General Properties

- **Chemical Structure**: Co/Ti/Ni/Zn-oxide
- **Colour Index Part I**: P.G. 50
- **Colour Index Part II**: 77377
- **CAS Number**: 68186-85-6
- **Physical Form**: Powder
- **Colour Shade**: Green

Preparations

- Rakusol Green 96-1007

(Other) preparations can be made on special request.

Colouristical Properties Org.

- **Hue Grade in PVC 1/9 SD**: 156
- **Chroma in PVC 1/9 SD**: 33.8
- **Red. Ratio in PVC 1/9 SD**: 1.03
- **Hue Grade in PVC 1/25 SD**: 155
- **Chroma in PVC 1/25 SD**: 24.2
- **Red. Ratio in PVC 1/25 SD**: 3.74
- **Hue Grade in PE-LD 1/9 SD**: 156
- **Chroma in PE-LD 1/9 SD**: 33.6
- **Red. Ratio in PE-LD 1/9 SD**: 0.97

Ease of Dispersion: <10

Physical Properties

- **Density**: 4.9 g/cm³
- **Bulk Density**: 0.9 g/cm³
- **Index of pH**: 8
- **Conductivity**: 75 µS/cm
- **Specific Surface**: 4 m²/g

Fastness properties

- **Heat stability**: 320 °C
- **Light fastness**: 8
- **Weather fastness**: 5
- **Migration fastness**: 5
- **Infl. on warping of PE-HD**: No

Fastness to chemicals:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCl conc.</td>
<td>2 Months</td>
</tr>
<tr>
<td>HCl 10%</td>
<td>&gt;6 Months</td>
</tr>
</tbody>
</table>
H2SO4 conc.      >6   Months
H2SO4 10%       >6   Months
HNO3 conc.      2     Months
HNO3 10%        >6   Months
NaOH conc.      >6   Months
Na2CO3 sat.     >6   Months

Criteria for the fastness to chemicals was a possible colour change of the coloured plastic material during the storage in the test medium.

Recommendations for applications

PVC-p              Suitable
PVC-u              Suitable
PUR                Suitable
LD-PE              Suitable
HD-PE              Suitable
PP                 Suitable
PS                 Suitable
SB                 Suitable
SAN                Suitable
ABS/ASA            Suitable
PMMA               Suitable
PC                 Suitable
PA                 Suitable
PETP               Suitable
CA/CAB             Suitable
UP                 Suitable

UCC: Under certain conditions

Recommendations for food applications

BgVV               Suitable
FDA                Suitable
France             Suitable

UCC: Under certain conditions
Product Specification - SICOPAL® GREEN K 9610

PROPERTIES
Pigment type: Co/Ti/Ni/Zn oxide
Colour Index: Pigment Green 50
Application: Colourant for plastics
Physical form: Powder
Storage: practically unlimited shelf life
Food packaging: approved according to "Empfehlung IX des BgVV".

SPECIFICATION
Colour tolerances: \(dH^* \pm 0.7; dC^* \pm 0.7; dL^* \pm 0.7; dE^* \leq 1.0; \)
\(da^* \pm 0.7; db^* \pm 0.7\)
Strength equivalence: 100 \(\pm 8\) %
Test method: BASF test method 11.3.1

Please note:
The above data will be warranted by us. These data, however, as well as
the properties of any product samples do not imply any legally binding
assurance of certain properties or of suitability for a specific purpose so that any
liability for damages cannot be derived therefrom.
Microscopy - SICOPAL® GREEN K 9610
Reflection Curve
SICOPAL® GREEN K 9610

Wavelength nm

400 450 500 550 600 650 700

% 0 20 40 60 80 100

Note: The program stores curve points (see table). The diagram shows approximations.

Test medium: PVC-p

2% 1:3 1:30

All data is subject to the producer’s disclaimer
LUCOLOR 2.0 - BASF Colourants for Plastics (Oct.1998) - Printed: 8/25/99
Particle Size Distribution
SICOPAL® GREEN K 9610

Sus. Fluid: H2O
Disp. Agent: Na4P2O7
Mixer Time: 60 s
Median Size: 1.11 µ
CILAS

Note: The program stores curve points (see table). The diagram shows approximations.
Heat Stability
SICOPAL® GREEN K 9610

Test medium:
PE-HD (Lupolen 6031M)
According to
DIN 53772

Note: The program stores curve points (see table). The diagram shows approximations.
Weather fastness
SICOPAL® GREEN K 9610

Test medium:
PE-HD (Lupolen 6031M)

According to
DIN 53387, 54001
Light fastness
SICOPAL® GREEN K 9610

Test medium:
PE-HD (Lupolen 6031M)

According to
DIN 53387, 54004
Name of product: SICOPAL® Green K 9610, K 9710, K 9810

C.I. No. / Name: 77 377 / C.I. Pigment Green 50, Cobalt green, (Co,Ni,Zn)2TiO4
CAS No.: 68186-85-6
EINECS No.: 269-047-4

Chemical nature: Practically insoluble spinel pigments based on cobalt(II)/nickel(III)/zinc titanate. The heavy metal oxides are absorbed by the spinel lattice and thus lose their chemical, physical, and physiological properties.

Toxicology: In experiments on animals, cobalt green pigments did not display acute toxicity. No acute irritant effect was shown in tests to determine the acute irritation of the skin and mucous membranes. Due to their insolubility the pigments can be regarded as not bio-available. Soluble cobalt compounds and cobalt metal may have sensitizing effects. No sensitizing effects have been reported, even after handling SICOPAL® Green pigments for many years.

Ecology: The SICOPAL® Green pigments do not represent any hazard for the environment owing to their inert, practically insoluble character. They can be removed mechanically from effluents. If they are dumped on a controlled dumping site, dissolved heavy metals are not given off to the seepage water. If articles coloured with these pigments are incinerated, they are recovered in the original form in the residual ash.

Water hazard class: WGK 0 (generally non water hazardous according to German legislation - self-classification)

Labelling: SICOPAL® Green pigments are not dangerous substances in the sense of the German Ordinance on Dangerous Substances or of corresponding EU regulations.

Classification as dangerous goods: The products are not classified as hazardous under transport regulations.

MAK value: The general threshold value for dust, i.e. 6 mg/m³, must be observed. (Proposal of the MAK commission for the alveolar passing dust fraction, i.e. 1.5 mg/m³, is not yet valid) (Germany)

Heavy metal content: SICOPAL® Green pigments do not contain any lead, cadmium, chromium(VI) and mercury compounds in their formulations. The sum of the total contents of these elements, according to tests on standard samples, is less than 100 mg/kg. It is thus below the limit in the EU packaging directives and the American CONEG model. The average values for the total contents of technically unavoidable impurities are as follows:

<table>
<thead>
<tr>
<th>Element</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>&lt; 3 mg/kg</td>
</tr>
<tr>
<td>Antimony</td>
<td>&lt; 5 mg/kg</td>
</tr>
<tr>
<td>Lead</td>
<td>&lt; 50 mg/kg</td>
</tr>
<tr>
<td>Cadmium</td>
<td>&lt; 10 mg/kg</td>
</tr>
<tr>
<td>Copper</td>
<td>100 mg/kg</td>
</tr>
<tr>
<td>Selenium</td>
<td>&lt; 1 mg/kg</td>
</tr>
<tr>
<td>Mercury</td>
<td>&lt; 1 mg/kg</td>
</tr>
</tbody>
</table>
The constitutional contents of cobalt, nickel, zinc and chromium(III) are listed in the following Table:

<table>
<thead>
<tr>
<th>SICOPAL® Green</th>
<th>Cobalt</th>
<th>Nickel</th>
<th>Zinc</th>
<th>Chromium</th>
</tr>
</thead>
<tbody>
<tr>
<td>K 9610</td>
<td>12 %</td>
<td>23 %</td>
<td>13 %</td>
<td>0,3 %</td>
</tr>
<tr>
<td>K 9710</td>
<td>13 %</td>
<td>25 %</td>
<td>12 %</td>
<td>0,2 %</td>
</tr>
<tr>
<td>K 9810</td>
<td>16 %</td>
<td>22 %</td>
<td>11 %</td>
<td>0,6 %</td>
</tr>
</tbody>
</table>

**Halogen content**

The SICOPAL® Green pigments do not contain any halogens in their formulations.

**Food legislation**

According to tests on standard samples (Type 8081) the SICOPAL® Green pigments listed conform to the demands on purity in the following food legislation (see also "Heavy metal contents"):

- **Europe**: Resolution AP (89)
- **USA**: FDA approved to § 170.39 for each polymer up to 2 %.
- **Germany**: BgVV Empfehlung IX., 190. Mitteilung vom 1.6.1994
- **France**: Brochure No. 1227
- **Italy**: Decreto Ministeriale dated 21.3.1973
- **Spain**: Resolución del 4.11.82 de la Subsecretaría de Sanidad

They feature absolute fastness to migration in the coloration of plastics in contact with food. Extraction tests with cobalt green pigments as 1 % colorant in different plastics were carried out. The extraction conditions were 10 days at 40 °C with 4 food simulants, distilled water, 3 % acetic acid, 10 % alcohol, and Test Fat HB 307. No detectable migration of cobalt, nickel, chromium and zinc was determined in the extraction experiments.

**Toys**

According to tests on standard samples (Type 8082), the SICOPAL® Green pigments listed conform to the demands on purity in the European standard on toys, i.e. EN 71, Part 3.

**Registration status**

The products are listed in the chemical inventories of the following countries: EU (EINECS), USA (TSCA), Canada (DSL), Japan (MITI), Australia (AICS), Korea (ECL), Philippines (PICCS, Final Version 1995), and Switzerland (BAGT No. 611500, Class free).

**Other legislation on chemicals**

The products do not fall under the provisions of the agreement on chemical weapons and do not contain any substances that are mentioned in the German Ordinance on the Prohibition of Certain Chemicals (ChemVerbotsV). They are produced without using substances that destroy ozone (Montreal Agreement - Ozone Depleting Substances).

**TA Luft**

Para 3.1.4, Class II (cobalt) (Germany)

Further information can be found in our Material Safety Data Sheets, Technical Information Bulletins and in the Product Safety Info No. 4 "Discussion on heavy metals contained in pigments". The Product Safety Department in our Inorganic Pigments Division will gladly reply to your queries and can be reached under the following address:

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