ANIMA LAB
animal facility and laboratory equipment • animal research models

TAPVEI®
Quality answers in aspen

High-grade animal research relies on **aspen** – the most natural laboratory equipment

Bedding
Nesting materials
Environmental enrichments

Contents

TAPVEI® is the world's leading producer of aspen products for animal welfare.

Since 1982, TAPVEI® has been producing the highest **quality bedding, nesting material and environmental enrichments** for laboratory animals. TAPVEI® is a **quality-driven company**, providing controlled laboratory environments for your animal research. In our production process we use naturally grown **Nordic aspen** (Populus tremula) and **renewable energy**.

Raw material

All TAPVEI® products are made from aspen (Populus tremula) – a natural hardwood from the pristine Nordic environment. Out of the multitude of studies carried out with various species and animal breeds, hardwood materials are typically found to produce the least undesirable side effects on experimental results.

Research and development

TAPVEI® runs an in-house research program on product quality and physical properties, as well as an out-sourced product development research program with independent centres of laboratory animal research in Estonia and Finland. Our research is grounded in well established customer relations in order to directly serve our customers' needs.

Quality assessments

Finished products are regularly tested for microbiological, chemical and environmental contaminants in independent laboratories. All TAPVEI® products are compliant with GV-Solas requirements for animal feed.

Environmental responsibility

The whole production process of TAPVEI® products follows high ecological standards. It starts with using untreated raw material from the intact Nordic wilderness under a Forest Stewardship Council® certified (FSC®) chain of custody and is followed by use of bioenergy for heating the production plant. Our products are biodegradable. Quality is ensured by applying the ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 standards.

Aspen in animal research

There are various reasons why the highest quality laboratories prefer aspen products to other raw materials (softwood, corncob, cellulose).

Most specifically, the discoveries of softwood bedding cytotoxicity and its effects on the metabolism of pharmacological agents under research have prompted research labs to switch to aspen bedding.

Additionally, mice and rats alike generally prefer aspen chips over softwood sawdust and corncob bedding. From amongst various types of hardwood, aspen is preferred due to its lower dust count. Aspen bedding shows high absorptive properties, and hardwood in general guarantees the lowest ammonia concentrations in rodent cages. Even when purposely contaminated with fungi, aspen chip bedding does not encourage the growth of fungi in the rodent cage environment (see Additional reading sections for references).

Products

TAPVEI® offers a full range of products to serve laboratory animal needs for bedding, nesting material and environmental enrichments.

Bedding is a compulsory element according to current laboratory animal welfare regulations and one of the main materials to which animals are continuously exposed. Its main practical purpose is to absorb moisture and ammonia from animal urine and faeces. It should also be pleasant and harmless for animals and support **species-specific behaviours** like nesting. High production standards help to avoid indirect maintenance and research costs of bedding-induced variability in research results. Hence, research- grade laboratory animal bedding is highly suggested.

TAPVEI® aspen bedding

Our innovative technology ensures that TAPVEI® bedding material has no sharp edges. This significantly reduces dust levels, which in turn has a major impact on dust-related costs and the operational problems associated with excessive dust. The moisture content and absorption capacity of TAPVEI® aspen bedding is achieved by an automatic drying process with 100-120 ˚C clean air and heated by environmental-friendly bioenergy. It also ensures that the bedding is microbiologically clean and fulfils corresponding requirements of the GLP standard.

- Raw material – aspen (Populus tremula)
- Moisture content around 10%
- Relative density 180-200 kg/m³
- Absorbing capacity 260%
- Dust content (particles < 0.25mm), less than 0.1%
- Binding of ammonium 26mg/L
- Ideal for use within automated bedding dispensers
- Recommended for IVC isolators and automated systems
- Autoclavable
- Biodegradable
- Full batch analysis
- Dried using only 100% renewable bioenergy
- Safe for animal and human respiratory tracts

Bedding 5x5x1 mm

Bedding 2x2x1 mm

TAPVEI® bedding is available in different packaging options: paper, vacuum and fiber.

TAPVEI® nesting materials

TAPVEI® nesting materials (wood wool) is also made from pure, untreated Nordic aspen. The soft strips of wood serve as an ideal nest-building material and cage enrichment for laboratory animals.

The TAPVEI® aspen wood strips come in three different sizes to suit the needs of various species.

- Raw material – aspen (Populus tremula)
- Moisture content around 10%
- Autoclavable
- Biodegradable
- Full batch analysis
- One 3 kg bag is sufficient for up to 600 cages
- Selling unit: 90L (ca 3kg) bag or pallet (21 bags/pallet)

PM90L
For mice
Ca 2 mm x 20 cm

PM90L/R
For rats
Ca 3 mm x 20 cm

PM90L/2R
For mice and rats
Ca 6 mm x 20 cm

TAPVEI® environmental enrichments

- Enable a fuller range of the animal's normal behaviour and increase behavioural diversity
- Give the animal a choice of activity and control over positive utilisation of its environment
- Reduce the frequency of abnormal behavior
- Increase the ability to cope with challenges
- Autoclavable
- Biodegradable
- Full batch analysis
- Washable and reusable up to 14 times
- Selling unit: box or pallet (80 boxes/pallet)

Gnawing bricks

These bricks, designed for chewing and gnawing, will help animals satisfy their natural instincts and exercise their teeth and gums, promoting dental health.

	Size (mm)	Packaging (pcs/box)
S-brick	50x10x10	1000 or 2000
M-brick	100x20x20	200
L-brick	200x43x43	50

	Size (mm)	Packaging (pcs/box)
Balls	Ø 30 mm	500

	Size (mm)	Packaging (pcs/box)
Rabbit Brick	65x58x23	100

Tubes

Ideal for refuge and to stimulate activity. Also good for gnawing. Provides a solid floor to rest on. Good for wire-bottom cages.

	Size (mm)	Packaging (pcs/box)
S-tube (for mice)	100x75x75	30

	Size (mm)	Packaging (pcs/box)
L-tube (for rats)	198x105x105	6

Arcades

Accessories without bases can be used with nesting materials and are easy to lift when the animals are inside. Accessories without bases are also more hygienic, since the animals lie on bedding material.

	Size (mm)	Packaging (pcs/box)
Arcade 14 (for mice)	198x105x90	12

	Size (mm)	Packaging (pcs/box)
Arcade 17 (for rats)	180x140x107	8

Options for enriching the cage life of mice

	Size (mm)	Packaging (pcs/box)
Tunnel	100x40x40 Ø 30 mm	100

	Size (mm)	Packaging (pcs/box)
Labyrinth	150x43x10 Ø 30 mm	50

	Size (mm)	Packaging (pcs/box)
Cube	60x60x60 Ø 30 mm	72

	Size (mm)	Packaging (pcs/box)
Stairs	75x20x208	40

Mouse houses & Guinea pig house

	Size (mm)	Packaging (pcs/box)
Mouse cabin	155x92x85 Ø 30 mm	24
Mouse cabin with stairs	155x92x85 Ø 30 mm	24

	Size (mm)	Packaging (pcs/box)
Mouse house	110x110x67 Ø 40 mm	20

	Size (mm)	Packaging (pcs/box)
Corner 15	105x75x80	60
Corner 15 with stairs	105x75x80	60

	Size (mm)	Packaging (pcs/box)
Guinea Pig House	220x178x138 door 70x90	2

Quality Certificates

With the obvious effects that TAPVEI's production of natural bedding, nesting and enrichment products have on the environment, ecological thinking and activities are inevitable in our business. In order to minimise environmental impact, constant attention is paid to decreasing and avoiding possible ecological harm. As a part of this process, we follow the responsible forest management practises of FSC®, an international organisation that guarantees the origin of raw material. The management system of TAPVEI Estonia OÜ has been approved by ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 standards.

Lloyd's Register

Certificate of Approval

This is to certify that the Management System of:

TAPVEI ESTONIA OÜ

Paekna küla, Kiili vald, 75408 Harjumaa, Estonia

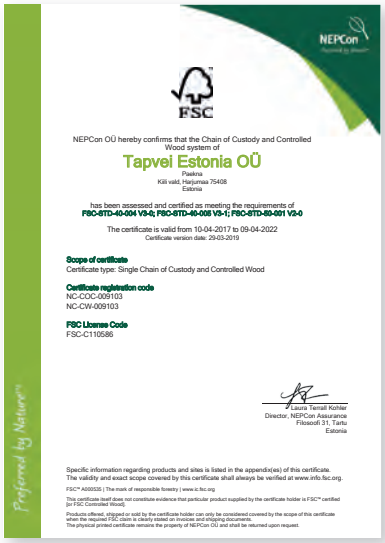
has been approved by Lloyd's Register to the following standards:

ISO 14001:2015, ISO 45001:2018, ISO 9001:2015

Approval number(s): ISO 14001 – 00685838, ISO 45001 – 00024341, ISO 9001 – 00685839

The scope of this approval is applicable to:
Production of wooden bedding, nesting material and living environment enrichments for animals, including laboratory animals.

P.G. Cornelissen
Area Manager North Europe
Issued by: Lloyd's Register EMEA Eesti filiaal
for and on behalf of: Lloyd's Register Quality Assurance Limited



NEPCon

FSC

NEPCon OÜ hereby confirms that the Chain of Custody and Controlled Wood system of

Tapvei Estonia OÜ

Paekna
Kiili vald, Harjumaa 75408
Estonia

has been assessed and certified as meeting the requirements of
FSC-STD-40-004 V3-0; FSC-STD-40-005 V3-1; FSC-STD-50-001 V2-0

The certificate is valid from 10-04-2017 to 09-04-2022
Certificate version date: 29-03-2019

Scope of certificate
Certificate type: Single Chain of Custody and Controlled Wood

Certificate registration code
NC-COC-009103
NC-CW-009103

FSC License Code
FSC-C110586

Laura Terrell Kohler
Director, NEPCon Assurance
Filosoofi 31, Tartu
Estonia

Preferred by Nature

Specific information regarding products and sites is listed in the appendix(es) of this certificate.
The validity and exact scope covered by this certificate shall always be verified at www.info.fsc.org.

FSC® A000535 | The mark of responsible forestry | www.ic.fsc.org

This certificate itself does not constitute evidence that particular product supplied by the certificate holder is FSC® certified [or FSC Controlled Wood].

Products offered, shipped or sold by the certificate holder can only be considered covered by the scope of this certificate when the required FSC claim is clearly stated on invoices and shipping documents.
The physical printed certificate remains the property of NEPCon OÜ and shall be returned upon request.

Certificates of Analysis

The microbiological and chemical composition of TAPVEI® products is screened quarterly in independent laboratories and compared to the limits set by GV-Solas guidelines for animal feed. Our products are screened for over 200 different compounds. TAPVEI's requirements for raw material, facilities, production and storage have guaranteed an outstanding quality standard for many years in a row.

Source: **Guidelines for the quality-secured production of laboratory animal feed.**
Society for Laboratory Animal Science, Committee for the Nutrition of Laboratory Animals, August 2001.

Microbiological critical values

		Critical value
Aerobic total germ count	§64 LFGB 06.00-18*	$<1x10^5$
Yeasts/Moulds	§64 LFGB 01.00-37*	$<1x10^3$
Enterobacteriaceae	§64 LFGB 05.00-5*	100
E.coli		10
Coagulase-positive staphylococci	§64 LFGB 00.00-55*	10
Salmonella	§64 LFGB 00.00-20*	–

*official method

cfu: colony forming unit

Critical values of contaminants

Chlorinated hydrocarbons	**mg/kg**
HCB	0,01
o, β, d-HCH	0,02
g-HCH (Lindane)	0,10
Heptachlorine and -epoxide	0,01
o, g-Chlordane	0,02
Aldrien and Dieldrin	0,01
Endrine	0,01
DDE + DDD + DDT	0,05
o, s Endosulfane and -sulfate	0,10

Phosphoric acid ester	**mg/kg**
Malathione	1.0
Fenitrothione	1,0
Pirimiphos (-methyl)	1,0
Chlorpyriphos (-methyl)	1,0
Other phosphoric acid esters	0,5

Poly-chlorinated biphenyls (PCB)	0,05

Heavy metals	
Arsenic	1,0
Lead	1,5
Cadmium	0,4
Mercury	0,1
Fluorine	150

Nitrosamines	
Nitrosodiethylamine (NDEA)	0,01
Nitrosodimethylamine (NDMA)	0,01

Dry weight 88%

Mykotoxins	
Alfatoxin B1	0,010
Alfatoxin B2	0,005
Alfatoxin G1	0,005
Alfatoxin G2	0,005

Fusarien toxins	
Deoxynivalenole	0,500
Ochratoxin	0,100
Zearalenone	0,100

TAPVEI® bedding certificate of analysis

AGROLAB LUFA GmbH

Dr.-Hell-Str. 6, 24107 Kiel, Germany
www.agrolab.de

AGROLAB GROUP
Your labs. Your service.

AGROLAB LUFA Dr.-Hell-Str. 6, 24107 Kiel

Tapvei Estonia OÜ
Paekna küla, Kiili vald
75408 Harjumaa
ESTLAND

Date 21.01.2020
Customer no. 10076953

REPORT 2672823 - 600205

Order	**2672823**
Sample no.	**600205**
Sample acceptance	**13.01.2020**
Date of sampling	**06.01.2020**
Sample code	**Aspen chips (Populus tremula), Batch 100120E**
Packaging	**plastic bag**

	Unit	Result	Declaration	Substance	Method
Pesticides Multi-Residue-Methods (complete list see appendix)					
In the range of performed analysis no pesticides were detected above limit of quantification.					
Physico-chemical parameters					
Nitrate	mg/kg	**<20,0**		OM	EN 12014-3 : 2005-05 (mod.)
Nitrite	mg/kg	**<1,0**		OM	EN 12014-3 : 2005-05 (mod.)
Trace elements / Heavy metals / Halogenides					
Boron (B)	mg/kg	**<5,00** m)		OM	DIN EN 15621 : 2017-10 (mod.)
Fluorine, detected as Fluoride	mg/kg	**<40**		OM	DIN EN 16279 : 2012-09
Copper (Cu)	mg/kg	**1,36**		OM	DIN EN 15621 : 2017-10
Zinc (Zn)	mg/kg	**9,23**		OM	DIN EN 15621 : 2017-10
Selenium (Se)	mg/kg	**<0,10**		OM	DIN EN 17053 : 2018-03
Cadmium (Cd)	mg/kg	**0,14**		OM	DIN EN 17053 : 2018-03
Lead (Pb)	mg/kg	**<0,10**		OM	DIN EN 17053 : 2018-03
Mercury (Hg)	mg/kg	**<0,02**		OM	DIN EN 16277 : 2012-09 (mod.)
Arsenic (As)	mg/kg	**<0,10**		OM	DIN EN 17053 : 2018-03
Mycotoxins					
Aflatoxine B1	µg/kg	**<1,0** m)		OM	QMP_504_KI_52_151 : 2017-12 (LC-MSMS)
Aflatoxine B2	µg/kg	**<1,0** m)		OM	QMP_504_KI_52_151 : 2017-12 (LC-MSMS)
Aflatoxine G1	µg/kg	**<1,0** m)		OM	QMP_504_KI_52_151 : 2017-12 (LC-MSMS)
Aflatoxine G2	µg/kg	**<1,0** m)		OM	QMP_504_KI_52_151 : 2017-12 (LC-MSMS)
Sum aflatoxines	µg/kg	**n.q.**		OM	calculated
Dioxinlike PCB (dl-PCB)					
PCB 77	ng/kg	**<6,00** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 81	ng/kg	**<0,40** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 105	ng/kg	**<100** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 114	ng/kg	**<8,00** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 118	ng/kg	**<200** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 123	ng/kg	**<4,00** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 126	ng/kg	**<0,40** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 156	ng/kg	**<20,0** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 157	ng/kg	**<4,00** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 167	ng/kg	**<10,0** pa)		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 169	ng/kg	**<0,20** pa)		OM	DIN EN 16215 : 2012-07 (mod.)

The parameters reported in this document are accredited according to ISO/IEC 17025:2005. Only not accredited parameters/values are identified by the symbol " * ".

AGROLAB LUFA GmbH

Dr.-Hell-Str. 6, 24107 Kiel, Germany
www.agrolab.de

AGROLAB GROUP
Your labs. Your service.

Date 21.01.2020
Customer no. 10076953

REPORT 2672823 - 600205

	Unit	Result	Declaration	Substance	Method
PCB 189	ng/kg	**<4,00** *pa)*		OM	DIN EN 16215 : 2012-07 (mod.)
TEQ-WHO (upper-bound, dl PCB)	ng/kg	**0,06** *xx5)*		OM	Calculation WHO 2005
Non-dioxinlike PCB (ndl-PCB)					
PCB 28	mg/kg	**<0,00040** *pa)*		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 52	mg/kg	**<0,00080** *pa)*		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 101	mg/kg	**<0,0011** *pa)*		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 138	mg/kg	**<0,00040** *pa)*		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 153	mg/kg	**<0,00040** *pa)*		OM	DIN EN 16215 : 2012-07 (mod.)
PCB 180	mg/kg	**<0,00020** *pa)*		OM	DIN EN 16215 : 2012-07 (mod.)
Sum ndl-PCB (upper-bound)	µg/kg	**3,3** *xx5)*		OM	calculated
Microbiological examinations					
Escherichia coli	cfu/g	**<1 (LOD)**		OM	DIN ISO 16649-2 : 2009-12
Enterococcus spp. *	cfu/g	**<100 (LOD)**		OM	DIN EN ISO 7899-2 : 2000-11 (mod.)
Aerobic mesophilic bacteria (total plate count)	cfu/g	**<100 (LOD)**		OM	VDLUFA III, 28.1.2 : 2007
Clostridium spp., sulfite reducing	cfu/g	**<1 (LOD)**		OM	ISO 15213 : 2003-05
Coliform bacteria	cfu/g	**<10 (LOD)**		OM	ISO 4832 : 2006-02
Moulds	cfu/g	**<100 (LOD)**		OM	VDLUFA III, 28.1.2 : 2007
Yeasts	cfu/g	**<100 (LOD)**		OM	ISO 21527-1 : 2008-07
Salmonella spp. in 25g		**not detected**		OM	ISO 6579-1 : 2017-02

xx5) For each single result below the LOQ, the LOQ was used for the calculation.
m) Due to the disturbing influence of the sample matrix, the limit of detection resp. limit of quantitation was increased.
pa) The detection and quantification limit had been increased because for this analysis matrix a smaller sample volume had to be used.
Explanation: "<" or "n.q." represent the fact that the concentration of the analyte is below the limit of quantification (LOQ).
The sign "<"...."(LOD)" or n.d. in column result means, the substance concerned cannot be detected within the limit of detection.

Explanation: OM = on original matter; DM = on dry matter base

Remark to Escherichia coli:
A resuscitation step is done to detect stressed bacteria.
Remark to Salmonella spp.:
In case of positive Salmonella results a confirmation of Salmonella spp. was conducted by MALDI-TOF (database BDAL/7311 MSPS).

Start of testing: 13.01.2020
End of testing: 21.01.2020

The analytical results are only valid for the delivered sample material. A plausibility check is hardly possible for samples of unknown origin. Duplication of this document or of parts of it requires the authorization from laboratory. The test results in this test report are displayed in a simplified manner according to the agreement made with you in writing according to the order confirmation. The display is in accordance with ISO/IEC 17025:2005, paragraph 5.10.1.

AGROLAB LUFA Frau Nora Bodmann, Tel. 0431/1228-317
Customer Relations Management feed

The parameters reported in this document are accredited according to ISO/IEC 17025:2005. Only not accredited parameters/values are identified by the symbol " * ".

21.01.20 12:36 AG Kiel
HRB 5796
Ust./VAT-ID-Nr:
DE 813 356 511

Geschäftsführer
Dr. Paul Wimmer
Benoist Lasserre

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-14082-01-00

References

- Ambery, A.G., Tackett, L., Penque, B.A., Hickman, D.L., Elmendorf, J.S. (2014) **Effect of Corncob Bedding on Feed Conversion Efficiency in a High-Fat Diet-Induced Prediabetic Model in C57Bl/6J Mice**. Journal of the American Association for Laboratory Animal Science, 53, 449–451.
- Cunliffe-Beamer, T.L., Freeman, L.C., Myers, D.D. (1981) **Barbiturate sleeptime in mice exposed to autoclaved or unautoclaved wood beddings**. Laboratory Animal Science, 31, 672-675.
- Nevalainen, T. (1989) **Deciduous wood chips as bedding material. Estimation of dust yield, water absorption and microbiological comparison**. Scandinavian Journal of Laboratory Animal Science, 16, 105-111.
- Kaliste, E., Linnainmaa, M., Meklin, T., Torvinen, E. Nevalainen, A. (2004) **The bedding of laboratory animals as a source of airborne contaminants**. Laboratory Animals, 38, 25–37.
- Mulder, J.B. (1975) **Bedding preferences of pregnant laboratory-reared mice**. Behavior Research Methods & Instrumentation, 7, 21-2.
- Odynets, A., Simonova, 0., Kozhuhov, A., et al. (1991) **Beddings for laboratory animals: criteria of biological evaluation**. Laboratornye Zhyvotnye, 1, 70-6.
- Pelkonen, K.H.O., Hänninen, O.O.P. (1997) **Cytotoxicity and biotransformation inducing activity of rodent beddings: A global survey using the Hepa-1 assay**. Toxicology, 122, 73–80.
- Potgieter, J., Wilke, P.I. (1996) **The dust content, dust generation, ammonia production, and absorption properties of three different rodent bedding types**. Laboratory Animals, 30, 79-87.
- Potgieter, F.J., Torronen, R., Wilke, P.I. (1995) **The in vitro enzyme-inducing and cytotoxic properties of South African laboratory animal contact bedding and nesting materials**. Laboratory Animals, 29, 163-171.
- Ras, T., van de Ven, M., Patterson-Kane, .G., Nelson, K. (2002) **Rats' preferences for corn versus wood-based bedding and nesting materials**. Laboratory Animals, 36, 420–425.
- Smith, E., Stockwell, J.D., Schweitzer, I., Langley, S.H., Smith, A.L. (2004) **Evaluation of cage micro-environment of mice housed on various types of bedding materials**. Contemporary Topics in Laboratory Animal Science, 43, 12-17.
- Törrönen, R., Pelkonen, K., Kärenlampi, S. (1989) **Enzymeinducing and cytotoxic effects of wood-based materials used as bedding for laboratory animals**. Comparison by a cell culture study. Life Sciences, 45, 559–565.
- Vesell, E.S. (1967) **Induction of drug-metabolizing enzymes in liver microsomes of mice and rats by softwood bedding**. Science, 157, 1057-1058.
- Wirth, H. (1983) **Criteria for the evaluation of laboratory animal bedding. Laboratory Animals**, 17, 81-84.
- Abou-Ismail, U.A., Mahboub, H.D. (2011) **The effects of enriching laboratory cages using various physical structures on multiple measures of welfare in singly-housed rats**. Laboratory Animals, 45, 145-153.
- Blom, H.J.M., Van Tintelen, G., Van Vorstenbosch, C.J.A.H.V., Baumans, V., Beynen, A.C. (1996) **Preferences of mice and rats for types of bedding materials**. Laboratory Animals, 30, 234-44.
- Brain, P.F., Buttner, D., Costa, P., Gregory, J.A., Heine, W.O.P., Koolhaas, J., Militzer, K., Ödberg, F.O., Scharmann, W., Stauffacher, M. (1993) Rodents. **Paper presented at The Accommodation of Laboratory Animals in Accordance with Animal Welfare Requirements, Berlin**.
- Chamove, A.S. (1989) **Cage design reduces emotionality in mice**. Laboratory Animals 23, 215-219.
- Chmiel Jr., D.J., Noonan, M. (1996) **Preference of laboratory rats for potentially enriching stimulus objects**. Laboratory Animals, 30, 97-101.
- Dean, S.W. (1999) **Environmental enrichment of laboratory animals used in regulatory toxicology studies**. Laboratory Animals, 33, 309-327.
- Eskola, S., Kaliste-Korhonen, E. (1999a) **Aspen wood-wool is preferred as a resting place, but does not affect intracage fighting of male BALBlc and C57BL/6J mice**. Laboratory Animals, 33, 108-121.
- Eskola, S., Kaliste-Korhonen, E. (1998) **Effects of cage type and gnawing blocks on weight gain, organ weights and open-field behaviour in wistar rats**. Scandinavian Journal of Laboratory Animal Science, 25, 180-193.
- Eskola, S., Lauhikari, M., Voipio, H.-M., Nevalainen, T. (1999b) **The use of aspen blocks and tubes to enrich the cage environment of laboratory rats**. Scandinavian Journal of Laboratory Animal Science, 26, 1-10.
- Gaskill, B.N., Rohr, S.A., Pajor, E.A., Lucas, J.R., Garner, J.P. 2009. **Some like it hot: Mouse temperature preferences in laboratory housing**. Applied Animal Behaviour Science, 116, 279-285.
- Gordon, C.J. 2004. **Effect of cage bedding on temperature regulation and metabolism of group-housed female mice**. Comparative Medicine, 54, 63-68.
- Hubrecht, R. (1997) Fundamentals of environmental enrichment. LASA Newsletter, Autumn issue, 8-9. Jensen, P., Toates, F.M. (1993) **Who needs' behavioural needs'? Motivational aspects of the needs of animals**. Applied Animal Behaviour Science, 37, 161–81.
- Kaliste-Korhonen, E., Eskola, S., Rekilä, T., Nevalainen, T. (1995) **Effects of gnawing material, group size and cage level in rack on Wistar rats**. Scandinavian Journal of Laboratory Animal Science , 22, 291-299.
- Lidfors, L., Wichman, A., Ewaldsson, B., Lindh, A.-S. (2014) **Enriched cages for groups of laboratory male rats and their effects on behaviour, weight gain and adrenal glands**. Laboratory Animals, 48, 36–49.
- Manser, C.E., Morris, T.H., Broom, D.M. (1995) **An investigation into the effects of solid or grid cage flooring on the welfare of laboratory rats**. Laboratory Animals, 29, 353–363.
- Manser, C.E., Broom, D.M., Overend, P., Morris, T.H. (1998) **Operant studies to determine the strength of preference in laboratory rats for nestboxes and nesting materials**. Laboratory Animals 32, 36-41.
- Mitchell, P.J. (1994) **Ethological studies of the social behavior of the rat**. Animal Technology 44, 109-20.
- Newberry, R.C. (1995) **Environmental enrichment: Increasing the biological relevance of captive environments**. Applied Animal Behaviour Science 44, 229-243.
- Õkva, K. (2012) **Effects of litter and cage furniture on mouse anxiety-like behaviour**. Department of Production Animal Medicine, Faculty of Veterinary Medicine University of Helsinki, Finland.
-Chmiel Jr, D.J., Noonan, M. (1996) **Preference of laboratory rats for potentially enriching stimulus objects**. Laboratory Animals, 30, 97- 101.
-Council of Europe. Appendix A of the European Convention for the Protection of Vertebrate Animals Used for Experimental and Scientific Purposes (ETS 123). **Guidelines for accommodation and care of animals**. Strasbourg 2006.
- Eskola, S., Lauhikari, M., Voipio, H.-M., Nevalainen, T. (1999) **The use of aspen blocks and tubes to enrich the cage environment of laboratory rat**. Scandinavian Journal of Laboratory Animal Science, 26, 1-10.
- Pentu, N., Hyvärinen, A., Toivola, M., Nevalainen, A. Nevalainen, T. (2000) **Filter top cages: Mouldy homes for rodents**? Scandinavian Journal of Laboratory Animal Science, 27, 1-12.
- Olsson, A., Dahlborn, K. (2002) **Improving housing conditions for laboratory mice: a review of environmental enrichment**. Laboratory Animal, 36, 243–70.
- Townsend, P. (1997) **Use of in-cage shelters by laboratory rats**. Animal Welfare, 6, 95-103.
- Van De Weerd, H.A., Van Loo, P.L.P., Van Zutphen, L.F.M., Koolhaas, J.M., Baumans, V. (1997) **Preferences for nesting material as environmental enrichment for laboratory mice**. Laboratory Animals, 31, 133-143.
- Van Loo, P. L. P., Van der Meer, E., Kruitwagen, C.L.J.J., Koolhaas, J.M., Van Zutphen, L.F.M., Baumans, V. (2004a) **Long-term effects of husbandry procedures on stress-related parameters in male mice of two strains**. Laboratory Animals, 38, 169–177.
- Van Loo, P.L.P., Van de Weerd, H.A., Van Zutphen, L.F.M., Baumans, V. (2004b) **Preference for social contact versus environmental enrichment in male laboratory mice**. Laboratory Animals, 38, 178–188.
- Van Praag, H., Kempermann, G., Gage, F.H. (2000) **Neural consequences ofenvironmental enrichment**. Nature Reviews Neuroscience 1, 191-198.
- Würbel, H. (2001) **Ideal homes? Housing effects on rodent brain and behaviour**. Trends in Neuroscience 24, 207-211.
- Würbel H. (2002) **Behavioral phenotyping enhanced – beyond (environmental) standardization**. Genes, Brain and Behavior, 1, 3–8.
- Young RJ. (2003) **Environmental enrichment for captive animals. UFAW Animal Welfare Series**. London: Blackwell Science Ltd.

Contact TAPVEI distributor

ANIMA LAB
animal facility and laboratory equipment • animal research models

info@animalab.eu

www.animalab.eu

Type your text

TAPVEI®
Quality answers in aspen

With over 35 years´ experience, TAPVEI is committed to improving animal welfare.

info@tapvei.com
www.tapvei.com

CERTIFIED ISO 9001 • ISO 14001 ISO 45001 UKAS MANAGEMENT SYSTEMS 001

FSC
www.fsc.org
FSC® C110586

The mark of responsible forestry

Only the products labeled accordingly are FSC certified