Suitability of Normastic 405 as Coating for Grain Transport Container

Customer:

Nor-Maali Oy
Vanhatie 20
15240 Lahti

Target:

Paint: Normastic 405 (Material Safety Data Sheet 1907/2006/EU, Article 31), Grey, 2 × 150 µm (DFT)

- Paint coating on a circular plate with diameter of 260 mm

Fig. 1. *Sample under test, Normastic 405, Grey, painted on a circular plate.*

Purpose of the Test:

To assess the suitability of paint Normastic 405 for use as an interior coating for the holds of ships employed in the transport of grain by determining whether toxic constituents are likely to contaminate a cargo when this paint is used as an interior surface coating.

Test Method:

Exposure

A cylindrical container was constructed so that the paint coated sample plate formed the base of the cylinder with its coated side facing in. Other parts of the cylinder were made of stainless steel. Wheat grain sample was stored in the cylindrical container for 21 days at ambient temperature of 23°C. A reference grain sample was stored under similar conditions except that it was not exposed to the paint coating, i.e. the base plate of the cylinder was uncoated.

The grain samples are taken at distance of 0 mm and 100 mm from the coated and reference surface after the exposure.

Measurements

Chemical analysis of the exposed grain samples and reference grain samples.

- J8248 - BADGE, NODGE, BFDGE (foods, HPLC)
- JCSRD – Solvent residues (BTEX)
- SF4PU - 2-Butanol / SFKP9
- SF4PY - t-Butanol (tBA) from SFKP9
- SF4Q3 - 1-Butanol from SFKP9
- SF4QA - m,p-Xylene / SFKP9
- SF4QB - o-Xylene / SFKP9

Feasibility of the Test Method:

The test conditions simulate the real conditions when grain cargo is transported in holds of ships. The selected chemicals are those that are likely to evaporate from the coating.

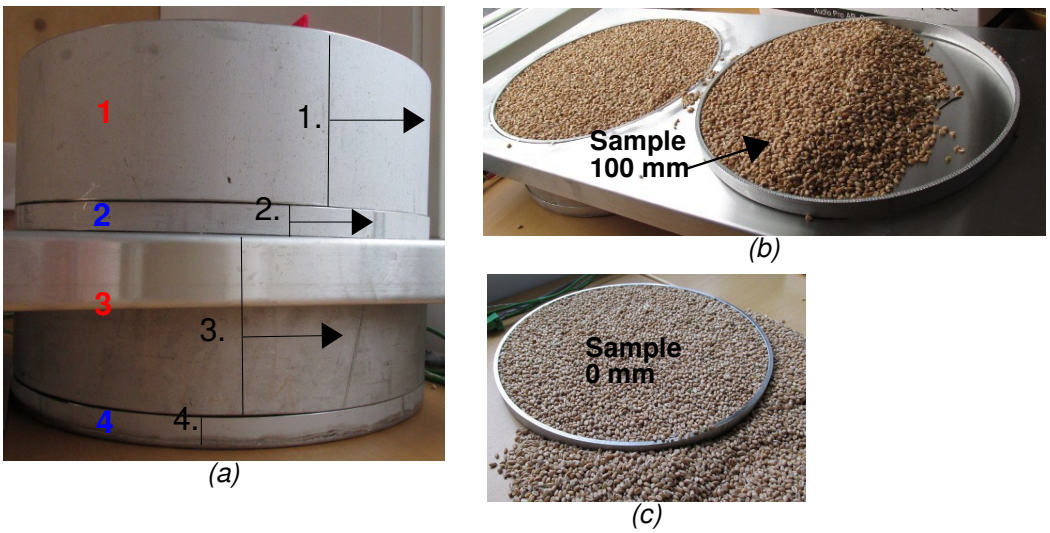
Performed Actions:

The grain used in the was organic spring wheat.

The wheat grain was stored in a specially designed cylindrical container for 21 days at ambient temperature of 23℃ ± 3℃. The sample plate coated with paint Normastic 405, Grey, formed the base of the cylinder with its coated side facing in. A reference grain sample was stored under similar conditions except that it was not exposed to the paint coating, i.e. the base plate of the cylinder was uncoated.

The cylinder consists of four layers that can be pulled out separately. A sample of the grain can be collected from cylinders that are at distances of 0 mm and 100 mm from the bottom. The sampling process is described in Fig. 2.

A weight was placed on the lids that were on top of the cylinders. The pressure caused by the weight was 1.6 kPa.



(a) (b) (c)

Fig. 2. *Sampling: Cylinders No. 1 – 3 can be pulled out in the order shown in (a). In cylinder No. 3 there is a fixed planar plate onto which the sample in cylinder No. 2 can be pulled out and then collected (b). Finally, the sample that is left in cylinder No. 4, can be collected (c).*

Testing Time
25th June – 31st July, 2014

Used Equipment:
Grain container for test use
Temperature: No. 64 / Temp, calibrated 5th June, 2014, calibration is valid.

Analysis:

A chemical analysis was performed for solvent residues, epoxy derivatives and selected volatile compounds. The methods used were High-performance liquid chromatography (HPLC) for the epoxy derivatives and Headspace Gas Chromatography/Mass Spectrometry technique (GC/MS) for the solvent residues and volatile compounds. The results of the wheat grain sample exposed to Normastic 405 and the non-exposed reference sample were compared to each other.

The analysed substances were:

Epoxy derivatives:
- Bisphenol A diglysidyl ether * 2 H2O
- Bisphenol A diglysidyl ether * 2 HCl
- Bisphenol A diglysidyl ether * H2O
- Bisphenol A diglysidyl ether * H2O*HCl
- Bisphenol A diglysidyl ether * HCl
- Bisphenol A diglysidyl ether, BADGE
- Bisphenol F diglysidyl ether, BFDGE
- Novolac glycidyl ether, NOGE

Solvent residues:
- Benzene
- Ethylbenzene
- m,p-Xylene
- o-Xylene
- Styrene
- Toluene

Volatile compounds:
- 2-Butanol
- t-Butanol (tBA)
- 1-Butanol

No difference in concentrations of epoxy derivatives, volatile compounds (Butanols), Benzene, Styrene and Toluene could be observed between the wheat grain sample exposed to Normastic 405 and the non-exposed reference sample. All results were below the detection limit.

For the wheat grain sample exposed to Normastic 405, traces of the solvent residues Ethylbenzene, m,p-Xylene and o-Xylene were observed. For the reference sample these values were below the detection limit. The observed concentrations of Ethylbenzene, m,p-Xylene and o-Xylene in the wheat sample are given in Table 1. For reference, guidelines available for drinking water are shown. The guidelines are based on acceptable daily intake. The observed amounts of solvent residues are well below these guideline values except for the amount of Xylenes at 0 mm, i.e., in direct contact with the paint coating, which is close to the guideline value.

Table 1. Solvent residues observed in the analysis of wheat grain exposed to paint Normastic 405, Grey, and as a reference, guidelines for drinking water based on an acceptable daily intake.

	Wheat grain exposed to Normastic 405 [ppm]		**Drinking water guidelines [ppm]**	
	0 mm	100 mm	QPHR	WHO
Ethylbenzene	0.082	0.029	0.3	0.3
m,p-Xylene	0.35	0.12		
o-Xylene	0.18	0.066		
Xylenes, total	0.53	0.186	0.6*	0.5*

*One value given that includes all the Xylenes

References:
QPHR (2005). Queensland Public Health Regulations 2005. Queensland Government, Brisbane, Australia.
WHO (2008). Guidelines for drinking water quality. Third Edition incorporating the first and second addenda. World Health Organization, Geneva, Switzerland.

Recommendations:

N/A

Conclusions:

The suitability of paint Normastic 405, Grey, for use as an interior coating for the holds of ships employed in the transport of grain has been assessed from a toxicity point of view.

No difference in concentrations of epoxy derivatives, volatile compounds (Butanols), Benzene, Styrene and Toluene could be observed between the wheat grain sample exposed to Normastic 405 and the non-exposed reference sample. All results were below the detection limit.

Traces of solvent residues Ethylbenzene, m,p-Xylene and o-Xylene were observed in the wheat grain sample exposed to Normastic 405 but not in the non-exposed reference sample. The observed amounts were below 1 ppm and do not exceed guideline values available for drinking water.

At a distance of 100 mm from the coating the concentration of Ethylbenzene, m,p-Xylene and o-Xylene had decreased to one third of the value observed at 0 mm, i.e., in direct contact with the paint coating. Under real conditions when grain cargo is transported in holds of ships, the total volume of grain is very large compared to the contaminated thin layer of grain in direct contact with the coating. The possible contamination will be diluted to negligible levels when the thin contaminated layer is mixed with the total volume during cargo transfer.

In conclusion, based on the test results, when paint Normastic 405, Grey, is used as an interior surface coating for the holds of ships employed in the transport of grain, the risk of dry cargo contamination is unlikely.

Remarks:

This test report is an update based on the previous test report NorMaaliPerala__ex150814HS.pdf and documentation provided by Nor-Maali.

Test results for 2014 are still valid. The chemical composition of the Normastic 405 Gray paint has remained exactly the same as at the time of testing in 2014.

Reference: Statement given by Laboratory Manager, Nor-Maali Oy / Date: 19th November, 2019.

Chemical analyses were carried out by Eurofins Scientific Finland Oy , Finland.

Expert assistance in the chemical analyses was obtained from Pyhäjärvi Institute, Finland.

Organic wheat was from the farm Tenho, Kullaa, Finland.

Actions, operations and reporting are in accordance with IEC/ISO 17025 'General requirements for the competence of testing laboratories'.

Signatures:

Riitta Perälä
Littoinen, 22nd November, 2019
Solar Simulator Finland

WEATHER TESTED • SÄÄTESTATTU
SOSIFI®
FUNCTIONAL