



SASOL

Rejuvenator to increase reuse of asphalt **SASOBIT RC 100 BIO**

Sasol Chemicals

J. Rettenmaier & Söhne GmbH + Co KG





About us

We at Sasol Chemicals innovate for a better world and deliver long-term value to our customers, communities and society.

Our broad portfolio of high-value products plays an integral role in the creation of numerous solutions that benefit the lives of millions of people.

Thousands of companies around the world leverage our technology, world-class facilities, expertise and collaborative approach to tackle their challenges.

Introduction

Asphalt pavements are aging during their life, i.e. ravel, get brittle and crack over the time. In order to save resources, reduce feedstock costs and improve sustainability of a road, the asphalt industry reuses old materials such as reclaimed asphalt pavements (RAP). However, due to loss of performance the amount is limited.

Even small quantities of **SASOBIT RC 100 BIO** added to an asphalt mix at a plant, to a bitumen at refinery or site of modifier enable the user to increase the amount of RAP in the final application. This works because **SASOBIT RC 100 BIO** is able to restore the original characteristics of the bitumen from the reclaimed asphalt pavement. **SASOBIT RC 100 BIO** is not a softener but a rejuvenator, which changes the rheological properties of the aged RAP binder in a positive and sustainable manner.

Compared with an asphalt pavement featuring less RAP and no **SASOBIT RC 100 BIO**, the final performance remains the same, or is even better.

Product description

Together with our sales partner J. Rettenmaier & Söhne GmbH + Co. KG, Sasol Germany GmbH offers the rejuvenator **SASOBIT RC 100 BIO** in most European countries and beyond as solid pellets in 500 kg bulk bags and in 20 kg sacks (480 kg per pallet).

SASOBIT RC 100 BIO is a highly pure fatty alcohol mixture made from sustainable raw materials, is not water hazardous and is made in Germany.

Product characteristics of SASOBIT RC 100 BIO

Table 1:
Typical physical characteristics of
SASOBIT RC 100 BIO

Parameter	Unit	Value range	Sasol analysis method
Alcohol content	wt. %	96.8 min.	GC
Density at 60 °C	g/ml	0.813 – 0.817	600-25
Bulk density at 25 °C (pastilles)	g/ml	0.48 – 0.50	600-25a
Melting point	°C	50 – 54	600-22c
Boiling point	°C	300 – 355	600-21
Viscosity at 60 °C	mPas	9 – 10	600-25
Molecular weight	g/mol	257 – 267	600-19
Hydroxyl value	mg KOH/g	208 – 218	600-30
Iodine value	mg I/100 mg	1.5 max.	600-39



Effect on bitumen characteristics

Bitumen characteristics

Iso-shear modulus-temperature
 → $T_{G^* = 15 \text{ kPa}}$
 Used to characterise performance at high temperatures.

Iso-stiffness temperature
 → $T_S = 300 \text{ MPa}$

Iso-m-value temperature
 → $T_m = 0,300$

Both used to characterise performance at low temperatures.

Effect

Per 1 wt. % of **SASOBIT RC 100 BIO** the $T_{G^* = 15 \text{ kPa}}$ is reduced by 3 to 4 °C (in this example, see Figure 1 by 3.2 °C), which illustrates the exceptional efficiency of the rejuvenator. Standard products from the competition show values for $T_{G^* = 15 \text{ kPa}}$ that are around 1 to 1.5 °C lower per 1 wt. %. For unmodified bitumen, the Softening Point Ring and Ball corresponds to $T_{G^* = 15 \text{ kPa}}$.

The example shows that 6.5 wt. % of **SASOBIT RC 100 BIO** is required to lower $T_{G^* = 15 \text{ kPa}}$ of a 50/70 bitumen aged by RTFOT+PAV to the level of the bitumen prior to aging.

This quantity of additive in the RTFOT+PAV-aged 50/70 bitumen led to an improvement in the values of around 3 bis 4 °C that characterise its performance at low temperatures, both in terms of stiffness and the m-value (see Figure 2).

This data indicates that even a low amount of **SASOBIT RC 100 BIO** can reduce susceptibility to cracking at low temperatures, and thus can be used to rejuvenate binders from aged RAP.

Figure 1: Effect of **SASOBIT RC 100 BIO** on the Iso-shear modulus-temperature of RTFOT+PAV-aged 50/70 bitumen with varying dosing amounts (example)

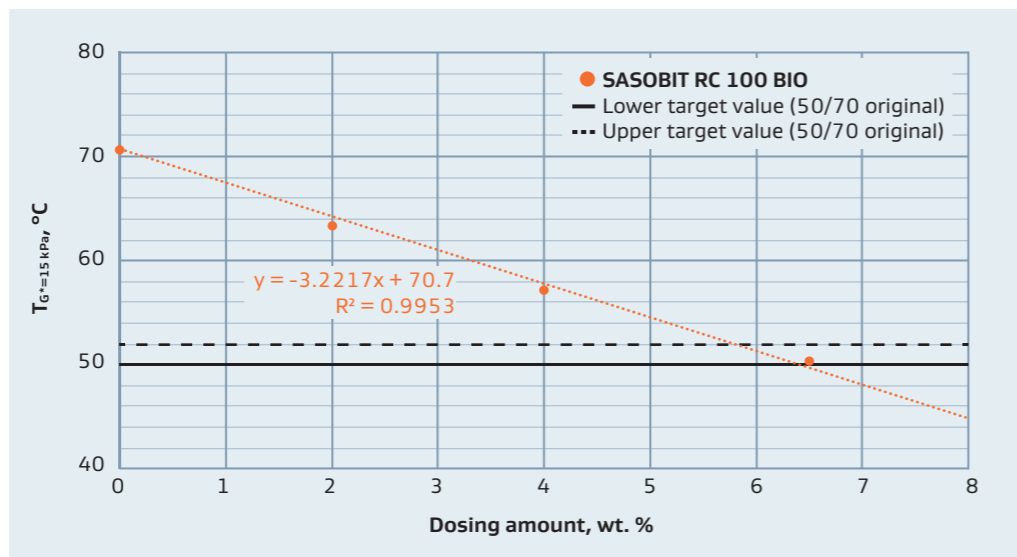
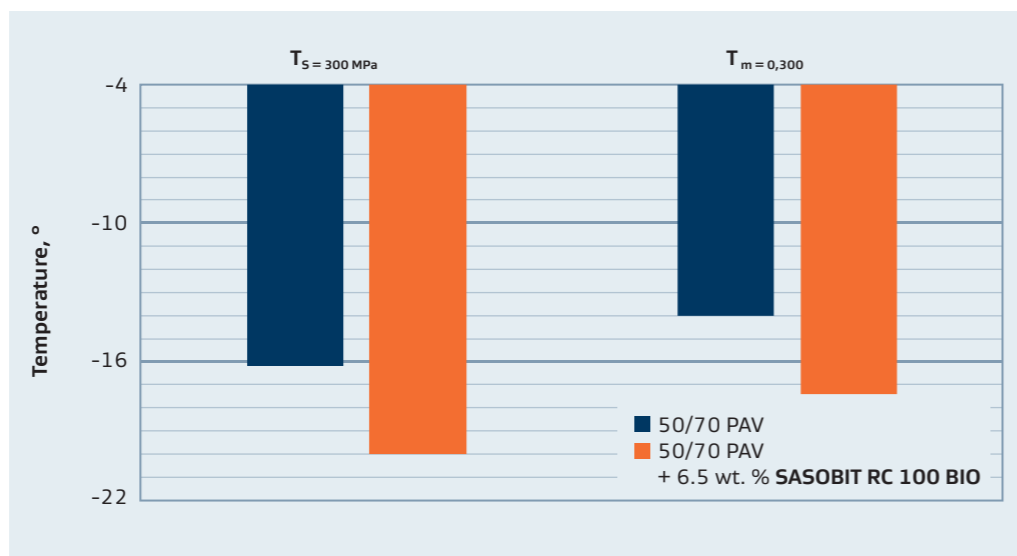


Figure 2: Effect of **SASOBIT RC 100 BIO** on performance of RTFOT+PAV-aged 50/70 bitumen at low temperatures (example)



Rejuvenator versus softener

A rejuvenator aims to restore the original characteristics of bitumen from RAP. Many products are only able to soften the RAP binder. The difference between rejuvenation and softening can be illustrated by what is known as the BLACK diagram, where G^* is plotted over the phase angle.

Rejuvenation occurs if the line for the aged and rejuvenated binder is pushed towards the curve for the original binder starting from the curve for the aged bitumen.

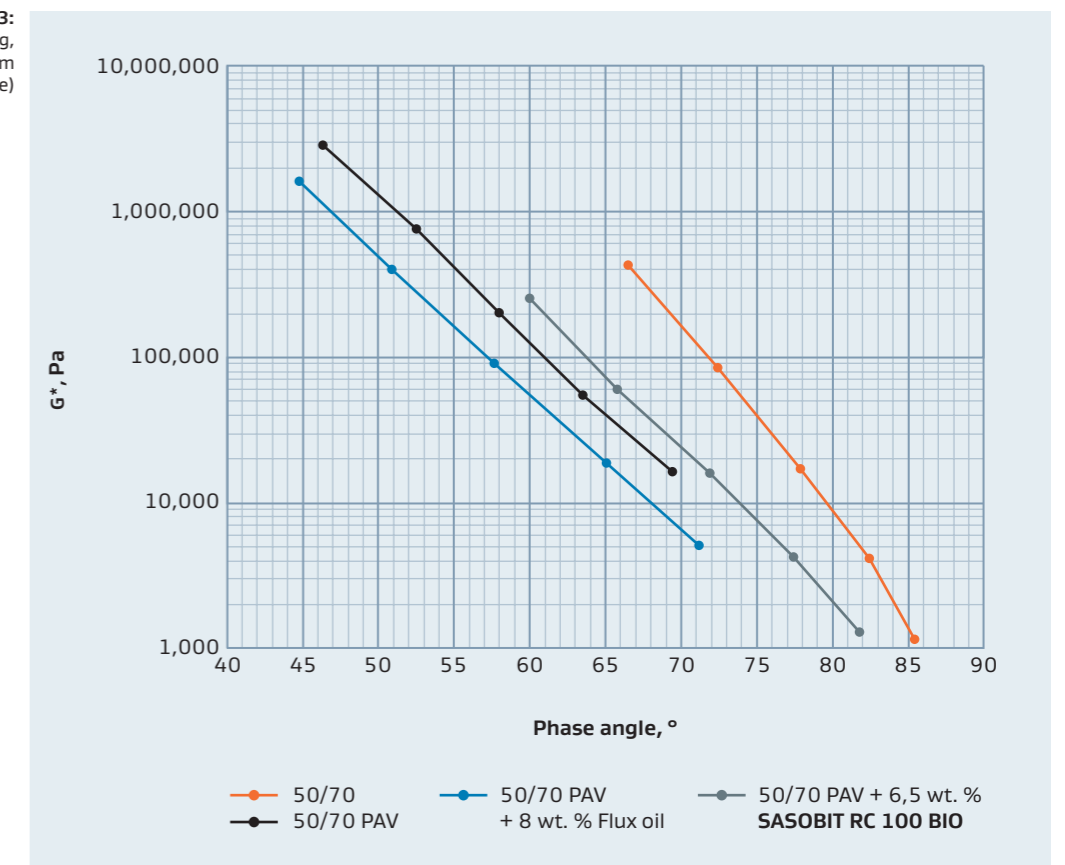
Softeners lower the stiffness by fluxing or even elasticising the aged bitumen.

In the first case, the curve for the fluxed binder overlaps with the curve of the aged bitumen and shifts to the lower right. In the second case, the curve shifts to the lower left, away from the curve of the original bitumen.

Figure 3 shows an example of this for aged 50/70, which is then either rejuvenated with 6.5 wt. % **SASOBIT RC 100 BIO** or softened and elasticised with 8 wt. % flux oil by way of comparison.

SASOBIT RC 100 BIO rejuvenates aged bitumen and does not merely soften it.

Figure 3: Rejuvenation versus softening, shown in the BLACK diagram (example)



Effect on asphalt characteristics

The document entitled “Hinweise zur Anwendung von Rejuvenatoren bei der Wiederverwendung von Asphalt” [Notes on the Use of Rejuvenators in the Reuse of Asphalt] (H Re WA) by the FGSV [German Road and Transportation Research Association], describes a process for proving the suitability of a rejuvenator for rejuvenating asphalt containing recycled material. Here, the performance characteristics (adhesion, thermal crack resistance, fatigue resistance and deformation resistance) of a reference asphalt mixture AC 8 D S with 50/70 are compared with those of an asphalt mixture of the same kind while applying 40 wt. % of an asphalt granulate conditioned using the Braunschweig ageing protocol (BSA) and the rejuvenator that is the subject of the test.

In this regard, the BSA is used to increase the value $T_{G^* = 15 \text{ kPa}}$ by 15 to 20 K for the bitumen recovered from the asphalt granulate as compared with the reference asphalt mixture.

With chosen quantity of rejuvenator added, the value $T_{G^* = 15 \text{ kPa}}$ for the recovered binder from the rejuvenated AC 8 D S made with 40 wt. % asphalt granulate should not vary by more than 2 K from the same bitumen characteristic of the reference asphalt mixture.

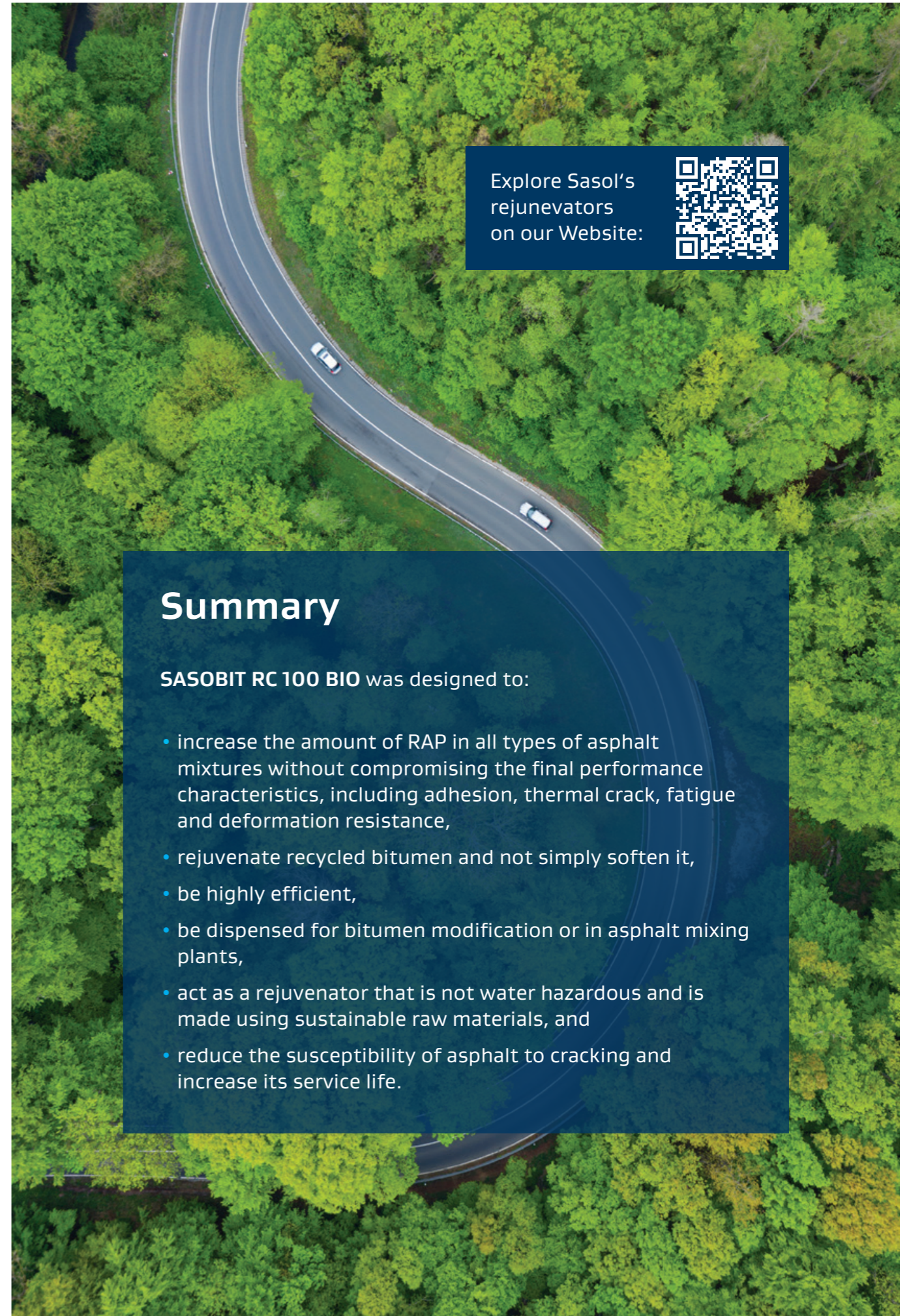
In the example documented below, 2.6 wt. % **SASOBIT RC 100 BIO**, calculated based on the resulting total binder content, was added in order to achieve the above characteristic. The H Re WA defines the requirements in terms of performance characteristics for rejuvenated asphalt with regard to the values for the reference asphalt mixture to be fulfilled in order for the rejuvenator being tested to qualify as having a rejuvenating effect.

Table 2 presents the relevant test results for the reference asphalt mixture and for the asphalt rejuvenated with **SASOBIT RC 100 BIO**, which used 40 wt. % asphalt granulate. The relevant requirement values can also be found in Table 2.

Table 2:
Effect of **SASOBIT RC 100 BIO** on the performance characteristics of asphalt concrete with 40 wt. % asphalt granulate (process as per H Re WA)

Parameter	AC 8 D reference	AC 8 D 40 wt. % AG 2.6 wt. % RC 100 BIO	Requirement H Re WA
Adhesion: Tensile strength ratio, %	95.3	109.4	81.0 min.
Thermal crack resistance: Breaking temperature, °C	-27.3	-26.1	-25.3 max.
Fatigue resistance, 20 °C: Nmax @ 0.005 % Nmax @ 0.010 %	496,152 120,312	725,945 107,465	421,729 min. 102,265 min.
Deformation resistance: Strain rate @ 50 °C	16.1	6.8	18.6 max.

The comparison of the test results with the required values shows that **SASOBIT RC 100 BIO** is suitable for the effective rejuvenation of RAP.



Explore Sasol's rejuvenators on our Website:



Summary

SASOBIT RC 100 BIO was designed to:

- increase the amount of RAP in all types of asphalt mixtures without compromising the final performance characteristics, including adhesion, thermal crack, fatigue and deformation resistance,
- rejuvenate recycled bitumen and not simply soften it,
- be highly efficient,
- be dispensed for bitumen modification or in asphalt mixing plants,
- act as a rejuvenator that is not water hazardous and is made using sustainable raw materials, and
- reduce the susceptibility of asphalt to cracking and increase its service life.

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