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Test report

Absorption of volatile chemicals by the Plantpack product

PT68

1. Abstract

Frequently products in containers emit vapors in concentrations that are considered as unsafe for working conditions. Aim of this study was to determine if and how far "Plant Tube 68" is able to absorb chemical vapors in such way to eliminate dangerous working conditions in confined spaces.
Different vapors were put in gastight bags, together with PT. Gas concentration measurements were carried out at regular intervals.

PT 68 showed significant absorption capacity.

2. Materials and methods

The following test gases were used :

- Pentane
- Toluene
- Xylene
- Ammonia
- 1,2-dichloro-ethane

Formaldehyde was also on the list, but this product appeared to be too unstable to conduct tests. Taking into account the chemical properties of this product we assume it will be absorbed too.

Bags were made with special plastic foil (7 layer EVOH foil). This foil is especially produced for the VacQPack technology and can be considered as completely gastight.
VacQPack is a division of the PPD EWS Group that is specialized in bio treatments of food and feed in order to enhance shelf life and to kill pest organisms by means of modified atmospheres under semi vacuum (www.vacqpack.com).

Example of a pallet under VacQPack conditions

A little valve with septum was glued in each bag, to make sample taking possible.
The volume of the bag was 20 liters.

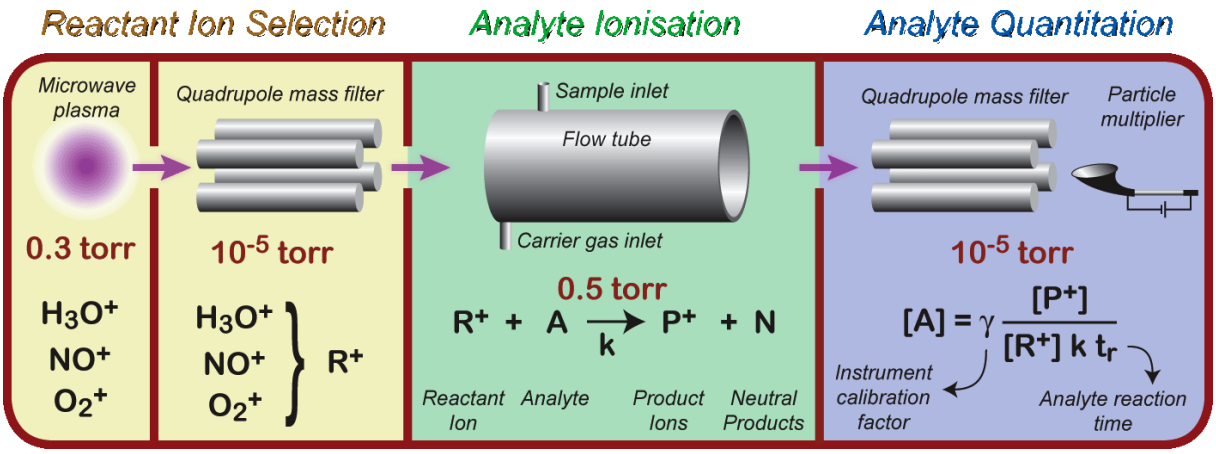
The VacQPack bags with the PT 68 were measured directly after opening for carbon monoxide, carbon dioxide and oxygen. The last two gases showed normal values. Only carbon monoxide levels were a little higher. This can be considered as normal in the presence of active coal material.

Bags filled with the sample gases for the test.

Measurement technology

The air samples are analysed with a SYFT Voice-200 mass spectrometer.

The working principle of this device is as follows :
The precursor ions (H_3O^+,NO^+ and O_2^+) are generated by the system itself and with the also built-in mass spectrometer the product ions are exactly measured.



The SIFT-MS technology derives its selectivity from the fact that each chemical compound reacts in a unique manner to different precursor ions. In these reactions, known product ions emerge for each combination of molecule and precursor ions.

The result is a selective and universal detection method for all volatile organic compounds, including solvents, in air samples up to the ppb level.

The SYFT systems at EWS are tuned (optimized K-factor) for components like Benzene, Toluene, Styrene, Xylene, Methylbromide, Phosphine, 1,2-Dichloroethane, Ammonia and Formaldehyde. This calibration ensures reliable results.

At the start of every day the SYFT Voice-200 is validated against a certified standard. This step is repeated every two hours to exclude influences of external parameters such as temperature. This procedure ensures a high constant level of results.




3. Results and conclusions

The test room was kept at 20 °C during the test.
Gas concentration samples were taken by means of a syringe trough the septum in the valve of the bags.
All concentrations mentioned are in *parts per million* (ppm).
The "reference" is the bag with the sample gases, but without Plantpack products. The concentration in the reference bags is visualized by the light blue line in the graphs.
The red line in the graphs is the (Dutch) safety limit of the product concerned. Start concentrations of the products were always clearly above the safety limit.
The denomination "bis" means an identical bag, under identical conditions. In the calculations the average result is withheld.
To compare the capacity of the Plantpack product, sample bags were filled with different amounts of the absorbant (34 grams, 68 grams and 102 grams).
In the graphs, the X-axis projects the measurements in time, and the Y-axis the concentration in parts per million.
For PT 68, ammonia and xylene were not completely stable during the test. Ammonia however showed a good absorption, and xylene a satisfactory absorption. For the other vapors the absorption was very good.

PT 68 test results :

Pentane	Start concentration	Measurement 1	Measurement 2
Time	19-12-2014 11:00	19-12-2014 17:00	22-12-2014 11:00
Reference	1650	1650	1650
34 Grams	1650	22,9	10
68 Grams	1650	14,8	7
102 Grams	1650	8,94	4
Net absorption 34 grams	0	1627,1	1640
Net absorption 68 grams	0	1635,2	1643
Net absorption 102 grams	0	1641,06	1646

Toluene	Start concentration	Measurement 1	Measurement 2
Time	18-12-2014 12:00	19-12-2014 10:00	22-12-2014 11:00
Reference	100	70	65
34 Grams	100	2,1	0,42
34 Grams bis	100	4,5	0,38
68 Grams	100	1	0
68 Grams bis	100	2,1	0
102 Grams	100	0,46	0
102 Grams bis	100	0,83	0
Average 34 grams	100	3,3	0,4
Average 68 grams	100	1,55	0
Average 102 grams	100	0,645	0
Net absorption 34 grams	0	66,7	64,6
Net absorption 68 grams	0	68,45	65
Net absorption 102 grams	0	69,355	65

Xylene	Start concentration	Measurement 1	Measurement 2
Time	18-12-2014 12:00	19-12-2014 14:00	22-12-2014 11:30
Reference	55	21	22
34 Gram	55	7	0
68 Gram	55	0	0
102 Gram	55	6,7	0
Net absorption 34 grams	0	14	22
Net absorption 68 grams	0	21	22
Net absorption 102 grams	0	14,3	22

Ammonia	Start concentration	Measurement 1	Measurement 2
Time	18-12-2014 12:00	19-12-2014 9:00	22-12-2014 10:30
Reference	48	40	7,1
34 Grams	48	0	0
34 Grams bis	48	2	0
68 Grams	48	0	0
68 Grams bis	48	0	0
102 Grams	48	0	0
102 Grams bis	48	0	0
Average 34 grams	48	1	0
Average 68 grams	48	0	0
Average 102 grams	48	0	0
Net absorption 34 grams	0	39	7,1
Net absorption 68 grams	0	40	7,1
Net absorption 102 grams	0	40	7,1

1,2 dichloroethane	Start concentration	Measurement 1	Measurement 2
Time	18-12-2014 12:00	19-12-2014 9:30	22-12-2014 11:00
Reference	35	32	30
34 Grams	35	0,9	0,4
34 Grams bis	35	0,8	0,3
68 Grams	35	0,7	0,3
68 Grams bis	35	0,5	0,2
102 Grams	35	0,5	0,1
102 Grams bis	35	0,4	0,1
Average 34 grams	35	0,85	0,35
Average 68 grams	35	0,6	0,25
Average 102 grams	35	0,45	0,1
Net absorption 34 grams	0	31,15	29,65
Net absorption 68 grams	0	31,4	29,75
Net absorption 102 grams	0	31,55	29,9

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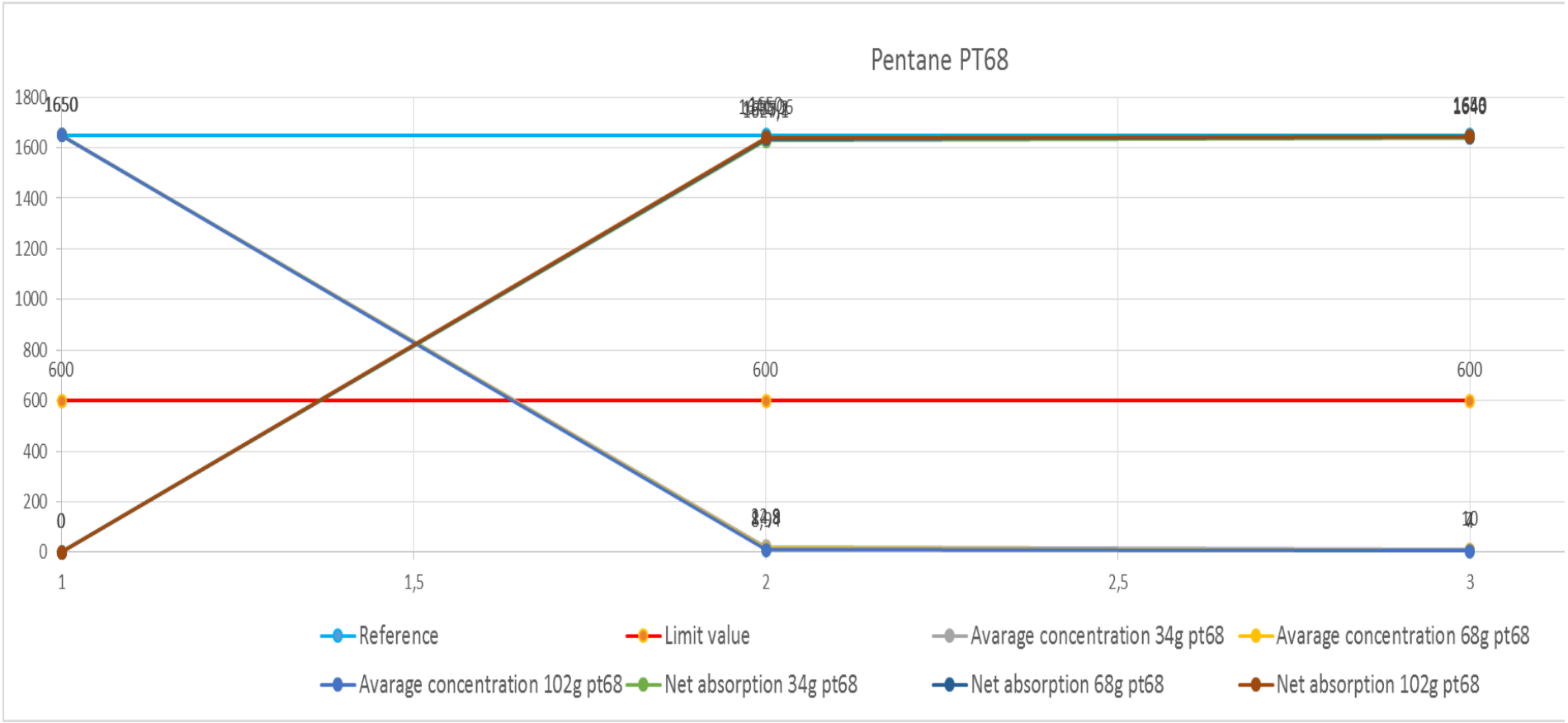

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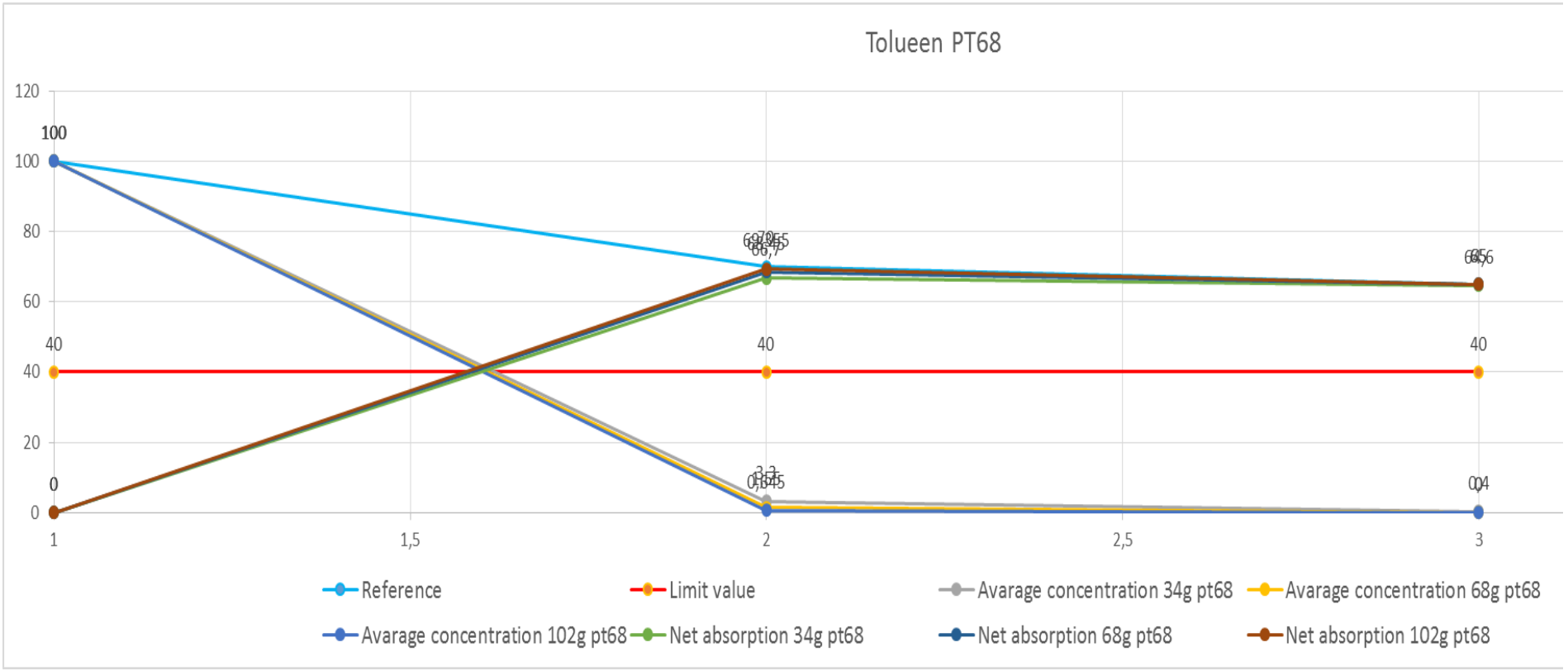

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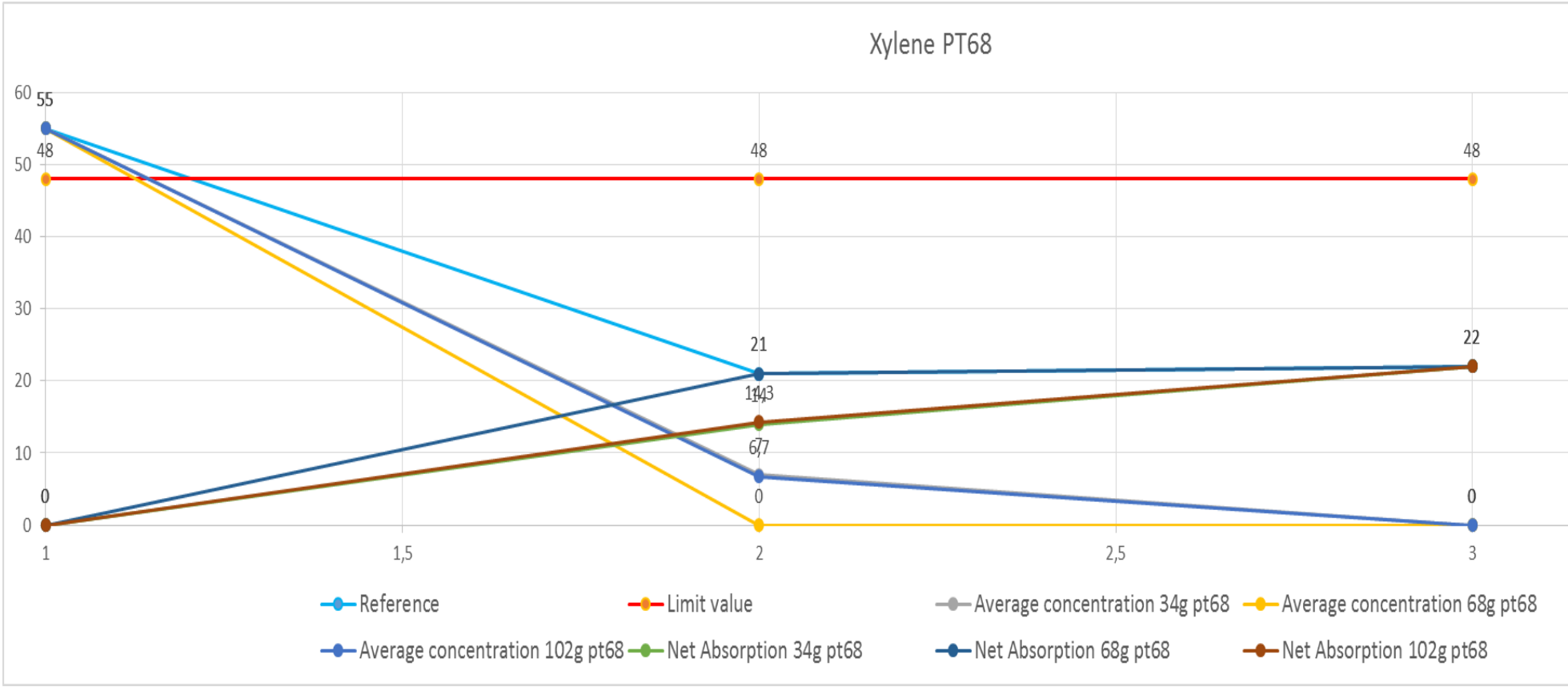

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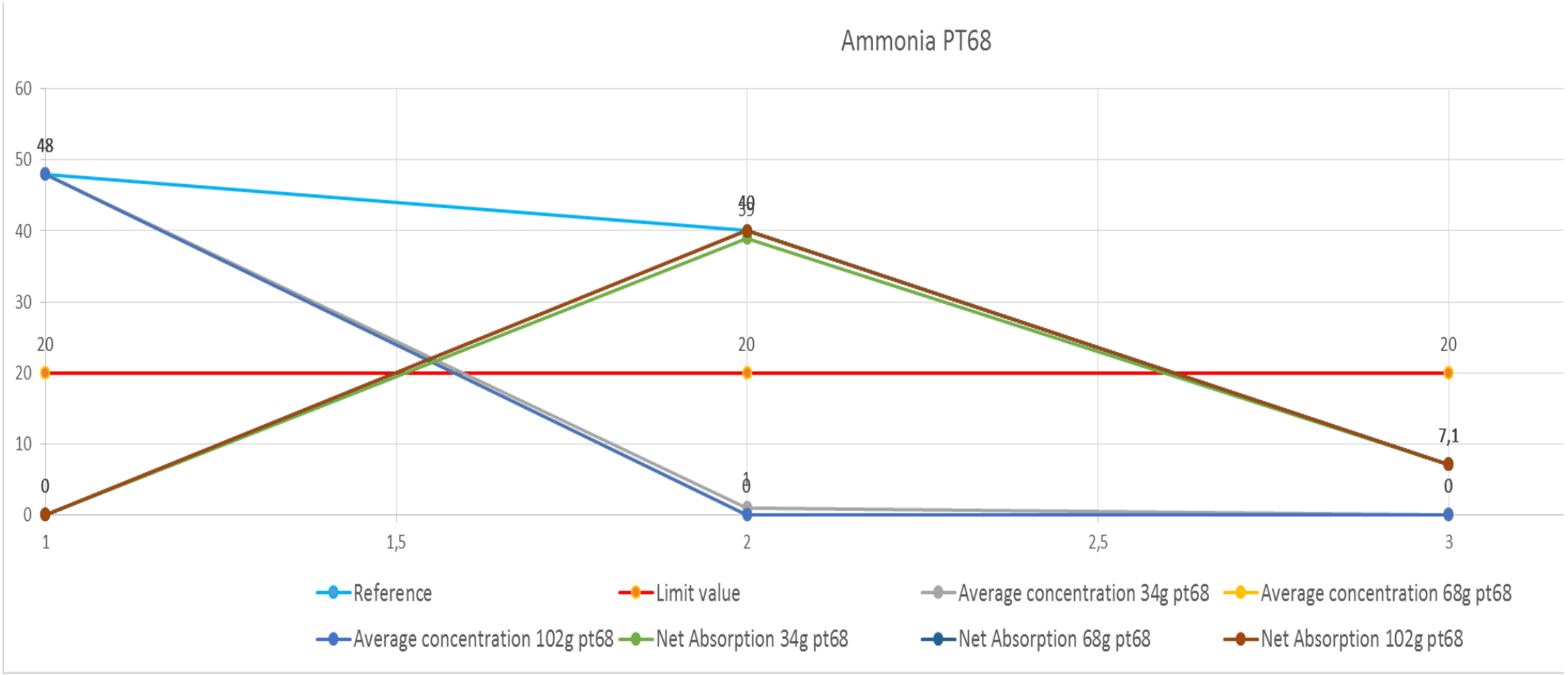

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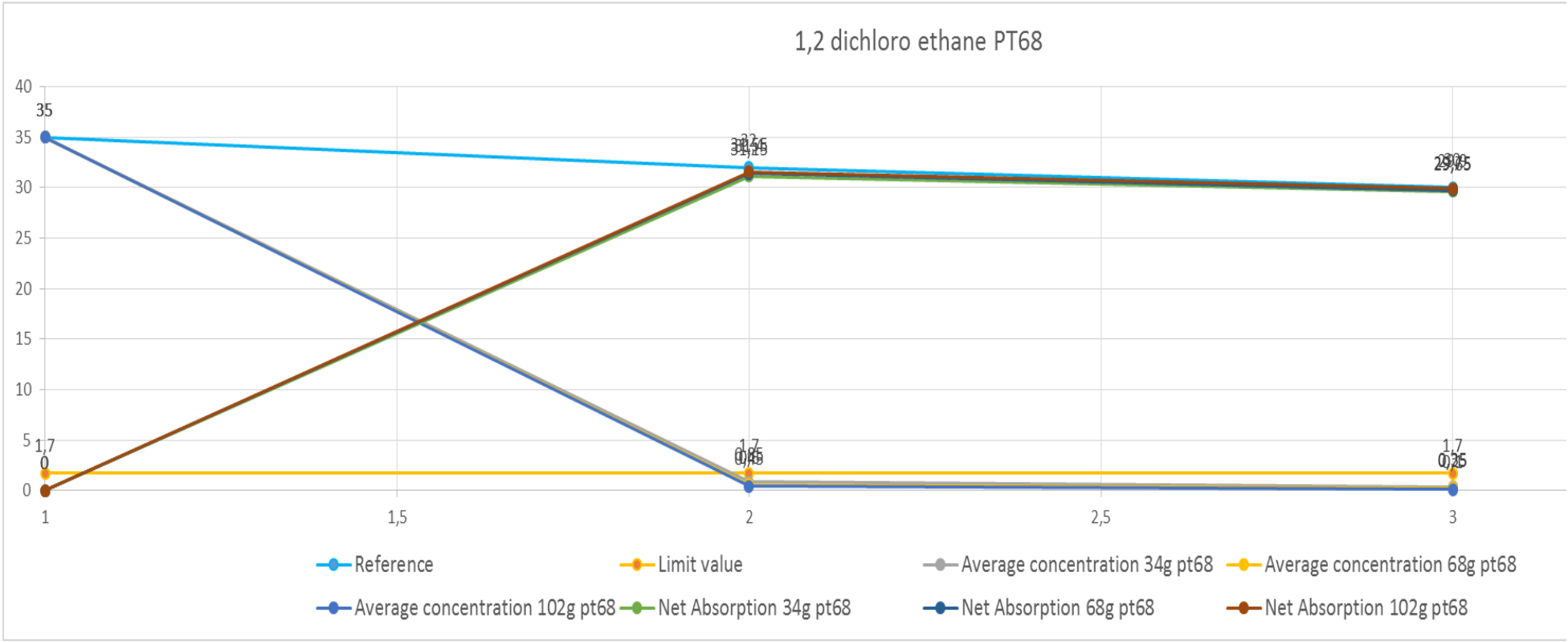

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Conclusions

Ammonia showed in the tests a relatively high instability. Xylene was also less stable than expected.

The PT 68 is for all the products tested a good absorbant. Further tests in real containers are advisable.

During those tests, 1,2-dichloro ethane was absorbed significantly.

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Expertise & Training
Scientific collaborator University of Gembloux (BE)