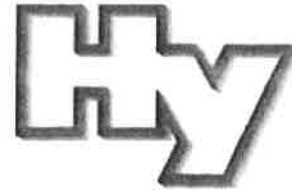


# Hygiene-Institut des Ruhrgebiets

Institut für Umwelthygiene und Toxikologie

Direktor: Prof. Dr. rer. nat. L. Dunemann

Träger: Verein zur Bekämpfung der Volkskrankheiten im Ruhrkohlengebiet e.V.



HYGIENE-INSTITUT · Postfach 10 12 66 · 45812 Gelsenkirchen / GERMANY

Visitor's/Parcel Address:  
Rotthäuser Str. 21  
45879 Gelsenkirchen

Telephone +49 (0)209 9242-0  
Extension +49 (0)209 9242-351  
Telefax +49 (0)209 9242-212  
E-Mail a.bernoussi@hyg.de  
Internet www.hyg.de

Reference-No.: K-292387-17-Bs  
Contact person: Anasse Bernoussi (Eng.)  
Translation: K-291896-17-Bs

Gelsenkirchen, 06.12.2017

## TEST REPORT on the examination

### of the PVC-coated sheet piling Vinyl Profiles from a groundwater hygiene point of view

**Order dated:** 20.09.2017

**Content of the test order:** ground water hygiene test

**Sample type/name:** PVC-coated sheet piling profiles made of Vinyl  
(Manufactured by GreenWall /Arcaprofil Italy)

**Test specimen dimensions:** coated boards with dimensions  
200 mm x 200 mm x 7 mm in the colours brown, grey, green  
and white

**Test specimen production:** samples sent

**Sample received on:** 27.09.2017

**Start of test:** 10.10.2017

**End of test:** 22.11.2017

This test report comprises 7 pages.

Die Ergebnisse unserer Prüfungen und die Bewertungen gelten für die untersuchten Prüfgegenstände und die zum Zeitpunkt der Prüfung geltenden gesetzlichen Regelungen. Dieses Dokument darf ohne unsere ausdrückliche schriftliche Genehmigung nur in vollständiger und unveränderter Form veröffentlicht oder vervielfältigt werden.



**DAKKS**  
Deutsche  
Akkreditierungsstelle  
D-PL-13042-02-00

Träger: Verein zur Bekämpfung der Volkskrankheiten im Ruhrkohlengebiet e.V., Vereinsregister: VR 519 Amtsgericht Gelsenkirchen, USt-ID: DE125018356  
Vorstand: Prof. Dr. Werner Schlake (Vors.), Prof. Dr. Jürgen Kretschmann, Dr. Emanuel Grün, Dr. Dirk Waider, Prof. Dr. Lothar Dunemann (geschäftsf. Vorstand)

**Motive:**

When using the PVC-coated sheet piling profiles made of vinyl in remedial measures on rivers and the sea and, among other things, underground channels, contact with groundwater is possible or is also to be expected as intended.

It should be clarified whether substances are released into the groundwater from the hardened material, which sustainably change its quality or which cause ecotoxic effects. In this process, the information sheet on the evaluation of the impact of construction products on soil and groundwater issued by DIBt was taken into account [1].

**Test method:**

The test was carried out in accordance with Part II of the information sheet on the evaluation of the effects of construction products on soil and groundwater (Table II-A.7).

The boards made from the material did not undergo any pre-treatment and came into contact with de-mineralised water three times in succession for 3 days (3 x 72 hours). The test waters were completely removed at the end of each contact period and the test specimens were refilled with de-mineralised water.

**Analysis parameters:**

The analysis of the test water was carried out on the following parameters:

external quality, organic stress (TOC), BTEX aromatics [2], chemical oxygen demand (CSB), Phenol index [3], polycyclic aromatic amines PAK [4] and selected heavy metals [5].

From the test water of the 1st and 3rd contact stage, the daphnia toxicity [6], the algae inhibition test [7], the luminescent bacteria toxicity [8] were additionally determined. Due to the low organic stress of the test water, the examination of the degradability was neither necessary nor technically possible.

**Test Results:**

The results of the test water analyses are summarised on pages 4 and 5 in tabular form. The test waters initially show a faint odour. Dyeing, opacities and tendency to foaming do not occur.

The concentration of organic compounds was determined using the sum parameter "TOC" in the test water of the first experimental stage at 0.6 mg/l and in the third experimental stage as <0.1 mg/l. BTEX aromatics, phenols and polycyclic aromatic amines (PAHs) have not been detected. Naphthalene was measured at 0.02 µg/l in the 2nd and 3rd contact stages.

The concentrations of the specific heavy metals were consistently at or below the limits of determination of the respective processes (see table page 5).

No significant toxic effects or inhibitory effects on daphnia, luminescent bacteria, and green algae are expected from the test water.

**Summary:**

In our opinion, there are no objections to the use of the PVC-coated sheet piling profiles made of vinyl in the groundwater contact, if used properly, based on the available test results.

While using the material in the immediate vicinity of water catchment, it must be ensured, by appropriate technical measures, that the surrounding groundwater aquifer is not affected in accordance with § 5 Water Resources Act.

The Director of the Hygiene Institute  
on behalf of



Dr.rer.nat. Andreas Koch  
Head of Department for Water-  
hygienic material testing

**Test results**

**Sample type/name:** PVC-coated sheet piling profiles made of Vinyl  
**Test specimen:** wetted surface: 3424 cm<sup>2</sup>  
**Volume/Surface-ratio:** 10 L/m<sup>2</sup>

Contact time: Test water extraction:	Test Water			Output water
	1. 72 h 13.10.17	2. 72 h 16.10.17	3. 72 h 19.10.17	
Colour	colour-less	colour-less	colour-less	colour-less
Opacity	clear	clear	clear	clear
Odour	weak	very weak	very weak	without
Odour threshold value (23°C)	3	2	2	1
Inclination to Foam- ing	none	none	none	none
pH-value	8.2	8.1	7.7	7.0
electrical conductivity µS/cm	27	24	20	1.0
org. bound carbon (TOC) mg/l	0.6	0.1	<0.1	<0.1
Phenol mg/l	<0.01	<0.01	<0.01	<0.01
∑ BTEX µg/l	<1	<1	<1	<1
∑ polycyclic aromatic amines µg/l	<0.01	<0.01	<0.01	n.n.
Naphthalene µg/l	<0.01	0.02	0.02	<0.01
chem. Oxygen- need (CSB) mg/l	<15	—	<15	<15
Daphnia test	G <sub>D</sub> = 1	—	G <sub>D</sub> = 1	
Algae test	G <sub>A</sub> = 1	—	G <sub>A</sub> = 1	
Luminescent bacteria test	G <sub>L</sub> = 1	—	G <sub>L</sub> = 1	

n.n. unverifiable

**Test results**

**Sample type/name:** PVC-coated sheet piling profiles made of Vinyl

**Test specimen:** wetted surface: 3424 cm<sup>2</sup>

**Volume/Surface-ratior:** 10 L/m<sup>2</sup>

Contact time: Test water extraction		Output water	1. 72 h 13.10.2017	3. 72 h 19.10.2017	Negligibility- threshold values (LAWA 2004)
As	mg/l	<0.001	<0.001	<0.001	0.01
Pb	mg/l	<0.001	0.002	0.001	0.007
Cd	mg/l	<0.0001	<0.0001	<0.0001	0.0005
Cr, ges	mg/l	<0.001	<0.001	<0.001	0.007
Cu	mg/l	<0.001	0.003	<0.001	0.014
Ni	mg/l	<0.001	<0.001	<0.001	0.014
Zn	mg/l	<0.005	0.016	0.013	0.058
Se	mg/l	<0.001	<0.001	<0.001	0.007
Sn	mg/l	<0.001	0.004	<0.001	0.04
Hg	mg/l	0.000068	0.000019	<0.000010	0.0002
Co	mg/l	<0.0001	<0.0001	<0.0001	0.008
Sb	mg/l	<0.001	<0.001	0.001	0.005

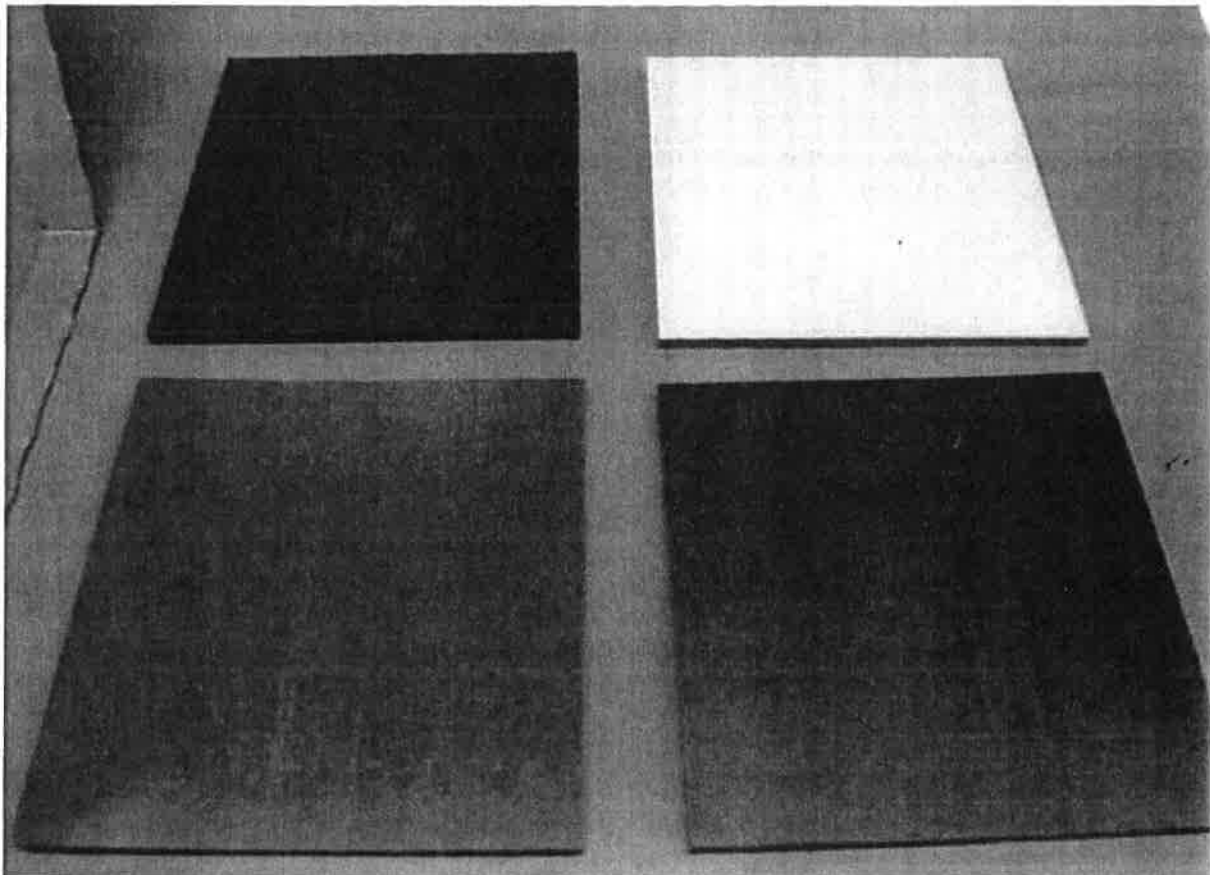
### Test results

**Sample type/name:**

PVC-coated sheet piling profiles made of Vinyl

**Test specimen dimensions:**

boards with dimensions  
200 mm x 200 mm x 7 mm in the colours brown, grey, green and  
white



Literature

- [1] Information sheet, evaluation of the Impact of construction products on soil and groundwater, Records of the German Institute for Structural Engineering, Series M, Book 1, German Institute for Structural Engineering (DIBt), Berlin, September 2011.
- [2] Determination of Benzene and some derivatives in water DIN 38407-F 9:1991-05
- [3] DIN EN ISO 14402:1999-12 (H37) photometric determination of the Phenol index
- [4] Determination of polycyclic aromatic hydrocarbons by means of GC/MS  
Method: ZEK 01.4-08
- [5] Determination according to EN ISO 17294-2:2017-1/ICP-MS
- [6] Daphnia toxicity: Determination of inhibition of mobility of *Daphnia magna* Straus (Cladocera, Crustacea) Acute Toxicity Test according to DIN EN ISO 6341:2012
- [7] DIN 38412 L33: Growth-inhibition test with the fresh water algae *Scenedesmus subspicatus*, April 1993
- [8] EN ISO 11348-2:2008 (L 52): Determination of the inhibitory effect of water samples on the light emission by *Vibrio fischeri* (Luminescent bacteria test)