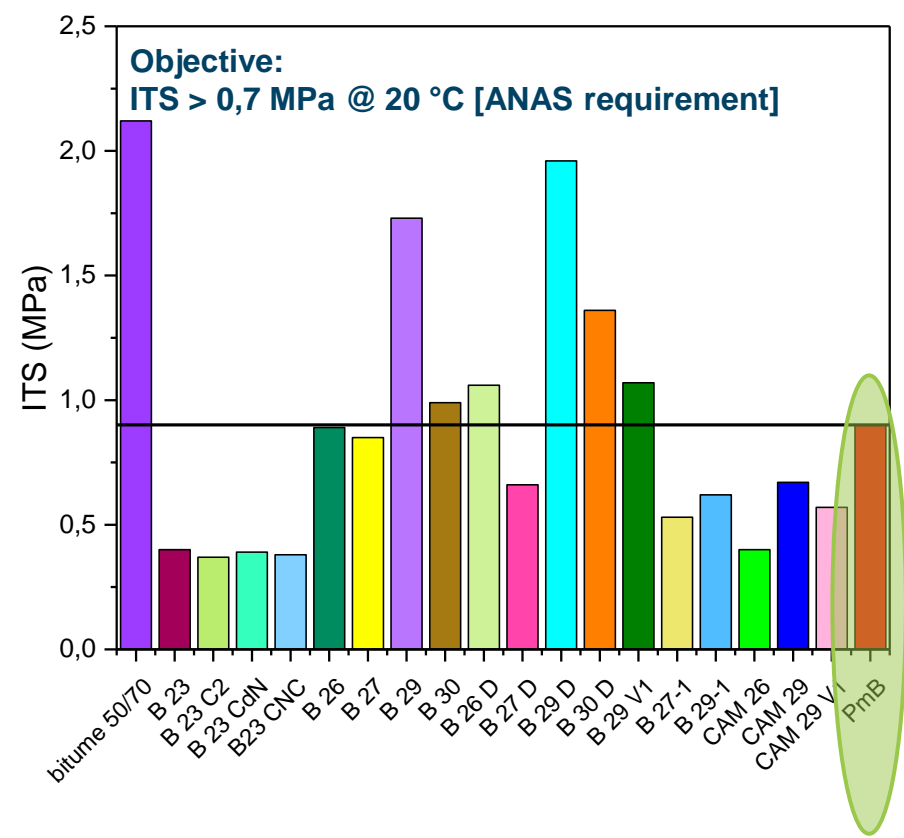
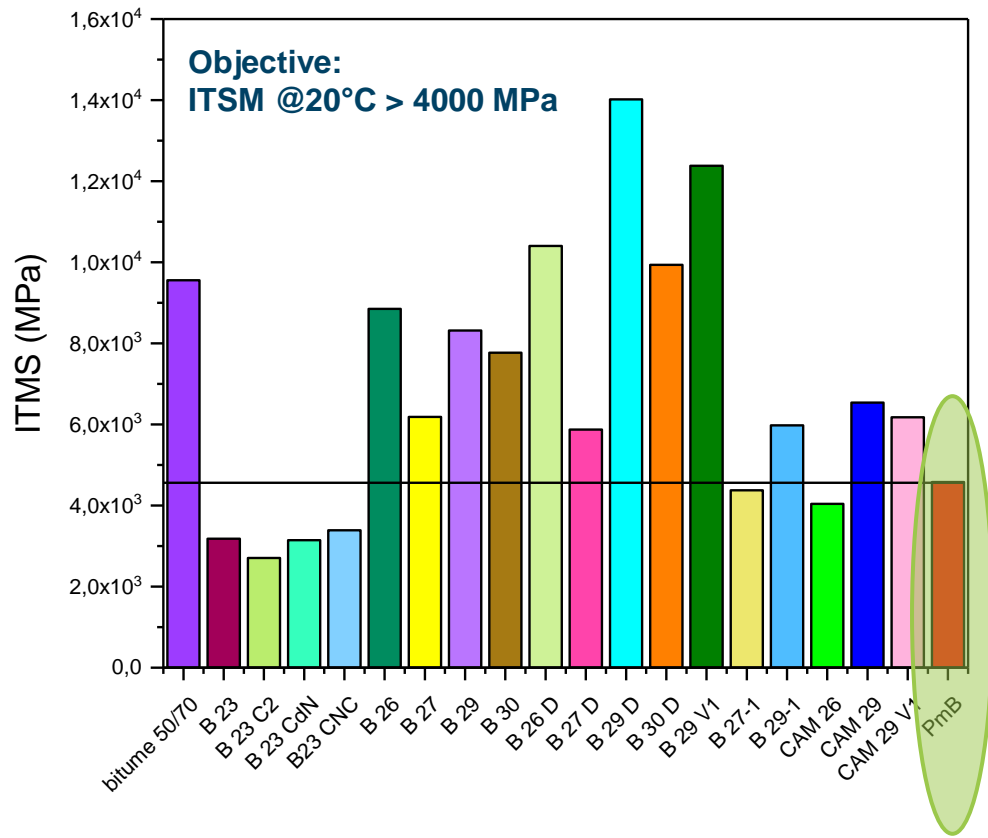
ITMS



ITS

All Bituminous conglomerates except the CAMs, have been prepared by using 100% of RAP





Work in progress

- New Blend complying with ANAS standard Parameters
- Substitute the elastomeric polymers with new thickening agents from natural sources
- Obtain new low-cost and eco-friendly blends

PmB like blend

ideal for paving asphalt

50/70 bitumen like

ideal for cold asphalt production



Thank you!

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