LABTECH s.r.o., Test Laboratory Brno
Authorised Hygienic Laboratory
According to the Law of Czech Republic No. 258/2000
Accredited Testing Laboratory No. 1147
Pod Nemocnicí 683, 339 01 Klatovy

L 1147

The protocol on authorised examination - PSV 08/20

According to the requirements of Law of Czech Republic No. 258/2000
About protection of public health

Order: 26.2.2020

Client :ART CARBON s.r.o.
U hřiště 418,
250 81 Nehvizdy

Sample No.: 4963-4971, 7946, 7947, 8105, 8106, 18548-18964, 19765, 19766

Purpose of examination:		**Evaluation of Hygienic properties of the sample accordingtothe Regulation of Ministry of Health of Czech Republic No. 409/2005 for product used in contact with drinking water as amended and the Law of Czech Republic No. 258/2000 about protection of the public health, as amended.**	
Product name:		**Carbon nanotubes for water purification**	
Producer:		ART CARBON Inc.	
Sample description:		Carbon material deposited on quartz sand	
Practical used		Water purification from organic and biological pollutants	
Sampling method used		The sample was supplied to the laboratory by the client. The sample was delivered in protective package. The laboratory is not responsible for mistake caused by the wrong way of sampling.	
Amount of delivered sample:		1 kg	
Test beginning:	25. 2. 2020	**Tests termination:**	30. 3. 2020
Justification of scope of the analyses and sample preparation procedure		Scope of analyses was performed according to the decree No. 409/2005 Coll. Ministry of Health on hygiene requirements for products coming into contact with drinking water, Annex No.1. Sample of activated carbon was also tested according to the requirements of EN 12902"Products used for treatment of water intended for human consumption - Inorganic supporting and filtering materials".	
Condition of sample preparation		The product was tested in this adjustment: **water in glass container–activated carbon in glass column**. This assembly allowed that the water flow to be set according to the required conditions. Prior to the beginning of the test, assembly was washed 20 times at a rate of 10 bed volumes per hour. Further, after 24 hours of stagnation, leachates was followed. During the subsequent three 24-hour intervals, leachates T1, T2 and T3 were obtained. Furthermore, the assembly was used for the preparation of drinking water according to the instructions Decree No. 409/2005 Coll., Annex 1, point 14.	

Table I. Testing methods used:

Analyte	No.	Test Method	Unit	Uncertainty (%)
Color	1	SPE 07A:ČSN EN ISO 7887	mg/l Pt	15
Turbidity	2	SPE 07B:ČSN EN ISO 7027	ZF(n)	5
Smell	3	SEN 01:TNV 757340,ČSN EN 1622		
Taste	4	SEN 01:TNV 757340,ČSN EN 1622		
pH	5	ECH 01A:ČSN ISO 10523		0,05
COD Mn	6	VOL 04:ČSN EN ISO 8467	mg/l	8
TOC	7	SPE 24A:ČSN EN 1484	mg/l	16
Ammonium	8	SPE 32:ČSN EN ISO 11732 (4)	mg/l	15
Nitrite	9	SPE 32:ČSN EN ISO 11732,ČSN EN ISO 13395,ČSN ISO 6332	mg/l	15
Nitrate	10	SPE 32:ČSN EN ISO 11732,ČSN EN ISO 13395,ČSN ISO 6332	mg/l	15
Cyanide	11	SPE 32: ČSN EN ISO 14403-2 (4)	mg/l	15
Cadmium	12	ICP 03A:ČSN EN ISO 17294	µg/l	10
Lead	13	ICP 03A:ČSN EN ISO 17294	µg/l	20
Arsine	14	ICP 03A:ČSN EN ISO 17294-2 (1)	µg/l	20
Chromium	15	ICP 03A:ČSN EN ISO 17294-2 (1)	µg/l	20
Mercury	16	AAS 06-07:ČSN 757440,ČSN EN 71-3	µg/l	20
Nickel	17	ICP 03A:ČSN EN ISO 17294-2 (1)	µg/l	15
Lead	18	ICP 03A:ČSN EN ISO 17294-2 (1)	µg/l	15
Selene	19	ICP 03A:ČSN EN ISO 17294-2 (1)	µg/l	15
PAH (sum)	20	LC 03:EPA Method610,ČSN 757554 (4)	µg/l	20
Benzo(a)pyrene	21	LC 03:EPA Method610,ČSN 757554 (4)		
Benzene	22	GC 09A:US EPA 5030B,5035,8260B	µg/l	15
Toluene	23	GC 09A:US EPA 5030B,5035,8260B	µg/l	20
Etylbenzene	24	GC 09A:US EPA 5030B,5035,8260B	µg/l	20
Xylene	25	GC 09A:US EPA 5030B,5035,8260B	µg/l	20

A. Tests with demineralised water

Table II. Results of the 1st leachate (after 24 hours stagnation)

Evaluated parameter	unit	$T_{1,a}$,	$T_{1,b}$	$T_{1,0}$	$T_{1,ABS}$
Color	mg/l Pt	<1,00	<1,00	<1,00	<1,00
pH		7,25	7,31	7,09	7,28*
Electrical conductivity	mS/m	1,04	0,324	0,126	0,56
COD Mn	mg/l	<0,20	<0,20	<0,20	<0,20
Ammonium	mg/l	<0,02	<0,02	<0,02	<0,02
Nitrite	mg/l	<0,01	<0,01	<0,01	<0,01
Nitrate	mg/l	<0,5	<0,5	<0,5	<0,5
Cyanide	mg/l	<0,002	<0,002	<0,002	<0,002
TOC	mg/l	<0,30	0,37	<0,30	<0,30
Arsine	mg/l	<0,001	<0,001	<0,001	<0,001
Cadmium	µg/l	<0,1	<0,1	<0,1	<0,1
Chromium	µg/l	<1	<1	<1	<1
Mercury	µg/l	<0,1	<0,1	<0,1	<0,1
Nickel	µg/l	<1	<1	<1	<1
Lead	µg/l	<1	<1	<1	<1
Selene	µg/l	<1	<1	<1	<1
Zinc	µg/l	<20	<20	<20	<20

$T_{1,a,b}$concentration of evaluated parameter after 24 hours stagnation (two consecutive leachate)
$T_{1,0}$ – concentration of control tests after 24 hours, ND - no detected
$T_{1,ABS}$ – average value of concentration of evaluated parameter after subtraction of control tests, * without subtraction

Table III. Results of the 2st leachate (after 24 hours stagnation)

Evaluated parameter	unit	$T_{2,a,}$	$T_{2,b}$	$T_{2,0}$	$T_{2,ABS}$
Color	mg/l Pt	<1,00	<1,00	<1,00	<1,00
pH		7,82	8,02	7,54	7,90*
Electrical conductivity	mS/m	0,576	0,223	0,112	0,29
COD Mn	mg/l	0,22	0,22	<0,20	<0,20
Ammonium	mg/l	<0,02	<0,02	<0,02	<0,02
Nitrite	mg/l	<0,01	<0,01	<0,01	<0,01
Nitrate	mg/l	<0,5	<0,5	<0,5	<0,5
Cyanide	mg/l	<0,002	<0,002	<0,002	<0,002
TOC	mg/l	0,41	<0,30	<0,30	0,35
Arsine	mg/l	<0,001	<0,001	<0,001	<0,001
Cadmium	µg/l	<0,1	<0,1	<0,1	<0,1
Chromium	µg/l	<1	<1	<1	<1
Mercury	µg/l	<0,1	<0,1	<0,1	<0,1
Nickel	µg/l	<1	<1	<1	<1
Lead	µg/l	<1	<1	<1	<1
Selene	µg/l	<1	<1	<1	<1
Zinc	µg/l	<20	<20	<20	<20

$T_{2,a,b}$concentration of evaluated parameter after 24 hours stagnation (two consecutive leachate)
$T_{2,0}$ – concentration of control tests after 24 hours, ND - no detected
$T_{2,ABS}$ – average value of concentration of evaluated parameter after subtraction of control tests, * without subtraction

Table IV. Results of the 3st leachate (after 24 hours stagnation)

Evaluated parameter	unit	$T_{3,a,}$	$T_{3,b}$	$T_{3,0}$	$T_{3,ABS}$
Color	mg/l Pt	<1,00	<1,00	<1,00	<1,00
Taste		acceptable	acceptable	acceptable	acceptable
Smell		acceptable	acceptable	acceptable	acceptable
pH		7,90	7,79	7,36	7,85*
Electrical conductivity	mS/m	0,255	0,168	0,104	0,11
COD Mn	mg/l	0,22	<0,20	<0,20	<0,20
Ammonium	mg/l	<0,02	<0,02	<0,02	<0,02
Nitrite	mg/l	<0,01	<0,01	<0,01	<0,01
Nitrate	mg/l	<0,5	<0,5	<0,5	<0,5
Cyanide	mg/l	<0,002	<0,002	<0,002	<0,002
TOC	mg/l	<0,30	<0,30	<0,30	<0,30
Arsine	mg/l	<0,001	<0,001	<0,001	<0,001
Cadmium	µg/l	<0,1	<0,1	<0,1	<0,1
Chromium	µg/l	<1	<1	<1	<1
Mercury	µg/l	<0,1	<0,1	<0,1	<0,1
Nickel	µg/l	<1	<1	<1	<1
Lead	µg/l	<1	<1	<1	<1
Selene	µg/l	<1	<1	<1	<1
Zinc	µg/l	<20	<20	<20	<20
PAH (sum)	µg/l	<0,002	<0,002	<0,002	<0,002
Benzo(a)pyrene	µg/l	<0,002	<0,002	<0,002	<0,002
Benzene	µg/l	<0,1	<0,1	<0,1	<0,1
Toluene	µg/l	<0,1	<0,1	<0,1	<0,1
Etylbenzene	µg/l	<0,1	0,2	<0,1	<0,1
Xylene	µg/l	<1,00	<1,00	<1,00	<1,00

$T_{3,a,b}$ -concentration of evaluated parameter after 24 hours stagnation (two consecutive leachate)
$T_{3,0}$ – concentration of control tests after 24 hours, ND - no detected
$T_{3,ABS}$ – average value of concentration of evaluated parameter after subtraction of control tests, * without subtraction

Table V.Evaluationofresultsofthe3st leachate

Evaluated parameter	unit	$T_{3,ABS}$	Concentration limit*
Color	mg/l Pt	<1,00	20
Taste		acceptable	acceptable
Smell		acceptable	acceptable
pH		7,85*	6,5-9,5
Electrical conductivity	mS/m	0,11	-
COD Mn	mg/l	<0,20	3
Ammonium	mg/l	<0,02	5
Nitrite	mg/l	<0,01	5
Nitrate	mg/l	<0,5	50
Cyanide	mg/l	<0,002	0,05
TOC	mg/l	<0,30	1
Arsine	mg/l	<0,001	10
Cadmium	µg/l	<0,1	5
Chromium	µg/l	<1	50
Mercury	µg/l	<0,1	1
Nickel	µg/l	<1	20
Lead	µg/l	<1	10
Selene	µg/l	<1	10
Zinc	µg/l	<20	3000*
PAH (sum)	µg/l	<0,002	0,1
Benzo(a)pyrene	µg/l	<0,002	0,01
Benzene	µg/l	<0,1	1
Toluene	µg/l	<0,1	200*
Xylene	µg/l	<1,00	200*

$T_{3,ABS}$ average value after subtraction of control tests
* Regulation of Ministry of health of the CzechRepublicNo.252/2004, Annex 1 (health requirements for drinking water)
** Regulation of Ministry of health of the CzechRepublicNo.409/2005, § 3

B. Test with microbiologically contaminated drinking water

VI. Results with microbiologically contaminated water

Evaluated parameter	unit	Beginning test*		Test after one week of standing*	
		Input water	Output water	Input water	Output water
colony count at 22 °C	CFU	435	53	1440	212
colony count at 36 °C	CFU	340	22	840	116
coli	CFU	120	0	x	x

*Microbiologically contaminated drinking water
Note: the sample was always collected after rinsing the filter bed with safe drinking water

VII. Results for contaminated drinking water*

Evaluated parameter	Unit	Input water	Output water
Color	mg/l Pt	2,08	<1,00
Turbidity	ZF(n)	0,32	0,10
pH		6,88	7,05
Electrical conductivity	mS/m	23,7	23,6
Ammonium	mg/l	<0,02	<0,02
Nitrite	mg/l	<0,01	<0,01
Nitrate	mg/l	28,7	28,9
Chloride	mg/l	6,9	6,7
TOC	mg/l	**6,67**	**1,18**
Iron	mg/l	<0,05	<0,05
colony count at 22 °C	KTJ/1ml	**5200**	**105**
colony count at 36 °C	KTJ/1ml	**2800**	**42**
coli	KTJ/100ml	**23**	**0**

*scope of examination – see Annex No. 5 to Decree No. 252/2004 Coll.

Conclusion:

The client submitted a sample of the material **ART SAND ASPP-50,** manufactured by **ART CARBON s.r.o., 250 81 Nehvizdy, Czech Republic**. According to the manufacturer declaration, this product is intended for purification of drinking water on the principle of sorption on carbon filter bed containing activated carbon in the form on nanotubes and quartz sand.

The product intended for contact with drinking water must, according to Decree No. 409/2005 Coll. (§3) meet the limits of leaching tests. These limits are derived from the hygiene limits valid for drinking water quality indicators, as imposed by the Decree. No. 252/2004 Coll. According to the customer statement the product should reduce in the case of short-term contact with drinking water the bacteria counts and content of organic substances. The testing was performed according to the valid standard (ČSN EN 12902) and to the Decree No. 409/2005 Coll., Annex No. 1, paragraph 14.

Based on the results of leachate tests (table V.) and valid legislation can be stated that the **tested product ART SAND ASPP-50 meets the requirements for products intended for contact with drinking water** according to Decree No. 409/2005 Coll., "On hygienic requirements for products coming into direct contact with drinking water and water treatment ". Tests carried out in accordance with the requirements of Decree No. 409/2005 Coll., Annex No. 1 and paragraph 14, (table VI. and VII.) confirmed, that product in the case of short-term contact with drinking water, does not deteriorate the quality of drinking water, in some parameters there was a significant improvement.

Report elaborated by: RNDr. Svatopluk Krýsl, CSc.
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Mgr. Jiří Míka
Head of Authorized Laboratory

Hygienická laboratoř LABTECH s.r.o.
Autorizovaná laboratoř
Osvědčení o autorizaci č.F0060101314

Labtech s.r.o., Hygienic Laboratory

Authorized Laboratory for examination of the health safety of products that come in to contact with drinking water and for water treatment

(regulation of Czech Health Ministry No. 409/2005)

Pod Nemocnicí 683, Klatovy, Czech Republic

ART SAND ASPP-50

CARBON NANOTUBES FOR WATER PURIFICATION

Client:

ART CARBON, s.r.o.

(U hřiště 218, Nehvizdy, Czech Republic)

Based on the hygienic requirements for products that come into contact with drinking water and for water treatment given by regulation of Czech Health Ministry No. 409/2005 (On the hygienic requirements for products coming in contact with drinking water and for treatment of water) and according to the protocol No. PSV 08/20

we declare, that

ART SAND ASPP- 50meets the requirements for products intended to come into contact with drinking water and for water treatment. When testing at the point of consumption, it was found that the test product does not deteriorate the quality of incoming water and additionally achieves an improvement of some chemical and microbiological parameters presented in the treated water

This statement is valid for the tested sample as well for all materially identical products.

Klatovy, 19th January 2021

Mgr. Jiří Míka
Head of Authorized Laboratory

Hygienická laboratoř LABTECH s.r.o. Autorizovaná laboratoř Osvědčení o autorizaci č.F0060101314