INTERTANKO

Cargo Tank Cleanliness Standards for Chemical Tankers

TWENTY 17

INTERTANKO

Cargo Tank Cleanliness Standards for Chemical Tankers

Rev.1

Contents

Introduction

The INTERTANKO tank cleanliness standards, first developed and published in 2011, were created to simplify the tank cleanliness verification process as well as to reduce the need for in-tank inspections. The objective was to provide the following benefits:

i. Predictability and standardisation

The costs and consequences of a clear set of tank cleanliness standards would be predictable.

Brokers, operators and shipboard management would easily estimate the impact each standard will have on the cost and time required for tank preparation and cleaning. This will save time and ease frustrations experienced during the booking process, i.e. from the time negotiations start until the cargo is loaded.

ii. Avoiding over cleaning

Tank preparations would be undertaken for the level of tank cleanliness that is required. Consequently less tank cleaning chemicals would be used; equipment and coating would last longer, and less slop would be generated. This would also reduce the use of fuel and manpower resources thereby making the entire process much more efficient. Furthermore, "over cleaning" to satisfy unrealistic standards of cleanliness would be avoided.

Less tank cleaning would also result in a reduced impact on the environment.

iii. Improved port turnaround

Port turnarounds would be quicker and would involve less complex inspection regimes. This should also reduce tank/vessel rejections by the surveyors and increase acceptance of the ship's Notice of Readiness.

iv. Clarity on charterparty terms

A defined set of tank cleanliness and inspection standards reduces the uncertainties and discussions on tank inspection clauses in charterparties.

v. Reduction of the number of in-tank inspections in port

The revised standards will contribute to the reduction of in-tank inspections (for verification of tank condition and cleanliness) which are carried out in port prior to loading.

In light of the recent introduction of revised inert gas regulations and the renewed focus on reducing and eliminating tank entries, particularly by surveyors conducting in-tank inspections prior to loading, the previous five Tank Cleanliness Standards have now been revised and have been replaced with four standards.

Background

The vessel and ship owner carry the responsibilities for the cleaning of the ship's cargo tanks and consequently also bear the liabilities that will result when tanks are not "clean".

Protecting the quality of cargoes carried is a shared goal of charterers, ship owners, cargo insurers, and surveyors. The tank cleanliness requirements in the trade are driven by the following three broad criteria:

- Cargo contracts place the liability for any on-board contaminations of the cargo on the ship
- Cargo insurers normally ask for proof that the cargo tank is clean prior to loading
- Charterers also provide special handling instructions and "prior cargo" restrictions to mitigate the risk of cargo contaminations.

These criteria have evolved over time, and with the development of sophisticated test equipment, tank cleanliness standards that are being expected by charterers have become increasingly stricter.

Increasingly complex and inconsistent standards have been incorporated in such requests due to developments in and sophistication of analytical equipment as well as cases of last cargo contaminations.

The ability of cargo shippers/receivers to detect minute traces of previous cargo in wall wash samples does not always mean that the tank is not clean or that the cargo is unsuitable for its intended use, especially once dilution factors are taken into account.

Combining this with growing port congestion, more complex cargo programs and new safety/ environmental regulations have had an overall negative impact on the efficiency of chemical tanker operations in a number of different ways:

- **Safety**
  Existing practices often necessitates tank entry for the verification of tank cleanliness. Such tank entry, particularly when done in port by third-party surveyors introduces a higher level of risk to the seafarer as well as the surveyor.
- **Environmental**
  Stricter cleanliness standards have resulted in excessive tank cleaning which in turn results in increased slops and cargo vapour emissions as well as the increased use of fuel to generate hot water/steam.
- **Wear and tear**
  Over-cleaning shortens the lifespan of tank coatings and all associated tank cleaning equipment.
- **Inefficiency**
  The time needed for conducting in-tank inspections as well as the time needed for the evaluation of laboratory results and any subsequent tank cleaning that may be necessary reduces the options available for berth rotation and leads to longer berth occupancy.

These negative impacts have led to a situation that is unsustainable for all stakeholders which is the reason why INTERTANKO has revised the tank cleanliness standards.

Application of the Revised Tank Cleanliness Standards

Adopting these new revised standards will provide the following benefits:

- Charterers can simplify their instructions to ship owners
- Introduce simplicity and increased standardisation in the verification of tank cleanliness.

These standards will deliver increased efficiencies in cost, environmental protection (emissions, chemical usage, time/financial resources) etc. as long as the "least restrictive" standard has been chosen based on cargo's intended end-use.

The definitions of each of the four tank cleanliness standards are supported by test criteria using traditional wall wash sampling procedures. The fact that these definitions describe a wall wash test method does not imply that the cleanliness standard of the tank should be verified by a charterer's surveyor prior to loading.

The standards introduce "on-board tests" to assist the crew in verifying the standard of tank cleanliness. These "on-board tests" have long been used by the industry and can be performed by the crew by utilising equipment readily available on board.

The key to ensuring that tank entry by charterer's surveyors is minimised will be in documenting the test results achieved by the crew on board and presenting these to the charterer prior to arrival.

In addition, a "wash-water" test has been introduced as another "on-board test". This is a test of the wash-water that is being pumped out of a tank during a tank cleaning operation and is based on the premise that when the wash-water is clean and largely free from previous cargo residues, the cargo tanks and lines can also be considered clean.

As with all test methods, the limitations of this test method must also be clearly understood. A guideline to the wash-water test method and other "on-board test" methods is included.

Recommendations

In order that the proposed benefits and efficiencies are achieved, INTERTANKO recommends that:

- Owners incorporate these revised tank cleanliness standards into their relevant Shipboard Management procedures
- Owners prepare reporting templates for tank cleanliness certificates that include charterers' required standards and test results following the owner's tank verification methods
- Charterers introduce and incorporate these standards into the voyage orders that are provided to owners
- When discussing and agreeing on the cleanliness standards that are needed, owners make clear the commercial and operational implications of choosing a higher standard than is necessary. If not, there may be a general tendency towards the use of standard 4 (ultra-high purity standard) to be used for all cargoes.

All stakeholders in the industry are encouraged to acknowledge and leverage ship owners' experience and knowledge of cleaning processes to ensure the proper implementation and use of these revised and improved tank cleanliness standards.

Cargo Tank Cleanliness Standards for Chemical Tankers

Standard No.	Standard Name	Definition	Test methods	On-board test conducted by ship's crew	Comments/description
1	Visually Clean Standard	Clean, dry and visually free of residues of previous cargo and/or foreign matter, no uncharacteristic odour.	NA	In-tank inspection – Dry, and visually free of residues of previous cargo and/or foreign matter, no uncharacteristic odour.	Master to confirm that the on-board tests were conducted via a tank cleanliness certificate. Tanks should only be inspected from deck level, no wall-wash to be taken.
2	Water White Standard	Dry, odour-free, free of visual residues of previous cargoes and/or foreign matter. Colour test: Wall-wash with suitable solvent shows: • colour PtCo (ASTM D 1209) 15 or less[1]	WWM[2]/ WWA[2]	In-tank inspection – Dry, odour-free, free of visual residues of previous cargoes and/ or foreign matter. Colour test: Wall wash with suitable solvent shows: • colour PtCo (ASTM D 1209) 15 or less[1]	Master will confirm that the on-board tests were conducted via a tank cleanliness certificate. Charterer may choose not to conduct in-tank inspections for wall wash (colour test).
			WsW[3]	N/A	
3	High-Purity Standard	Dry, odour-free, free of visual residues + wall-wash with methanol conforms to: • Water miscibility test (ASTM D 1722) passes • Colour PtCo (ASTM D 1209) or APHA 10 or less • Chlorides less than 2 ppm • Permanganate time test above 50 min • UV spectrum passes		In-tank inspection – Dry, odour-free, free of visual residues + wall-wash with methanol conforms to: • Water miscibility test (ASTM D 1722) passes • colour PtCo (ASTM D 1209) or APHA 10 or less • Chlorides less than 2 ppm • Permanganate time test above 50 min • If WWM is used UV spectrum passes	This is the most commonly used standard for the carriage of methanol as a cargo. Master will confirm that the on-board tests were conducted via a tank cleanliness certificate. Charterer may accept the cleanliness certificate provided by the master or may require an internal visual inspection and a wall-wash test. This should be pre-agreed with the charterer/shipper.
			WsW[3]	Less than 100 ppm of last cargo in final wash-water	
4	Ultra-High Purity Standard	Dry, odour-free, free of visual residues + wall-wash with methanol conforms to: • Water miscibility test (ASTM D 1722) passes • colour PtCo (ASTM D 1209) or APHA 10 or less • Chlorides less than 2 ppm • Permanganate time test above 50 min • UV spectrum passes • Non-volatile matter less than 10 ppm • Last cargo by Gas Chromatography or other suitable method less than 2 ppm	WWM/ WWA	In-tank inspection – Dry, odour-free, free of visual residues + wall-wash with methanol conforms to: • Water miscibility test (ASTM D 1722) passes • colour PtCo (ASTM D 1209) or APHA 10 or less • Chlorides less than 2 ppm • Permanganate time test above 50 min • UV spectrum passes[4]	This standard is used for the carriage of extremely high-spec cargoes that require a higher level of cleanliness than that required for the carriage of methanol. Master will confirm that the on-board tests were conducted via a tank cleanliness certificate. Charterer may accept the cleanliness certificate provided by the Master, but will most likely require an in-tank inspection and wall-wash test.
			WsW[3]	Less than 100ppm[5] of last cargo in final wash-water	

[1] No visible discoloration compared to a blank sample
[2] Wall-wash test using methanol (WWM) and wall-wash test using acetone (WWA)
[3] Wash-water test is an alternative test method for the verification of cargo tank cleanliness using wash-water sampled during tank cleaning operations and is based on the premise that when the wash water is clean and largely free from previous cargo residues, the cargo tanks and lines can also be considered clean.
[4] Applicable if UV spectrometer available on board.
[5] The operator should use their experience and judgement when applying the 100ppm standard to the wash-water at this level of cleanliness. Prior cargo compatibility, tank coating, and other such factors should be assessed to ensure that 100ppm standard of wash-water will be sufficient to pass the equivalent wall wash test at this level otherwise a more stringent level of wash water test should be applied at this level.

The Cargo Tank Inspection

Introduction

Accepting cargo tanks on the basis of internal cargo tank inspections (visual or wall-wash) prior to loading chemical cargoes is the generally accepted industry practice. This relies on a combination of visual assessments as well as wall wash tests to be conducted to differing test criteria dependent on quality of the cargo to be loaded.

For a number of years the term "water-white" was considered sufficient as a measurement of solvent color. Several expressions for defining "water-white" gradually appeared and it became evident that a more precise colour standard was needed. This was accomplished in 1952 with the adoption of Test Method D 1209 using the platinum-cobalt scale. This test method is similar to the description given in Standard Methods for the Examination of Water and Waste Water and is referred to by many as "APHAColor."

The preparation of these platinum-cobalt colour standards was originally described by A. Hazen in the American Chemical Journal in which he assigned the number 5 (parts per ten thousand) to his platinum-cobalt stock solution. Subsequently, in their first edition (1905) of Standard Methods for the Examination of Water, the American Public Health Association, using exactly the same concentration of reagents, assigned the colour designation 500 (parts per million) which is the same ratio. The parts per million nomenclature is not used since colour is not referred directly to a weight relationship. It is therefore recommended that the incorrect term "Hazen Colour" should not be used. Also, because it refers primarily to water, the term "APHA Colour" is undesirable. The recommended nomenclature for referring to the color of organic liquids is "Platinum-Cobalt Colour, Test Method D 1209." [6]

These methods have been time-tested by industry and have been proven to work; however, they fundamentally require entry into the tanks by ship and shore personnel which introduces additional risks.

Cargo Tank Inspection by Wash-Water Analysis

The testing of wash-water has been developed as an alternative process that provides an assessment of the cleanliness standard of the cargo tank.

This alternative process focuses on the analysis of wash-water generated during onboard cargo tank cleaning operations. It is based on the premise that when the wash-water sample is clean and largely free from previous cargo residues, the cargo tanks and lines can also be considered clean.

As wash-water can be sampled and analysed at deck level, this process has the potential to:

- Reduce or eliminate the need for in-tank visual inspections and/or wall wash tests by surveyors
- Reduce the need for enclosed space entries by the ship's crew
- Reduce the environmental impact of tank cleaning operations (in terms of fuel oil and cleaning chemical consumption)
- Ensure continued compliance with cargo quality specifications
- Increase operational efficiency and flexibility.

This paper links this alternative tank assessment process with a UV analysis of wash-water, however, ship-owners and charterers may find that wash-water may also be tested using alternate analysis methodologies such as pH, toxicity, etc. Examples of these alternative methodologies are included towards the end of this document.

[6] Source: ASTM D 1209-00

It should be noted that this guidance presents wash-water analysis as a process that is agreed between the ship owner and the charterer for the purposes of accepting tanks for loading. Ship owners may find however, that this procedure when used as a stand-alone shipboard process is very beneficial for the optimisation of tank cleaning operations. In such cases it is important that shipboard experience and prudent judgement is applied when correlating the test standards for wash-water with the results of wall wash tests.

Applicability and limitations of testing wash-water

The process is most reliable when cleaning stainless steel tanks. In order to use this process in coated tanks, due consideration should be given to factors such as the prior cargo, prior cargo properties, cleanliness standard required, etc. Some cargo tank coatings are known to absorb and retain certain types of cargo. In these cases, when the wash-water sample is clean, there may still be previous cargo residues retained in the coating.

It must be noted that not all cargoes are suitable for detection by UV spectrometers. Some cargoes, typically due to their insolubility in water, do not have UV profiles and others have relatively low responses to UV light testing. There may be cargoes that are quite insoluble in water yet have enough UV response to indicate the level of cleanliness achieved in the tank. In cases where UV is not a suitable indicator, the overall method of wash-water testing may still work using alternative test methodologies that employ indicators such as pH or toxicity.

Some high melting point lubricating oils are completely insoluble in water and at best, create an emulsion in water during tank cleaning. In such cases, tank cleaning should continue until the water is free from emulsion, at which point the response of the wash-water sample will be a "flat line", running across the bottom of the spectrum. This will indicate that there is no evidence of the previous cargo in the wash-water sample.

When cleaning from cargoes that have very low solubility in water, ships generally use chemical additives that are specifically designed to remove water insoluble cargoes. At the end of the rinsing after this chemical cleaning, the wash-water sample should also be a "flat-line" along the bottom of the spectrum.

Ship owners are encouraged to discuss and agree on the applicable terms and conditions with their charterers, insurers, and surveyors when establishing any new process. In addition, due consideration should be given risk assessments, training protocols, etc. when establishing such new processes and procedures.

The analysis of wash-water as a cargo tank inspection process is a relatively new initiative and therefore the following considerations should be made when implementing this procedure as a tank inspection process.

1. For certain tank coatings and/or cargo combinations (for instance, aromatics in epoxy tanks), even when the wash-water sample is "largely free from previous cargo residues" i.e. tests indicate less than 100mg/l of previous cargo, tanks and lines may not necessarily be clean.

2. Previous cargoes that are insoluble in water will have limited UV absorption and the range of application of this test will therefore be limited.

3. External factors such as temperature, high humidity and a large time span between cleaning and loading may require additional checks and/or precautions.

4. High grade cargoes may require a stricter standard than the 100 ppm limit referenced in this document – careful liaison with charterers and/or shippers is essential before implementing this procedure.

Process Description

The consideration of how and when wash-water analysis methodology is to be used starts during the planning phase of tank-washing operations. Due consideration should be given to factors such as the tank construction, coating type, suitability of the prior cargo to work with wash-water analysis, equipment needed, cleaning procedure, etc.

Consistent with shipboard procedures, cargo tank washing/wash-water analysis plans should be documented and communicated to the ship's crew. Details of the briefing given by the chief officer to the crew regarding the planning and execution of the tank cleaning operation should be available for the charterer's/shipper's representative upon arrival at the loading port.

The ship is encouraged to take multiple wash-water samples throughout the tank-cleaning operation in order to develop the most efficient tank cleaning process; particularly during the sea water washing stages, when it is accepted that the previous cargo residues are being actively removed from the cargo tanks.

Vessels should carefully determine the effluent wash-water sample point location(s). Sample points should be located at the end(s) of the cargo system being cleaned. (For example, at port and/or starboard manifold if tanks are lines are being cleaned as part of one system). The final wash-water sample should be drawn during the last cleaning step (approximately five minutes before the end of the cycle) thus ensuring that the sample is representative of the cargo system being cleaned. The drain valve and the sample bottle should be well flushed with the wash-water before the sample is collected. Less than 10ml of water is required for analysis, nevertheless it is recommended to draw a sample that is a minimum 100ml in volume.

Before the final wash-water sample is drawn and whilst tank cleaning is still in progress, a reference sample of "clean" wash-water should be drawn directly from the tank cleaning line before it enters the cargo tank. Again, the drain valve and sample bottle should be well flushed prior to collecting the sample and a minimum sample volume of 100ml should be taken. All wash-water samples should be collected and secured in screw cap sample bottles and clearly labelled.

The ship's crew should analyse the samples as per the following Equipment and Analysis sections or as per other prescribed shipboard procedures.

After analysis, the sample bottles should be re-capped and retained until after the ship has completed loading and discharging the nominated cargo(es). The samples should be stored in an appropriate sample locker out of direct sunlight.

After ensuring that the final wash-water samples are acceptable and confirming that the cargo tanks are mopped dry and visually clean, the ship should secure the cargo tanks/lines and where possible, purge them with nitrogen down to a level of 8% oxygen to prevent the ingress of moisture and/or other contaminants. Tanks and lines should then be kept at a slight positive pressure. If purging is not possible, consideration should be given to the environmental humidity, time duration between tank cleaning and cargo operations, and/or the impact of moisture build-up on product quality.

The ship should send the results of the final wash-water sample analysis to the charterer/shipper prior to arrival at the load berth as proof that the ship's cargo tanks are ready for loading. As long as the charterers/shippers are in agreement on the use of the results from wash-water analysis, there is no need for a third-party surveyor to internally inspect the cargo tanks prior to the start of loading.

When the ship arrives at the loading berth, it is recommended that the following are completed prior to commencement of loading:

- A surveyor should check the positive pressure in the tanks and lines and the quality of the purge medium (nitrogen) prior to commencement of loading
- The ship should prepare a certificate of cleanliness for each nominated cargo tank and provide that to the charterer's/shipper's representative. A sample certificate of cleanliness is attached as per Appendix 1.

As with the existing inspection process and provided the quality of the cargo is confirmed at the point of delivery by means of approved manifold and/or shore-line samples, the ship owner remains responsible for the quality of the cargo once it is loaded on board the ship.

Equipment

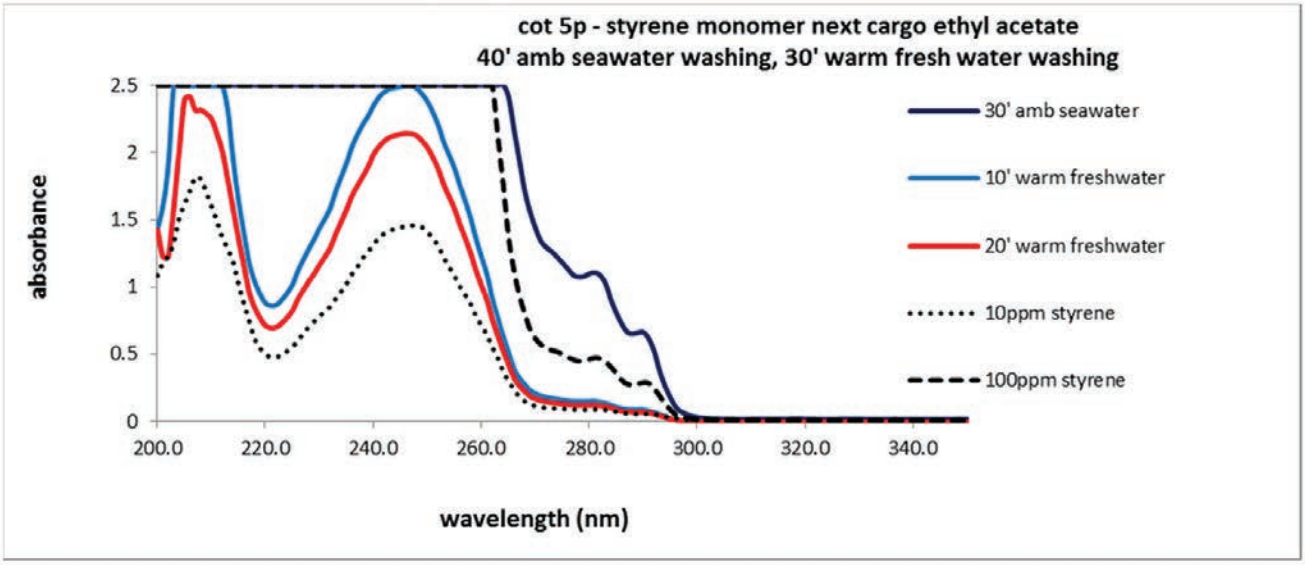
- Scanning UV / Vis spectrophotometer, capable of scanning / reading between 200nm and 350nm
- 10mm path length quartz glass sample cells
- Clean sample bottles.

Sample analysis

1. Set the UV/Vis spectrophotometer to scan from 200nm to 350nm.
2. Take the sample of reference wash-water and carefully pour into a 10mm path length quartz glass sample cell.
3. Place the cap on the top of the sample cell and invert two or three times.
4. Remove the sample cell cap and safely pour away the water.
5. Immediately refill the sample cell with the reference wash-water and replace the cap.
6. Wipe down the sample cell windows with soft tissue or cotton rag to ensure they are clean and dry.
7. Insert into the spectrophotometer and set the instrument to zero.
8. Remove the cell from the spectrophotometer and safely pour away the water.
9. Repeat steps 2 to 6 using the final wash-water sample instead of the reference sample.
10. Insert into the spectrophotometer and press the "read" or "scan" key.
11. Save the data to a computer for presentation / interpretation.
12. Ensure that the UV scan of the final wash-water sample confirms that there is less than 100ppm of the previous cargo in the sample, by comparing the generated graph with the data provided at the end of this process.

Data

During operational use of the wash-water analysis process, the ship/carrier will be able to present the charterer/shipper graphical representation of wash-water test data showing the laboratory prepared data compared to the operational wash-water sample analysis. This sort of graph provides a visual confirmation that the operational wash-water sample contains less than 100mg/L of the cargo. For example:



Addition of New Cargoes

When adding a new cargo to this alternative tank assessment process, the ship/carrier should arrange for a laboratory to prepare a 100mg/L standard** of that cargo in de-ionised water and have it analysed as follows:

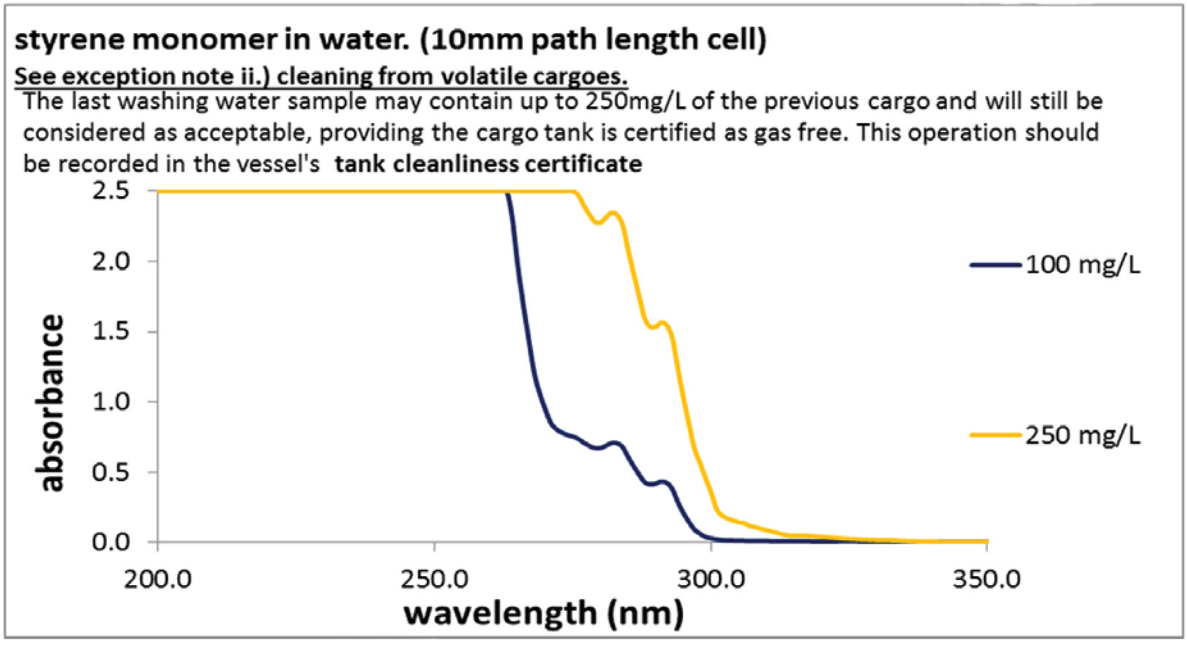
i. UV spectroscopy scan from 200nm – 350nm

ii. Reference – de-ionised water

iii. Sample cell path length – 10mm

** If the vapour pressure of the cargo is greater than 5mBar at 20oC, a 250mg/L standard should also be prepared and analysed.

For example, styrene monomer in water:



Process Verification for New Cargoes

It is recommended that when using tank wash-water analysis on a new product (or a new family of products with similar properties), that a verification process is implemented.

- The laboratory graph is created as stated above
- The ship executes the tank wash analysis process
- Independent verification of the tank cleanliness is performed by internal cargo tank inspection (generally, against a methanol wall wash standard)
- The three bullet points above are repeated for at least three different cargo tanks
- If the in tank verifications agree that the 100/250 mg/L standard is appropriate to achieve the desired level of cleanliness, the cargo is suitable to be incorporated into operational procedures.

Note: The level of tank cleanliness required is generally a function of the cargo that will be loaded next. Due consideration should be given to establishing a verification standard consistent with the bulk of charterer/ shipper portfolios to maximise stowage flexibility and usability.

Examples of Other Wash-Water testing Methodologies

i.) Cleaning from Caustic Soda (and all inorganic acids and alkalis). Inorganic cargoes such as caustic soda (potassium hydroxide, sulphuric acid, phosphoric acid etc.) do not have a UV fingerprint, but they do exhibit extremes of pH. As an alternative to spectroscopy, the last wash-water sample should be drawn in accordance with the above process and tested for pH, using either litmus paper or a specific pH meter. The pH of the wash-water sample should be between 6 and 8, indicating that the water no longer contains excess alkali or acid and this result should be recorded in the tank cleanliness certificate.

ii.) Cleaning from volatile cargoes (vapour pressure greater than 5 mBar at 20oC). Such cargoes produce significant volumes of vapour during tank cleaning operations and it has been identified that this vapour may contribute to a higher than expected concentration of the cargo in the last wash-water sample. In such cases, if the last wash-water sample contains more than 100mg/L (up to a maximum of 250mg/L) of the previous cargo, it has been found by experience that there will be no residues of the previous cargo remaining on the bulkheads or in the cargo lines after the cargo tank is safely force ventilated and completely gas freed. Furthermore, the cargo tank should be certified as gas free by the ship using any recognised flammable gas detector or the appropriate Draeger tube and this operation should be recorded in the tank cleanliness certificate.

Appendix 1: Sample Tank Cleanliness Certificate

Ship Name		**Voyage Number**	
Date			
Load port		**Terminal**	
Charterer			

This certificate is a declaration that that the tanks listed below have been cleaned to the required tank cleanliness standards (ref INTERTANKO Cargo Tank Cleanliness Standards for Chemical Tankers – Rev. 01)

Cargo Tank #	Cargo Tank Volume	Coating Type	Cargo to Load	Previous cargo	Required Tank Cleanliness Standard	Test method	Result/ Readings	Comments

Master's Signature		**Charterer Rep**	
Master's Name		**Name**	
Date		**Date**	
Ship Stamp		**Stamp**	

ISO 9001:2008
Certificate Number: 33714

INTERTANKO London
St Clare House
30-33 Minories
London EC3N 1DD
United Kingdom
Tel: +44 20 7977 7010
Fax:+44 20 7977 7011
london@intertanko.com

INTERTANKO Oslo
Nedre Vollgate 4
5th floor
PO Box 761 Sentrum
N-0106 Oslo
Norway
Tel: +47 22 12 26 40
Fax:+47 22 12 26 41
oslo@intertanko.com

INTERTANKO Asia
5 Temasek Boulevard
#12-07 Suntec City Tower 5
Singapore 038985
Tel: +65 6333 4007
Fax:+65 6333 5004
singapore@intertanko.com

INTERTANKO North America
801 North Quincy Street – Suite 200
Arlington, VA 22203
USA
Tel: +1 703 373 2269
Fax:+1 703 841 0389
washington@intertanko.com

INTERTANKO Athens
Karagiorgi Servias 2
Syntagma
Athens 10 562
Tel: +30 210 373 1772/1775
Fax: +30 210 876 4877
athens@intertanko.com

INTERTANKO Brussels
Rue du Congrès 37-41
B-1000 Brussels
Belgium
Tel: +32 2 609 54 40
Fax: +32 2 609 54 49
brussels@intertanko.com

INTERTANKO

www.intertanko.com