Dispersant Inventory Management: The Case for a Fit-For-Purpose Effectiveness Testing Regimen

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Introduction

The oil and shipping industries and their regulators place a high priority on the prevention of oil spills. This has resulted in a welcome downward trend in the frequency of major spills. In turn, this has led to an increased likelihood that dispersant stockpiles may remain unused and stored for long periods, potentially many years. Contemporaneously, the oil industry has established Global Dispersant Stockpiles comprising a total of around 5,000 m^3 dispersant (OSRL, 2017). Some national governments' stockpiles exceed 1,000 m^3. These are large volumes that require a systemic and pragmatic approach to retesting.

When stored in suitable containers under benign conditions, dispersant shelf-life may be essentially indefinite. However, there some pressures being manifest to institute relatively short-term retesting procedures for dispersant stocks. To meet these pressures, a maintenance regimen and retesting programme should be fit-for-purpose. This means providing assurance that stockpiles remain effective whilst avoiding an unnecessary bureaucracy or financial burden on those holding the stocks.

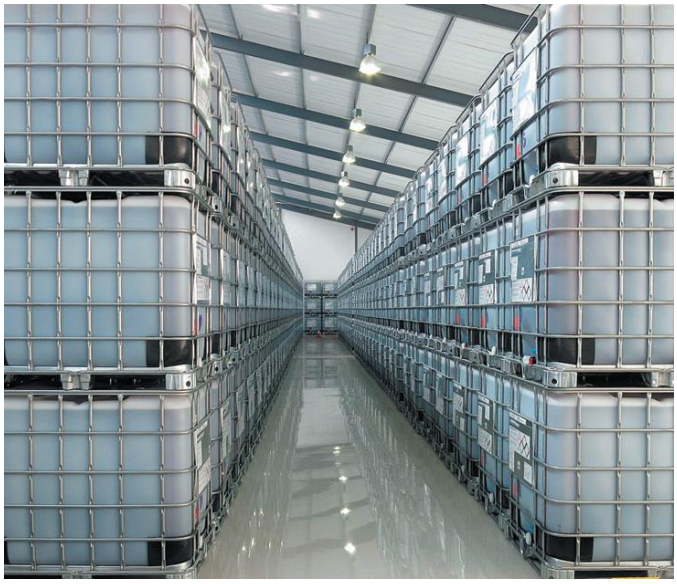
Main Results

Shelf life

The surfactants and solvents that are blended to make modern dispersants are chemically stable. The dispersant components do not undergo chemical reaction with each other or with the oil onto which they are applied. When stored in suitable facilities, they do not decompose or otherwise change, provided they are kept in suitable sealed containers that remain intact. Consequently, most dispersant manufacturers or suppliers indicate that their products have long shelf lives. Controlled studies and practical experiences over decades have demonstrated that long shelf lives are achievable.

Storage

Deterioration of storage containers has been the most frequently cause of dispersant stocks suffering reduced effectiveness over time, through loss of solvent due to air ingress or directly through the walls of a container. When solvent is lost, the dispersant may become too viscous to spray and the product is less able to deliver surfactant to the oil/water interface, where it promotes the formation of dispersed oil droplets. The latest good practice involves the use of containers that reduce or prevent solvent loss. Large stockpiles are increasingly stored in high-density polyethylene (HDPE) intermediate bulk containers (IBCs) or 'totes'. There are HDPE variants that are UV stabilised and impervious to solvent loss or gaseous permeation. This ensures that the product retains its original formulation for long periods (potentially decades).



Orderly storage of IBCs in a warehouse; the neat rows allow visual inspections and facilitate emergency response if needed.

Maintenance checks - visual

A general visual inspection of stockpiles is recommended at least every month. This would typically involve personnel walking between and around the containers to identify any signs of small leaks or damage to the IBCs or other containers. Labels should be checked for legibility and replaced if deteriorating. The inspection should also include an observation of any abnormal appearance and colour of the product where this is feasible, e.g. through the walls of translucent IBCs. Every two to three years, each IBC should be given a thorough external visual inspection for cracks, warping/deformation, corrosion of the steel cage, abnormalities with the discharge valve and camlock fitting (if present) or any other damage.

Stock control

A maintenance record should include batch numbers and dates of dispersant manufacture. This will allow stocks to be utilized in order of age, so that older stock is deployed first. To facilitate this, the maintenance record should be accessible to an organization's emergency responders and incident management team.

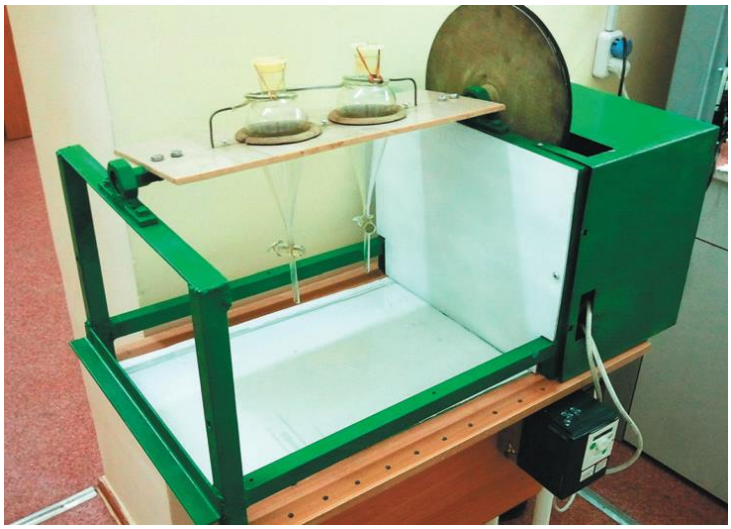
Retesting

It is prudent to undertake retesting to ensure that no deterioration has occurred that would render the product's effectiveness unacceptable. There are variations in national efficacy retesting requirements; IPIECA's published guidance (IPIECA, 2017) may be used in the absence of such regulatory stipulations.

Initial retesting may be made on the density and viscosity of a product, and the results compared with the manufacturer's values for these parameters, e.g. as reported in the product's Safety Data Sheet. Any measurements outside of the reported range, or a significant change from a single value for either the density or viscosity, is likely to precede or indicate a possible reduction in product efficacy. Measurements of these physical properties are relatively straightforward; they can be performed on-site and do not require the services of a certified laboratory.

A common practice is to randomly select 10% of the containers in a batch for physical property retesting. These test results can then be used as a preliminary screening tool, wherein samples from containers found to exceed the manufacturer's acceptable density or viscosity values can then undergo efficacy retesting. Selecting 10% of the containers helps ensure most of stocks remain undisturbed and maximises the realization of extended shelf life.

For non-bulk storage in IBCs, unless defined differently by applicable national regulation, it is recommended that the initial efficacy retesting is carried out after 10 years, provided that the product has remained sealed in its original containers. Subsequently the product should be retested every five years. The test should be carried out on at least 10% of samples from numerically referenced batches that have been stored in the same location under the same conditions.



A laboratory test used to verify a dispersant product retains suitable effectiveness.

The laboratory test methodology for efficacy should mirror that used for the original product approval wherever possible. Where a test methodology is not stipulated by regulation, consideration should be given to

using simple and widely recognized tests, e.g. the rotating flask, baffled flask or EXDET test protocols. Approved or certified laboratories should be utilized for efficacy retesting whenever feasible.

A jurisdiction typically sets a pass mark for an efficacy test as part of the initial product approval process. Recognizing the investment made in dispersant stockpiles, it is accepted that some loss of efficacy is permissible. For example, in the UK the pass mark for retesting is accepted as 75% of the original minimum. Thus, where the original minimum pass mark for product approval in the UK is 60%, the retest pass mark is 45% using the same methodology.

Conclusion

It is important to ensure that dispersant stockpiles remain in a state of readiness for response, including reasonable assurance that their initial effectiveness/efficacy is retained. Proper storage facilities for suitable containers is the key to ensuring stocks do not deteriorate. A pragmatic approach to retesting for effectiveness is recommended, using a regime combining visual inspection, simple physical property tests and laboratory tests.

References

IPIECA (2017). *Dispersant storage, maintenance, transport and testing.* A technical support document to accompany the IPIECA-IOGP guidance on surface and subsurface dispersant. http://www.ipieca.org/resources/awareness-briefing/dispersant-storage-maintenance-transport-and-testing/.

OSRL (2017). *Global Dispersant Stockpile: Technical Information Sheet*. https://www.oilspillresponse.com/globalassets/services/member-response-services/global-dispersant-stockpile/tis-gds-2017-oct-27.pdf.