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Verband der Automobilindustrie

# AdBlue®

Very pure NO<sub>x</sub>-reduction agent for Diesel engines equipped with SCR catalysts.

AdBlue fulfills the quality requirements drafted in the international standard ISO 22241-1:2006(E).

|                                    |   |
|------------------------------------|---|
| <b>Chemical nature</b>             | Urea, carbamide, in ultra pure water  |
| <b>CAS No.</b>                     | 57-13-6   |
| <b>EINECS-No.</b>                  | 200-315-5   |
| <b>Physical form and packaging</b> | AdBlue is supplied in road tankers, IBC's and cans.   |
| <b>Shelf life</b>                  | At product temperatures between -11.5 and 25 °C AdBlue has a shelf life of 12 months after production (maximum product temperature 30 °C, average product temperature 25 °C). |

## Properties

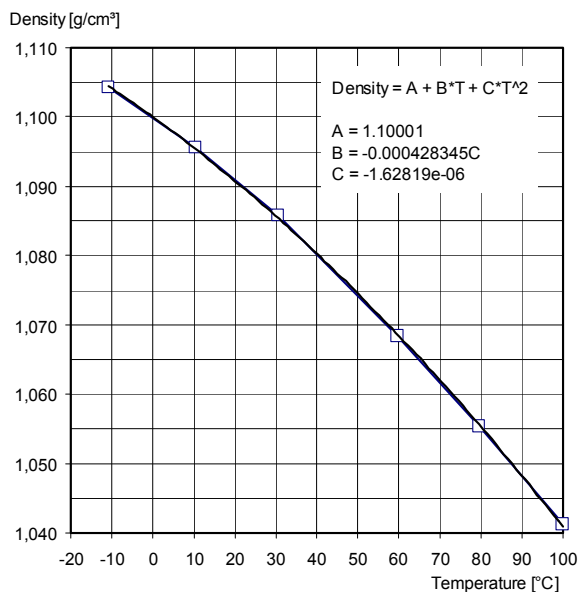
### Delivery specification

| Test Item                     | Unit              | Limits                 | Test method        |
|-------------------------------|-------------------|------------------------|--------------------|
| Urea content                  | % (m/m)           | 31.8 – 33.2            | ISO 22241-2 Ann. C |
| Density at 20°C               | g/cm <sup>3</sup> | 1.0870 – 1.0930        | DIN EN ISO 12185   |
| Refractive index at 20°C      | –                 | 1.3814 – 1.3843        | ISO 22241-2 Ann. C |
| Alkalinity as NH <sub>3</sub> | % w/w             | 0.2 max.               | ISO 22241-2 Ann. D |
| Biuret                        | % w/w             | 0.3 max.               | ISO 22241-2 Ann. E |
| Aldehydes                     | mg/kg             | 5 max.                 | ISO 22241-2 Ann. F |
| Insolubles                    | mg/kg             | 20 max.                | ISO 22241-2 Ann. G |
| Phosphate                     | mg/kg             | 0.5 max.               | ISO 22241-2 Ann. H |
| Calcium                       | mg/kg             | 0.5 max.               | ISO 22241-2 Ann. I |
| Iron                          | mg/kg             | 0.5 max.               |                    |
| Copper                        | mg/kg             | 0.2 max.               |                    |
| Zinc                          | mg/kg             | 0.2 max.               |                    |
| Chromium                      | mg/kg             | 0.2 max.               |                    |
| Nickel                        | mg/kg             | 0.2 max.               |                    |
| Aluminium                     | mg/kg             | 0.5 max.               |                    |
| Magnesium                     | mg/kg             | 0.5 max.               |                    |
| Sodium                        | mg/kg             | 0.5 max.               |                    |
| Potassium                     | mg/kg             | 0.5 max.               |                    |
| Identity                      | –                 | Identical to reference |                    |

These specification will be amended as soon as there are changes in the standards ISO 22241-1:2006(E) and ISO 22241-2:2006(E) to maintain compliance with the most actual standard.

### Physical properties

#### Density $\rho(T)$



Source: *Exp. data*, BASF

#### Density of frozen AdBlue

approx. 1,03 g/cm<sup>3</sup>

Source: *Exp. data*, BASF

#### Melting enthalpy of frozen AdBlue

Melting enthalpy: +270 J/g

Melting range (2 K/min): -20 °C – -6 °C

Source: *Exp. data*, BASF

#### Specific heat capacity $C_p(T)$ of liquid AdBlue

| T [°C] | Cp. exp. [J/g*K] |
|--------|------------------|
| 25.04  | 3.51             |
| 45.04  | 3.57             |
| 65.02  | 3.64             |

$$C_p(T) = 8E-06 * T^2 + 0.0027 * T + 3.4345$$

Source: *Exp. data*, BASF

#### Specific heat capacity $C_p(T)$ of frozen AdBlue

| T [°C] | J/(g*T) |
|--------|---------|
| -42.0  | 1.49    |
| -36.0  | 1.53    |
| -30.0  | 1.59    |

Source: *Exp. data*, BASF

#### Vapour pressure above liquid AdBlue

| T [°C] | Pressure <sub>exp.</sub> [hPa] |
|--------|--------------------------------|
| 20.08  | 23.0                           |
| 30.26  | 41.1                           |
| 40.19  | 70.6                           |
| 55.18  | 150.3                          |
| 70.26  | 306.9                          |
| 85.21  | 609.8                          |
| 100.21 | 1182.2                         |

$$\ln(p/\text{bar}) = 13.9461 - 5198.36 / (273.15 + T)$$

T [Celsius]  
 Mean dev., est.: 3%

$$\ln(p/\text{Pa}) = 25.45899 - 5198.351/T$$

Mean dev., est.: 3%

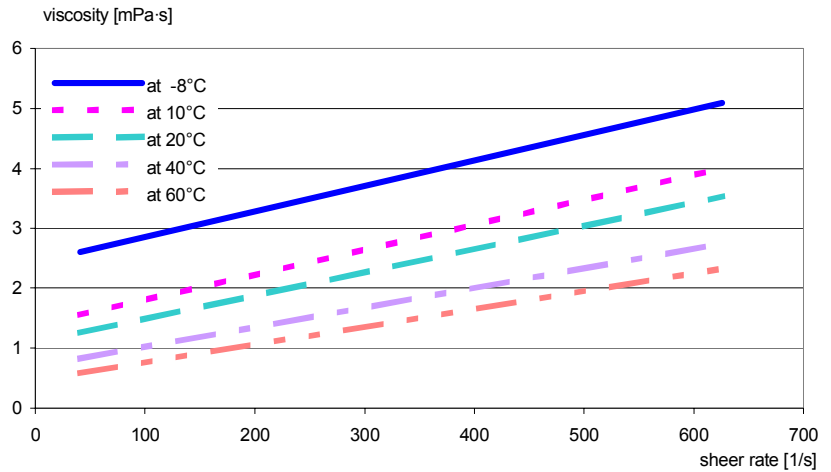
Source: *Exp. data*, BASF

**Thermal conductivity**

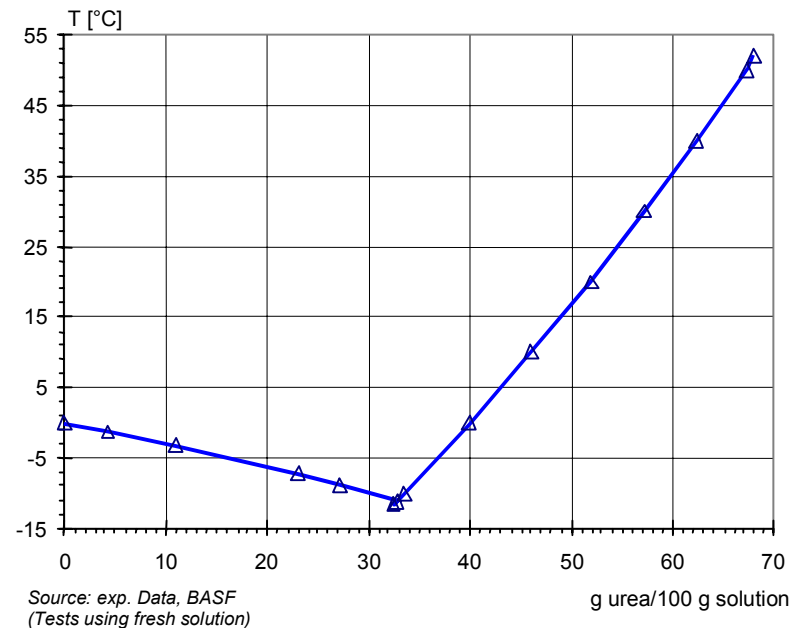
approx. 0.570 W/m·K at 25°C

**Viscosity**

approx. 1.4 mPa·s at 25°C

**Surface tension**

min. 65 mN/m at 20 °C

**Freezing point f (T, m) of urea solution****Chemical properties**

AdBlue has a faint alkaline reaction. The pH of a freshly prepared solution is of the order of 9.0 to 9.5. During storage a pH value of approx. 10 might be reached.

The dissolved urea decomposes slowly even at room temperature, generating ammonia and carbon dioxide. The rate of this reaction increases if the solution is heated. Above approx. 70 °C biuret is formed additionally at a significant rate.

## Materials resistance

Equipment coming into contact with AdBlue can be made of alloyed austenitic Cr-Ni-steels or Cr-Ni-Mo-steels according to EN 10088-1 to -3 (e.g. 1.4541 and 1.4571). Steels of an equivalent quality (e.g. according to US standards) can be used without any restriction.

Non alloyed steels, zinc coated steels, copper, and alloys containing copper are not suitable due to their poor resistance towards urea, urea solution, or the ammonia dissolved therein.

Polymers, e.g. polyethylene, polypropylene and polyoxymethylene are suitable at temperatures up to 60°C.

For sealings e.g. PTFE is suited.

However, the properties of parts made of polymeric materials depend to a considerable extent on blending and processing during the manufacturing process. Therefore, for material made from polymers the supplier should be requested to submit written resistance data towards AdBlue for both mechanical and chemical properties, which are tailored for the intended use as well as for the intended operating temperature.

Any other material not cited above must be tested regarding corrosion resistance and possible influences on the product specification given in ISO 22241-1:2006(E).

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## Safety

### Physiological data

**AdBlue** is not a hazardous substance in the sense of the German Gefahrstoffverordnung.

### Handling

When using this product, the information and advice given in our **Safety Data Sheet** should be observed. Due attention should also be given to the **precautions** necessary for handling chemicals.

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## Storage and transportation

**AdBlue** is not a dangerous substance for transportation. Owing to its chemical nature, however, it must be transported and stored separately from nitrites.

Transportation should be made in insulated tanks or on plastic tank pallets (IBC).

**Note**

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

November 2006