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**Goriva za motorna vozila - Informacije o anilinu, N-metil anilinu, N-etil anilinu, N,N-dimetil anilinu in sekundarnem butil acetatu, če se uporabljajo kot mešalne komponente v neosvinčenem bencinu**

Automotive fuels - Information on aniline, N-methyl aniline, N-ethyl aniline, N,N di-methyl aniline and secondary-butyl acetate when used as blending components in unleaded petrol

Kraftstoffe - Leitfaden zum Mischen von Benzin - Informationen zu Anilin, Anilinderivaten und sekundärem Butylacetat **(standards.iteh.ai)**

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TECHNICAL REPORT

CEN/TR 17491

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

April 2020

ICS 75.160.20

English Version

Automotive fuels - Information on aniline, N-methyl  
aniline, N-ethyl aniline, N,N di-methyl aniline and  
secondary-butyl acetate when used as blending  
components in unleaded petrol

Kraftstoffe - Leitfaden zum Mischen von Benzin -  
Informationen zu Anilin, Anilinderivaten und  
sekundärem Butylacetat

This Technical Report was approved by CEN on 6 April 2020. It has been drawn up by the Technical Committee CEN/TC 19.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

<b>Contents</b>		Page
European foreword.....		3
1	Scope .....	4
2	Normative references .....	4
3	Terms and definitions .....	4
4	Introduction .....	5
5	Chemical compounds used as unleaded petrol blending components.....	5
6	Effects of SBA, aniline, NMA, NEA and DMA on engine and fuel quality.....	5
6.1	SBA.....	5
6.2	Aniline, NMA, NEA and DMA .....	6
7	Field experience .....	6
8	European specifications for unleaded petrol.....	7
Bibliography.....		8

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## European foreword

This document (CEN/TR 17491:2020) has been prepared by Technical Committee CEN/TC 19 “Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin”, the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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**CEN/TR 17491:2020 (E)****1 Scope**

This document is intended to inform about the potential technical consequences on engine parts and fuel systems when some types of chemical compounds are used as blending components in unleaded petrol. This document is not meant to intentionally limit market fuel development.

The chemical compounds addressed, specifically, in this document are:

- sec-butyl acetate (SBA) (CAS 105-46-4),
- aniline (CAS 62-53-3),
- N-methyl aniline (NMA) (CAS 100-61-8),
- N-ethyl aniline (NEA) (CAS 103-69-5), and
- N,N di-methyl aniline (DMA) (CAS 121-69-7).

Other chemical compounds are not addressed in this document, however, attention is drawn to EN 228, which requires that unleaded petrol be free from any adulterant or contaminant that can render the fuel unacceptable for use.

NOTE 1 This document does not address environmental and/or health related issues. These aspects are beyond the scope of CEN/TC 19 activities.

NOTE 2 For the purposes of this document, the term “% (V/V)” is used to represent the volume fraction,  $\varphi$ .

**2 Normative references**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 228:2012+A1:2017, *Automotive fuels - Unleaded petrol - Requirements and test methods*

**3 Terms and definitions**

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp/ui>

**3.1 accelerated test**  
test performed under controlled conditions aimed at reflecting in an engine but in a shorter time frame

Note 1 to entry For example, the effects observed on the lubricant over the oil drain interval.

## 4 Introduction

Over the recent years, an increasing number of cases have been observed in which insufficiently tested chemical compounds are being blended into unleaded petrol.

The vast majority of those cases are mainly related to unleaded petrol blends in Africa, Middle East and Asia. Occurrences of the presence of such chemical compounds have been seldom observed in Europe.

These chemical compounds are primarily used to increase octane numbers of the fuel. When used at high concentrations, they can cause engine problems, such as corrosion of engine parts, black sludge and can affect driving performance [1].

## 5 Chemical compounds used as unleaded petrol blending components

In the literature, there are numerous studies on the effect of chemical compounds on fuel properties and octane, in particular [2] and [3].

The main chemical compounds that have been identified as being used as blending component are:

- sec-butyl acetate (SBA), and
- aniline, N-methyl aniline (NMA), N-ethyl aniline (NEA) and N,N di-methyl aniline (DMA).

This list is not exhaustive.

Attention is drawn to EN 228:2012+A1:2017, which requires that unleaded petrol be free from any adulterant or contaminant that can render the fuel unacceptable for use. Thus, when considering blending of other chemical compounds, care should be taken to ensure they are fit for use in order to comply with this requirement.

Some of the reported effects of these chemical compounds, when blended with unleaded petrol, on engine performance under accelerated test conditions and fuel quality are discussed in Clause 6.

## 6 Effects of SBA, aniline, NMA, NEA and DMA on engine and fuel quality

### 6.1 SBA

According to one OEM, SBA's strong reaction with acids and oxidants and its strong dissolving ability, can cause a swelling effect on any rubber-based materials and can induce engine malfunction under accelerated test conditions.

Moreover, under accelerated conditions, SBA reduces the durability of lubricating oils and increases significantly the amount of fouling in various parts of the engine (pistons, valves) as illustrated in Figure 1 (Source: Groupe PSA, France)



Figure 1 — Examples of the effect of SBA at concentration of 2,5 % (V/V)

## 6.2 Aniline, NMA, NEA and DMA

Blending aniline, NMA, NEA or DMA, at a concentration of several percent by volume significantly improves by several numbers the octane number of the base unleaded petrol.

However, in accelerated rig and engine test conditions these compounds have been found to reduce the durability of engine oils and increase the amount of engine fouling (deposits and varnishes) as demonstrated in SAE paper [1] and recent findings from CUNA/FCA [4].

Because of its physicochemical properties, when used at high concentrations, aniline can cause the swelling of seal rings in the engine.

## 7 Field experience

In some countries such as Russia, the use of NMA was allowed in unleaded petrol up to 1,3 % (V/V) in the EEU's technical regulation (TR 013/2011[5])<sup>1</sup>. NMA is no longer allowed in Class 5 unleaded petrol with a maximum sulfur content of 10 ppm since January 2013 and for all other grades, since June 2016.

Higher concentrations of NMA or SBA have been found in Asian countries and have resulted in their ban, notably in China in 2013 and Vietnam<sup>2</sup>.

Occasionally, aniline, NMA, NEA, DMA and SBA in unleaded petrol have been identified in several European countries. However, based on the available information, in most of the European countries, the blending of these components does not appear to be a common practice and when found, they are used at much lower levels than in other regions:

In Croatia, NMA concentrations of 0,35 % (V/V) were measured in 2016.

In Eastern European countries, NMA and SBA were found up to 1 % (V/V) in unleaded petrol in 2013 and 2015.

<sup>1</sup> Test method GOST 32515 [6] can be used to measure NMA levels in unleaded petrol fuels

<sup>2</sup> According to Platt's, in 2012, an unleaded petrol containing 15 % (V/V) of secondary butyl acetate was identified in Vietnam



In Italy, NMA and DMA have often been found in high octane unleaded petrol at concentrations up to 0,92 % (V/V) expressed as NMA equivalent.

One OEM reported only very few field problems associated with NMA at the reported concentrations reported in Europe. And, these were mainly associated to the use of inadequate, obsolete engine oils.

Another OEM has observed several cases of oil degradation in the field with latest engine oil formulations as well. The chemical analyses of the lubricant performed on one of these cases have shown a relation with the use of NMA. Other cases have been assessed visually and related to the same cause [4].

## 8 European specifications for unleaded petrol

The European unleaded petrol specification, EN 228:2012+A1:2017, does not address specifically the issue of the harmful chemical compounds. It does, however, state in its section 5.4 the following: "Unleaded petrol shall be free from any adulterant or contaminant that can render the fuel unacceptable for use in petrol engine vehicles designed to run on unleaded petrol".

It is, therefore, the responsibility of the fuel blender to ensure that the unleaded petrol blend is fit-for-purpose.

CEN/TC 19/WG 21 is closely monitoring the situation in Europe and will consider, in future revision of EN 228, further actions if required.

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